ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

ELECTRONICS & COMMUNICATION 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 ELECTRONICS & COMMUNICATION ENGINEERING

DEPARTMENT VISION

ECE dept envisions to develop high quality and technically competent women engineers who can address the growing challenges in the modern world with a keen sense of social responsibility.

DEPARTMENT MISSION

- Knowledge Based Engineering Education (Quality)
- Analysis and Design Skills with Modelling Potential, Technical Competence
- Industry Compatibility and Women Empowerment with Societal Commitment
- Professional Career Growth with Values and Ethics

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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

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 fter 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.

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 (EfC)**	**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%)**

4.4 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.

9.3a. 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 :

12.2.1 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 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 ELECTRONICS & COMMUNICATION 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 ELECTRONICS & COMMUNICATION 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	ES113AQ	Network Theory	3	-	-	3
3.	PC	PC113AW	Electronic Devices and Circuits	3	1	-	4
4.	PC	PC113AY	Signals and Systems	3	-	-	3
5.	PC	PC113AT	Digital System Design	3	-	-	3
6.	PC	PC11322	Electronic Circuits Lab	-	-	3	1.5
7.	ES	ES11314	Basic Simulation Lab	-	-	3	1.5
8.	PC	PC11320	Digital System Design 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	BS114BA	Probability Theory and Stochastic Processes	3	-	-	3
2.	ES	ES114BC	Material Science	3	-	-	3
3.	PC	PC114BF	Analog Circuits	3	-	-	3
4.	PC	PC114BG	Analog and Digital Communications	3	1	-	4
5.	PC	PC114BM	Microprocessors and Microcontrollers	3	-	-	3
6.	PC	PC11426	Analog Circuits Lab	-	-	3	1.5
7.	PC	PC11425	Analog and Digital Communications Lab	-	-	3	1.5
8.	PC	PC11432	Microprocessors and Microcontrollers lab	-	-	3	1.5
9.	MC	MC114BE	Environmental Sciences	2	-	-	-
			TOTAL	**17**	**1**	**9**	**20.5**

B.Tech. 4 Year (8 semesters) Regular Programme in ELECTRONICS & COMMUNICATION 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.	PC	PC115CM	VLSI Design	3	-	-	3
2.	PC	PC115BY	Digital Signal Processing	3	1	-	4
3.	PC	PC115CD	EM Theory and Transmission Lines	3	-	-	3
4.	PE-1		**Professional Elective-1**	3	-	-	3
		PE115BS	Computer Organization				
		PE115CC	Electronic Measurements and Instrumentation				
		PE115CF	Information Theory and Coding				
5.	PC	PC11538	Digital Signal Processing Lab	-	-	3	1.5
6.	PC	PC11539	e-CAD and VLSI Lab	-	-	3	1.5
7.	HS	HS11542	Employability and Soft Skills Lab	-	-	2	1
8.	OE	OE115XX	**Open Elective – 1**	3	-	-	3
			TOTAL	**15**	**1**	**8**	**20**

III YEAR **II SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	HS	HS116DE	Managerial Economics and Financial Analysis	3	-	-	3
2.	PC	PC116DJ	Principles of Computer Networks	3	-	-	3
3.	PC	PC116DC	Linear Control Systems				
4.	PE-2		**Professional Elective-2**	3	-	-	3
		PE116CQ	Antennas and Wave Propagation				
		PE116DK	Speech and Audio Signal Processing				
		PE116CS	Bio-Medical Electronics				
5.	OE	OE116XX	**Open Elective – 2**	3	-	-	3
6.	PC	PC11644	Computer Networks Lab	-	-	3	1.5
7.	PC	PC11645	Electronic Design Lab	-	-	3	1.5
8.	PW	PW11652	Seminar	2	-	-	2
			TOTAL	**17**	**-**	**6**	**20**

B.Tech. 4 Year (8 semesters) Regular Programme in ELECTRONICS & COMMUNICATION 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.	HS	HS117EC	Fundamentals of Management	3	-	-	3
2.	PC	PC117EJ	Microwave Engineering	3	-	-	3
3.	PE-3		**Professional Elective-3**	3	-	-	3
		PE 117DS	Digital Image & Video Processing				
		PE117EH	Low Power VLSI Design				
		PE117GH	Principles of Wireless Communications				
4.	PE-4		**Professional Elective-4**	3	-	-	3
		PE 117DN	Artificial Intelligence				
		PE117EA	Fiber Optic Communications				
		PE117DX	Embedded System Design				
5.	OE	OE117XX	**Open Elective – 3**	3	-	-	3
6.	PC	PC11757	Microwave Engineering Lab	-	-	2	1
7.	PW	PW11758	**Mini Project***	-	-	-	2
8.	PW	PW11761	Project Phase – I	1	-	4	3
			TOTAL	**16**	**-**	**6**	**21**

***Note: Summer between III & IV Year: Mini Project**

IV YEAR **II SEMESTER**

S.No.	Group	Sub Code	Subject	L	T	P	Credits
1.	HS	HS118FK	Entrepreneurship and Project Management	3	-	-	3
2.	PE-5		**Professional Elective-5**	3	-	-	3
		PE 118FL	Global Navigation Satellite Systems				
		PE118EY	Adaptive Signal Processing				
		PE118FW	Radar Systems				
3.	PE-6		**Professional Elective-6**	3	-	-	3
		PE118FS	Internet of Things				
		PE118EZ	Adhoc Wireless Networks				
		PE118FE	Artificial Neural Networks				
4.	OE	OE118XX	**Open Elective – 4**	3	-	-	3
5.	PW	PW11863	**Project Phase– II**	2	-	12	8
			TOTAL	**14**	**-**	**12**	**20**

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. ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: BS111AC	**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 wavefront and amplitude. Young's double slit experiment, Interference from a thin plane glass plate (reflected light), Newton's rings experiment. Types of diffraction, Farunhofer 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, Davission–Germer experiment; Uncertainty principle, Time-dependent and time independent Schrodinger 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/ECE 6451L1 IntroductionToElectronicMaterials.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.

	L	T	P	C
I Year B.Tech. ECE I-Semester				
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: (~8 Lecture 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: (~8 Lecture 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: (~12 Lecture 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: (~10 Lecture 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 students 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. ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES111AF	**3**	**-**	**-**	**3**

PROGRAMMING FOR PROBLEM SOLVING

(Common to EEE, ECE, 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. Reema Thareja, Introduction to C Programming, 2nd Edition, 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. C Programming Language, B.W.Kernighan & Dennis Ritchie, 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. ECE 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: (~4 Lecture Hours and 12 Practical Hours)
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: (~3 Lecture Hours and 9 Practical Hours)
Orthographic Projections: Principles of Orthographic Projections – Conventions - Projections of points, straight lines and planes.

UNIT 3: (~3 Lecture Hours and 9 Practical Hours)
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: (~3 Lecture Hours and 9 Practical Hours)
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: (~3 Lecture Hours and 9 Practical Hours)
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 Resources:

1. www.engineeringdrawing.org
2. Virtual labs (www.vlab.co.in)

Course Outcomes:

At the end of the course, the students 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. ECE 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, equipment's 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 Lecture Hours 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 Lecture Hours)
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 Edition, Scitech publications (I) Pvt. Ltd., Hyderabad.
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, volI 2008 and Vol II 2010, Media Promoters and Publishers private limited, Mumbai.

Online Resources:

www.technologystudent.com

Course Outcomes:

At the end of the course, the students will be 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. ECE 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. ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES11105	**-**	**-**	**3**	**1.5**

PROGRAMMING LAB

(Common to EEE, ECE, 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 1and 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. ECE 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 KMnO4 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. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: BS112AG	**3**	**1**	**-**	**4**

NUMERICAL TECHNIQUES AND TRANSFORM CALCULUS

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

Prerequisites:-Nil-

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 students 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. ECE II-Semester **L T P C**
Course Code: HS112AJ **2 - - 2**

ENGLISH

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

Prerequisites:-Nil-

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, summarizing.
- **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 direction-Seeking / giving information-Apologizing.

UNIT 5: (~ 6 Lecture Hours)

- **Reading Comprehension**: Travelogue The Pamplona Clone: Jallikattufrom **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. Sudha Murthy, 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. Mukul Chowdhry, Simplified and abridged Wings of Fire: An Autobiography, APJ Abdul Kalam with Arun Tiwari University 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 students 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.

	L	T	P	C
I Year B.Tech. ECE II-Semester				
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 analyze 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-ϕ 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- ϕAC 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)
3-ϕ 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.
Induction motors: Basic concepts of 1-ϕInduction 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 2018, Oxford University Press.
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”, 2010, Tata McGraw Hill.
2. V.DelToro, “Electrical Engineering Fundamentals”, 1989, Prentice Hall India.
3. D.C.Kulshreshtha, “Basic Electrical Engineering”, 2009, McGraw Hill.

Course Outcomes:
After completion of this course, students will 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. ECE 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 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 polymer 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. ECE 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.

Course Outcomes:

After learning the contents of this course, the students 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. ECE 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-ϕ Induction Machine (cage type).
3. Study of Cut - out sections of
   c) Synchronous Machine d) 1- ϕInduction 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-ϕ transformer. Determination of efficiency.
2. Verification of voltage and current relations in a 3 -ϕ transformer.
3. Measurement of Power in a 3 -ϕ balanced load.
4. Torque v/s speed characteristics of a separately excited DC motor.
5. Torque-slip characteristics of a 3 -ϕ 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, students will 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. ECE 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 1/3rd rule and 3/8th 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 students 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.ECE 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: (~8Lecture 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. Harmonic functions, Milne-Thompson Method.

UNIT 4: (~10 Lecture 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.

UNIT 5: (~10Lecture Hours)
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. Integrate 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 ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: ES113AQ	**3**	**-**	**-**	**3**

NETWORK THEORY

(Common to ECE & ETE)

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. To understand the basic concepts on RLC circuits.
2. To know the behavior of the Steady state and transient analysis in RLC circuits.
3. To know the application of Laplace transforms techniques in solving the networks with different inputs.
4. To understand the two port network parameters, properties of LC networks and filters.

UNIT 1: (~10 Lecture Hours)
Review of DC Network basics, Nodal and Mesh Analysis.
Network Topology: Terminology, Cut-set and Tie-set matrices for Planar Networks with DC sources, related definitions and problems, Source Transformation and Duality.
Network Theorems: Thevenin's, Norton's, Maximum Power Transfer, Superposition, Tellegan's, Reciprocity, Millers, Millman's and Compensation theorems with DC and AC excitations.

UNIT 2: (~9 Lecture Hours)
Transient analysis: RC, RL and RLC series and parallel Circuits with DC, step, impulse, ramp, exponential and AC response using Time Domain and Laplace transform methods.

UNIT 3: (~10 Lecture Hours)
Two port network: Z, Y, h, g, ABCD and inverse ABCD parameters, Relationship among all the parameters, interconnection of 2 two port networks and problems.
Network function: Driving point and transfer functions and their properties and problems.
Synthesis: RC, RL and LC networks using Foster I & II form and Cauer I & II form.

UNIT 4: (~8 Lecture Hours)
Resonance: Series, parallel circuits, Concept of bandwidth and Q factor. Steady state response of a network to non-sinusoidal periodic inputs.

UNIT 5: (~8 Lecture Hours)
Filters: Image impedance, iterative impedance of T, π, L Sections, Characteristic impedance, Image transfer constants, Filter fundamentals, design of LP, HP and BP Filters using constant-k, m-derived and composite filters.

Text Books :

1. Van Valkenburg, Network Analysis, 3rd Edition, Prentice Hall of India, 2000.
2. A. Sudhakar and Shyammohan S.Palli, Circuits & Networks, 3rd Edition, Tata Mc Graw- Hill company, 2006.
3. William Hayt and Jack E. Kemmerly, Engineering Circuit Analysis, 8th Edition, Tata Mc Graw Hill Company.

Reference Books:

1. J.D.Ryder, "Networks, Lines and Fields" 2nd Edition, PHI, 1999.
2. Charles K Alexander and Mathew N O Sadiku, "Fundamentals of electric circuits", Mc Graw Hill Company, 2013.

Online Resources :

1. http://mlg.eng.cam.ac.uk/mchutchon/ResonantCircuits.pdf.
2. web.cecs.pdx.edu/~ece2xx

Course Outcomes:

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

1. Recognize the concepts of RMS, Average values.
2. Analyze the given network using Theorems, Transient, Laplace transform and Network topology.
3. Distinguish between Series and Parallel resonance.
4. Classify a given network in terms of different two port network parameters.
5. Develop the network from the Network functions.
6. Design different Passive filters.

	L	T	P	C
II Year B.Tech ECE I-Semester				
Course Code: PC113AW	**3**	**1**	**-**	**4**

ELECTRONIC DEVICES AND CIRCUITS

(Common to ECE & ETE)

Prerequisites: Physics

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 and transistors (BJTs and FETs).
4. To differentiate between various feedback Amplifiers.

UNIT 1: (~10 Lecture Hours)

P-N Junction Diode: Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuits, Load line analysis, Diffusion and Transition Capacitances. Break down Mechanisms-Avalanche breakdown, Zener breakdown, Zener Diode as a Regulator, Tunneling Phenomenon.

Rectifiers: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier.

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 - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization against variations in V_{BE} and β.

UNIT 3: (~8 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 4: (~8 Lecture Hours)

Field Effect Transistors: JFET Construction and Principle of operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Small Signal

Model, Biasing FET, MOSFET characteristics (Enhancement and depletion mode), Symbols of MOSFET, Comparison of BJT and FET.

UNIT 5: (~9 Lecture Hours)

Positive & Negative Feedback in Amplifiers: Classification of amplifiers, Concepts of feedback-Classification of feedback amplifiers - General characteristics of negative feedback amplifiers-Effect of Feedback on Amplifier characteristics-Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations-Simple problems. Barkhausen criterion, RC oscillators (phase shift, Wienbridge), LC oscillators (Hartley, Colpitts), Crystal oscillators.

Text Books

1. J.Millman, C.C.Halkias, and SatyabrathaJit, 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.

Reference Books:

1. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th Edition, Pearson, 2014.
2. Millman , Christos Halkias, Chetan D Parikh Integrated Electronics, 2nd Edition, Tata McGraw Hill, 2011.
3. S.G.Burns and P.R.Bond, Principles of Electronic Circuits, 2nd Edition, Galgotia Publications, 1998.
4. C.T. Sah, Fundamentals of Solid State Electronics, World Scientific Publishing Co. Inc,1991.
5. T.F. Bogart Jr., J.S.Beasley and G.Rico, Electronic Devices and Circuits, 6th Edition, Pearson Education, 2004.

Online Resources :

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

Course Outcomes:

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

1. Illustrate the fundamental behavior of various diodes and transistors.
2. Examine the construction, operation and characteristics of BJT, JFET and MOSFET.
3. Analyze the various amplifier circuits using small signal hybrid model.
4. Identify various biasing techniques.
5. Distinguish between Positive and Negative feedback circuits.
6. Apply the knowledge of Diodes in designing circuits like rectifiers.

II Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC113AY	**3**	**-**	**-**	**3**

SIGNALS AND SYSTEMS
(Common to ECE & ETE)

Prerequisites: Linear Algebra and Multivariable Calculus

Course Objectives:

1. To provide basics of signals and systems required for analyzing various areas related to signal processing.
2. To analyze spectral behavior of signals and systems using different transform techniques.
3. To develop mathematical skills to solve problems involving convolution and filtering.
4. To understand the importance of sampling theorem.

UNIT 1: (~9 Lecture Hours)
Classification of Signals and Systems: Introduction to signals and systems, classification of signals-continuous and discrete, periodic & non-periodic, energy and power signals, even & odd, deterministic & random signals & problems. Operation on signal/sequence, problems, elementary signals. classification of systems-linearity, time-invariance, causality, stability, memory & invertibility (problems on each).

UNIT 2: (~10 Lecture Hours)
Fourier Representation of Continuous time Periodic&Non-Periodic Signals : Orthogonality concept, Dirichlet condition, continuous time Fourier series- derivation of co-efficient, problems, properties (only statements).Continuous time Fourier transform- CTFT of standard signals, properties - linearity, time scaling & reversal, shifting in time & frequency, symmetry, convolution & multiplication, differentiation in time & frequency, integration, duality, Parseval's theorem (proof & problems).

UNIT 3: (~8 Lecture Hours)
Fourier Representation of Discrete time Periodic & Non-Periodic Signals: Discrete time Fourier series-derivation of co-efficient, problems, properties (only statements). Discrete time Fourier transform, problems, properties (proofs & problems)- periodicity, linearity, time scaling & reversal, shifting in time & frequency, symmetry, convolution & multiplication, differentiation in frequency, Parseval's theorem.

UNIT 4: (~10 Lecture Hours)

Time Domain Representation of LTI Systems: Introduction, discrete time LTI system-convolution sum(derivation), problems, continuous time LTI system-convolution integral (derivation), problems, properties of impulse response of LTI system, step response, sinusoidal response.

Application of Fourier Representation:

Frequency response of LTI systems, problems, Fourier transform of periodic signal, problems. Sampling theorem (proof), reconstruction of signal from samples, practical reconstruction – zero order hold, problems.

UNIT 5: (~8 Lecture Hours)

Representation of Signals Using Continuous Time Complex Exponential-Laplace Transform: Introduction, Laplace transform (LT), region of convergence (ROC) & properties of ROC, LT of standard signals, unilateral LT, properties of LT w.r.t to ROC- linearity, time scaling & shifting, S-domain shift, convolution, differentiation in time & S-domain, integrity property, initial & final value theorems (with proofs).

Inverse Laplace transform w.r.t ROC, solving differential equation using Laplace transform.

Text Books:

1. Simon Haykin & Barry van Veen, Signals and Systems, 2nd Edition, John Wiley and Sons (Asia) Private Limited, 2007.
2. A.V. Oppenheim, A.S.Willsky and S.Hamid Nawab, Signals and Systems, 2nd Edition, Prentice Hall, 2004.

Reference Books:

1. R.F.Ziemer, W.H.Tranter and D.R.Fannin, Signals and Systems - Continuous and Discrete, 4th Edition, Prentice Hall, 2005.
2. B.P. Lathi, Principles of Signal Processing and Linear Systems, 1st Edition, Oxford University Press, 2014.
3. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, Signals and Systems, 2nd Edition, TMH New Delhi, 2011.
4. Tarun Kumar Rawat, Signals & Systems, 1st Edition, Oxford university press, 2010.
5. Ashok Ambardar, Analog and Digital Signal Processing, 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 2001.

Online Resources:

1. https://www.edx.org/course/signals-and-systems-part-1-1

2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/

Course Outcomes:

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

1. Classify the signals and sequences, introduce the orthogonality in signals and approximate signals using orthogonal functions.
2. Analyze the spectral characteristics of continuous-time/ discrete-time periodic and aperiodic signals using Fourier analysis.
3. Classify the continuous and discrete systems, represent LTI systems and analyze the characteristics of systems.
4. Apply sampling theorem and describe the practical reconstruction techniques.
5. Analyze the continuous time systems and discrete time systems using convolution integral and convolution sum respectively.
6. Apply Laplace transform techniques to analyze continuous-time signals and systems.

II Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PC113AT	**3**	**-**	**-**	**3**

DIGITAL SYSTEM DESIGN

(Common to ECE & ETE)

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 impart student the concepts for analyzing digital systems in terms of state machines.

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: (~8 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.

UNIT 3 : (~11 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 4: (~11 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.

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 Hour**s)**

Finite State Machines: State Diagrams, Mealy and Moore Models, Finite State Machines-Capabilities, Limitations, Minimization, Serial Binary Adder, Sequence Detector, Parity-bit Generator, and Pseudo Random Sequence Generator.

Algorithmic State Machines: ASM Charts, Design of ASM Charts for Binary Multiplier, Dice Game Controller.

Text Books:

1. Morris Mano, Digital Design, 5th Edition, Pearson, 2012.
2. R.P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill, 2009.
3. Zvi Kohavi & Niraj K. Jha, Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2009.

Reference Books:

1. Charles Roth, Digital System Design using VHDL, 2nd Edition, Tata McGraw Hill, 2012.
2. W. H. Gothmann, Digital Electronics- An Introduction to Theory and Practice, 2nd Edition, PHI, 2006.
3. A. Anand Kumar, Switching Theory and Logic Design, PHI, 3rd Edition, 2013.

Online Resources:

1. http://www.nesoacademy.org/
2. Lectures on Switching Circuits and Logic Design by Prof.Indranil Senguptha IITK https://nptel.ac.in/courses/106105185/

Course Outcomes:

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

1. Explore 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. Design complex digital systems using simpler digital subsystems.
5. Verify the digital designs for required functionality.
6. Provide solutions for various required specifications in the form of digital designs.

II YEAR B.Tech, ECE I-Semester **L T P C**
Course Code: PC11322 **- - 3 1.5**

ELECTRONIC CIRCUITS LAB

(Common to ECE & ETE)

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 know the functionality of different oscillators.

Part A: Electronic Workshop Practice (in 3 lab sessions)

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

Part B: (Minimum of 12 experiments to be conducted)

1. V-I characteristics of PN junction Diode under Forward and Reverse Bias.
2. V-I characteristics of Zener diode and Zener diode as voltage regulator.
3. Input and output Characteristics of a BJT in CE configuration.
4. Input and output Characteristics of a BJT in CB configuration.
5. Drain and Transfer characteristics of JFET.
6. HWR without filter.
7. FWR without filter.
8. Transistor as a Switch.
9. Frequency response of CE Amplifier.
10. Frequency response of CC Amplifier.
11. Frequency response of JFET CS Amplifier.
12. RC phase shift and Hartley Oscillator.
13. Voltage Series Feedback Amplifier.
14. Current Shunt Feedback Amplifier.

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 be able 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 rectifier and oscillator circuits and estimate of their performance characteristics.
4. Design, develop and test BJT and FET amplifier circuits with/without feedback and estimate the Amplifier 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. ECE I-Semester **L T P C**
Course Code: ES11314 **- - 3 1.5**

BASIC SIMULATION LAB
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:
1. To introduce MATLAB simulation software.
2. To demonstrate the concepts learnt in Signals & Systems in MATLAB software.
3. To enable students use graphical programming environment for modeling, simulating and analyzing few concepts of signals & systems using MATLAB Simulink software.
4. To prepare students on how to make use of MATLAB software for various Engineering problems.

List of Experiments:
1. Basic operations on matrices.
2. Generation of various signals and sequences (Periodic and Aperiodic), such as unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
3. Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.
4. Finding the even and odd parts of signal/sequence and real and imaginary parts of signal.
5. Convolution for signals and sequences.
6. Verification of linearity and time invariance properties of a given continuous/discrete system.
7. Computation of unit sample, unit step and sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties.
8. Gibbs phenomenon simulation.
9. Finding the Fourier transform of a given signal and plotting its magnitude and phase spectrum.
10. Computing discrete time Fourier series of given discrete signal.
11. Computing discrete time Fourier transform of given discrete signal.
12. Finding frequency response of LTI system given in difference equation/ transfer function form
13. Waveform synthesis using Laplace transforms.

14. Locating the zeros and poles and plotting the pole-zero maps in S-plane for the given transfer function.
15. Sampling theorem verification.

Note:

1. Minimum 12 experiments should be conducted. All these experiments are to be simulated using MATLAB.
2. Experiment numbers 3, 5, 6, 12, 14 are also to be simulated using Simulink.

Online Resources :

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/
2. https://www.edx.org/course/signals-and-systems-part-1-1

Course Outcomes:

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

1. Understand fundamental concepts & usage of MATLAB simulation software using Communications & Signal processing toolboxes.
2. Identify the specifications, requirements & built in functions to generate different kinds of signals & sequences and mathematical operations involving them.
3. Develop MATLAB code for designing various filters and verifying the properties of LTI system.
4. Develop MATLAB code for analyzing Fourier and Laplace transforms and their utility.
5. Develop MATLAB code for Fourier analysis of Discrete sequences.
6. Generate relevant simulation codes, with and without usage of built in functions & estimation of the numerical results with supporting plots.

II Year B.Tech ECE I-Semester **L T P C**
Course Code: PC11320 **- - 3 1.5**

DIGITAL SYSTEM DESIGN LAB

(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To generate various frequencies and plot transfer characteristics of inverter using NAND and NOR gates.
2. To construct higher order combinational circuits using smaller digital ICs.
3. To design higher order registers using smaller digital ICs.
4. To design and verify asynchronous and synchronous counter using digital ICs.

List of Experiments:

1. Design a 450 KHz clock using NAND / NOR gates.
2. Realize and Design a 16 x 4 priority encoder using two 8 x 3 priority encoder.
3. Realize and Design a 16 bit comparator using 4 bit comparators.
4. Realize and Design a 16 x 1 multiplexer using 8 x 1 multiplexer.
5. Realize and Design a 16 bit adder / subtractor using 4 bit adder / subtractor IC's
6. Realize and Design 4 bit gray to binary and binary to gray code converters.
7. Plot the transfer characteristics of 74H, LS, HS series IC's.
8. Realize and Design a modulo 53 counter using two decade counters.
9. Realize and Design a 4 bit pseudo random sequence generator using 4 bit ring counter.
10. Realize and Design a two digit 7 segment display unit. Display a Mod-53 counter output on the 7 segment display.
11. Realize and Design an 8 bit parallel load and serial out shift register using two 4 bit shift register.
12. Realize and Design an 8 bit serial in and serial out shift register using two 4 bit shift register.
13. Realize and Design a ring counter and twisted ring counter using a 4 bit shift register
14. Realize and Design a 4 digit hex counter using synchronous one digit hex counters.

15. Realize and Design a 4 digit hex counter using asynchronous one digit hex counters.
16. Hobby project.

Note: Minimum of 12 experiments to be conducted.

Online Resources

1. http://www.nesoacademy.org/
2. Lectures on Switching Circuits and Logic Design by Prof.Indranil Senguptha IITK https://nptel.ac.in/courses/106105185/

Course Outcomes:

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

1. Develop the concepts in combinational and sequential circuits.
2. Generate clock frequency and plot the transfer characterstics of inverter using NAND and NOR gates.
3. Analyze the simple combinational circuits using different digital ICs.
4. Design the higher order sequential circuits using lower order digital circuits.
5. Verify the output of the digital circuits with respect to truth tables.
6. Interpret and verify the digital circuits based on the fundamental properties of logic circuits.

II Year B.Tech. ECE 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. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: BS114BA	**3**	**-**	**-**	**3**

PROBABILITY THEORY AND STOCHASTIC PROCESSES

(Common to ECE & ETE)

Prerequisite:-Nil-

Course Objectives:

1. To introduce basic methodology of randomness in nature and a general overview of statistical methods, probability theory and random variables
2. To deal with multiple random variables.
3. To analyse random process and obtain statistical characteristics of response of LTI system.
4. To study spectral characteristics of the response of LTI system.

UNIT 1: (~9 Lecture Hours)

Probability: Probability introduced through sets and relative frequency – experiments and sample spaces, discrete and continuous sample spaces, events, probability definitions and axioms, mathematical model of experiments, Probability as a relative frequency, joint and conditional probabilities, independent events.

Random Variable: Definition of a random variable, conditions for a function to be a random variable, discrete, continuous and mixed random variables.

UNIT 2: (~10 Lecture Hours)

Distribution & Density Functions of Random Variable: Distribution function, density function, The Gaussian random variable, other distribution and density examples, conditional distribution and density functions.

Operation on One Random Variable-Expectations: Introduction, expectation-expected value of a random variable, expected value of function of a random variable, moments, Chebychev's inequality, Markov's inequality, Chernoff's bound, functions that give moments – characteristic function, moment generating function, Transformations of a random variable.

UNIT 3: (~11 Lecture Hours)

Multiple Random Variables: Vector random variables, joint distribution and its properties, joint density function and its properties, conditional distribution and density -Point conditioning, conditional distribution and density-Interval conditioning, statistical independence.

Operations on Multiple Random Variables: Expected value of a function of random variables, joint characteristic functions, jointly Gaussian random variables, transformations of multiple random variables, linear transformations of Gaussian random variables, Law of large numbers (statement), distribution and density of sum of random variables, Central limit theorem, equal distributions (Proof required).unequal distribution (Proof not expected)

UNIT 4: (~8 Lecture Hours)

Stochastic Processes-Temporal Characteristics: The stochastic process concept, stationarity and independence-distribution and density functions, statistical independence, first-order stationary processes, second-order and wide-sense stationarity, Nth order and strict-sense stationarity, time averages and ergodicity-mean-ergodic processes(Proof not expected), correlation-ergodic processes (Proof not expected), correlation functions, Gaussian random processes, Poisson random process, random signal response of linear system.

UNIT 5: (~7 Lecture Hours)

Stochastic Processes-Spectral Characteristics: Power density spectrum and its properties, relationship between power spectrum and autocorrelation function, cross-power density spectrum and its properties, relationship between cross-power density spectrum and cross-correlation function, spectral characteristics of system response.

Text Books:

1. Peyton Z. Peebles, Probability, Random Variables & Random Signal Principles, 4th Edition, TMH, 2010.
2. Athanasios Papoulis and S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes 4th Edition, TMH, 2011.

Reference Books:

1. Mallikarjuna Reddy, Probability Theory and Stochastic Processes, 4th Edition, Cengage Learning, 2013.
2. Schaum's outline of Theory and Problems of Analog and Digital Communications-Schaum's Outline Series, 2nd Edition, McGraw-Hill, 2004.
3. Henry Stark and John W. Woods, Probability and Random Processes with Application to Signal Processing, 4th Edition, Pearson Education, 2012.

Online Resources :

1. https://www.edx.org/course/introduction-probability-part-1-mitx-6-041-1x
2. Lectures on Probability and Random Processes (Video) Prof. Mrityunjoy Chakraborty IIT Kharagpur http://nptel.ac.in/courses/117105085/

Course Outcomes:

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

1. Comprehend the random variables, vectors and processes.
2. Analyze the use of multiple random variables and relate them to communication engineering problems.
3. Evaluate and apply moments & characteristic functions, inequalities and significance of Central Limit Theorem.
4. Present the concept of Correlation, Power Density Spectrum and their properties.
5. Explore relation between the output, input and Impulse Response of LTI system with respect to various statistical characteristics.
6. Create mathematical models for practical design problems and determine theoretical solutions to the created models.

II Year B.Tech. ECE 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. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC114BF	**3**	**-**	**-**	**3**

ANALOG CIRCUITS

(Common to ECE & ETE)

Prerequisite: 1.Electronic Devices and Circuits 2. Network Theory

Course Objectives:

1. To familiarize with different types of power amplifiers, Wave shaping circuits and Multivibrators.
2. To understand working of Operational Amplifier and its applications.
3. To know the functionality of ADC and DAC circuits
4. To distinguish between various modes of 555 Timer.

UNIT 1: (~10 Lecture Hours)

Multistage Amplifiers: Different coupling schemes used in amplifiers, Analysis of Cascaded RC Coupled amplifiers, Cascode amplifier, Darlington pair.

Power amplifiers: Classification of Amplifiers-Distortion in amplifiers, Various classes of operation (Class A,B), Class A Power Amplifier, Maximum Efficiency of Class A Amplifier, Transformer Coupled Class A Amplifier, Push- Pull and Complimentary Symmetry Class B, Concept of Tuned amplifier and its application.

UNIT 2: (~10 Lecture Hours)

Linear Wave Shaping: High pass and low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square, & Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator.

Non-Linear Wave Shaping: Diode clippers, Clipping at two independent levels, Concept of Clampers

UNIT 3: (~8 Lecture Hours)

Multivibrators: Analysis and Design of Bistable Multivibrator, Commutating Capacitors, Types of Triggering, Direct Coupled Binary, Collector coupled Monostable and Astable Multivibrators , Schmitt trigger using Transistors.

UNIT 4: (~8 Lecture Hours)

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Applications of open loop and closed loop Op-Amp-Differential Amplifier, Logarithmic amplifier, Differentiator and Integrator, Summing Amplifier, Precision Rectifier.

UNIT 5: (~9 Lecture Hours)
IC 555Timer: Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic & Applications.
Digital-to-Analog converters (DAC): Weighted resistor, R-2R ladder.
Analog-to-Digital converters (ADC): Single slope, dual slope, successive approximation, flash.

Text Books:

1. J. Millman, H. Taub and Mothiki S. Prakash Rao, Pulse, Digital and Switching Waveforms, 2nd Edition, McGraw Hill, 2008.
2. J.Millman and Christos C Halkias, Integrated Electronics, TMH 2010.
3. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, PHI, 2003.

Reference Books:

1. D. Roy Chowdhury, Linear Integrated Circuits, 2nd Edition, New Age International (p) Ltd, 2003.
2. J. Millman and A. Grabel, Microelectronics, 2nd Edition, McGraw Hill, 1988.

Online Resources:

Lectures on Analog Circuits Prof. Jayanta Mukherjee IIT Bombay https://nptel.ac.in/courses/108101094/

Course Outcomes:

At the end of this course students will be able to

1. Classify various power amplifier circuits in terms of their functionality.
2. Distinguish between Linear and Non-linear Wave shaping circuits.
3. Analyze the operation of OP-AMP, Multivibrator and 555 Timer
4. Design different types of Multivibrator circuits.
5. Demonstrate various applications of op-amps.
6. Illustrate the performance of ADC and DAC.

II YearB.Tech. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC114BG	**3**	**1**	**-**	**4**

ANALOG AND DIGITAL COMMUNICATIONS

(Common to ECE & ETE)

Prerequisites: Signals and Systems

Course Objectives:

1. To develop the ability to analyze system requirements of Analog Communication Systems.
2. To analyze the generation, detection of various Analog Modulation Techniques with mathematical analysis.
3. To analyze different types of Digital Modulation Techniques and information theory concepts.
4. To model digital communication system for bit error rate analysis.

UNIT 1: (~10 Lecture Hours)

Amplitude Modulation: Representation of band pass signals and signal envelopes, Need for modulation, FDM, Amplitude Modulation-Time and Frequency domain, single tone modulation, power relations , Generation of AM wave with switching modulator, Detection of AM Waves using Envelope detector, DSB-SC: Time and Frequency domain, Generation of DSB-SC-Ring Modulator, Coherent detection, Hilbert transform and properties, SSB-SC: Time and Frequency domain, Generation of SSB-Frequency and Phase discrimination method, Demodulation of SSB.

UNIT 2: (~8 Lecture Hours)

Angle Modulation: Frequency Modulation: Single tone Frequency Modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Transmission bandwidth of FM Wave, Generation of FM Waves-Direct and Indirect FM, Detection of FM Waves: Foster Seeley Discriminator, Phase locked loop, Comparison of FM and AM.

Noise: Types of Noise, Modelling of noise and AWGN, Comparison of Noise performance in AM, DSBSC, SSB & FM (without derivations), Pre-emphasis and De-emphasis, Superheterodyne Receiver.

UNIT 3: (~10 Lecture Hours)

Pulse Analog Modulation: Bandpass sampling, Types of sampling process, Types of Pulse Modulation, PAM- Generation and Demodulation, PWM-Generation and Demodulation, PPM-Generation and Demodulation, TDM.

Pulse Digital Modulation: PCM, Generation and Reconstruction, Quantization Noise, DPCM, DM and Adaptive DM, Noise in PCM and DM.

UNIT 4: (~10 Lecture Hours)
Digital Carrier Modulation Schemes: Optimum Receiver for Binary Digital Modulation Schemes, Description of Binary ASK,FSK,PSK and QPSK Schemes, Transfer Function of the matched filter, Bandwidth and Probability of Error calculations of binary ASK, FSK, PSK and QPSK (Coherent schemes), Comparison of Digital Modulation Schemes. Introduction to QAM, Signal space representation of binary- ASK, PSK, FSK, QPSK and QAM.

UNIT 5: (~8 Lecture Hours)
Concepts of Information theory: Discrete Messages and Information Content-Entropy, Information Rate, Source Coding Theorem, Source Coding-Shannon Fano Coding, Huffman Coding, Shannons Theorem, Channel Capacity-Capacity of Gaussian Channel, Bandwidth-S/N Ratio Trade off, Mutual Information and Channel Capacity.

Text Books:

1. Simon Haykin, Communication Systems, 4th Edition, John Wiley and Sons.
2. K.Sam Shanmugam, Digital and Analog Communication Systems, John Wiley and Sons, 2004.
3. Taub H and Schilling D.L., Principles of Communication Systems, TMH, 2001.

Reference Books:

1. B.P. Lathi, Communication Systems, BS Publication, 2004.
2. R.P.Singh and S.D Sapre, Communication Systems Analog and Digital, TMH, 2006.
3. Wayne Tomasi, Electronics Communications Systems: Fundamentals Through Advanced, 5th Edition, Pearson, 2004.
4. Upamanyu Madhow, Introduction to Communication Systems, Cambridge University Press, 2014.

Online Resources:

1. Analog communications by Prof.Goutam Das, IIT Kharagpur. https://nptel.ac.in/courses/117105143/
2. Principles of Digital communications by Prof.S.N.Merchant,IITB, https://nptel.ac.in/courses/108101113/

Course Outcomes:

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

1. Analyze different modulation and demodulation schemes for analog & digital communications.
2. Evaluate fundamental communication system parameters such as Bandwidth, Power, Signal to quantization noise ratio and Figure of merit.
3. Design Analog & Digital communication systems to meet desired needs.
4. Elucidate the design tradeoffs and performance of Analog and Digital communication systems.
5. Calculate error rate, Spectral efficiency of Digtal Modulation techniques.
6. Analyze the concept of source coding and channel coding techniques

II Year B.Tech. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC114BM	**3**	**-**	**-**	**3**

MICROPROCESSORS AND MICROCONTROLLERS

(Common to ECE & ETE)

Prerequisites: Digital System Design

Course Objectives:

1. Describe the architecture of Microprocessor and Microcontrollers.
2. Understand and apply the fundamentals of assembly language programming of Microprocessors and Microcontrollers.
3. Experimenting with memory and I/O interfacing of Microcontroller.
4. Develop real time applications of Microprocessors as well as 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 of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

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

UNIT 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. K. Ray and K.M. Bhurchandani, Advanced Microprocessors and Peripherals, TMH, 2nd Edition, 2006.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051 Microcontroller ad Embedded. Systems. Using Assembly and C. Pearson, 2nd Edition, 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, The 8051 Microcontroller, 3rd Edition, Cengage Learning, 2006.

Online Resources:

1. https://lecturenotes.in/subject/22/microprocessor-and-microco ntroller-mpmc
2. NPTEL Material on Microprocessors by Dr. Pramod Agarwal,IIT Roorkee http://nptel.ac.in/courses/108107029/

Course Outcomes:

At the end of this course, students will 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.

II Year B.Tech. ECE II-Semester **L T P C**
Course Code: PC11426 **- - 3 1.5**

ANALOG CIRCUITS LAB
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objective:
1. To design, simulate various non-linear wave shaping circuits, multivibrators.
2. To verify practically different applications of Op-Amp.
3. To familiarize with the operation of DACs.
4. To know the functionality of 555 timer in different modes.

Minimum Twelve experiments to be conducted:

List of Experiments:
1. Design, develop and Testing of a Two Stage RC Coupled Amplifier.
2. Design, develop and Testing of a Non-linear wave shaping
   a) Clippers b) Clampers
3. Design, develop and Testing of a Bi-stable Multivibrator.
4. Design, develop and Testing of a Monostable Multivibrator.
5. Design, develop and Testing of a Astable Multivibrator.
6. Design, develop and Testing of a Schmitt Trigger.
7. Design an Adder, Subtractor using Op-amp 741.
8. Design an Integrator and Differentiator using Op-amp 741.
9. Design an Inverting Amplifier and Non-Inverting Amplifier using Op-amp 741.
10. Design an R-2R ladder DAC.
11. Design aWeighted Resistor DAC.
12. Design a Monostable mutlivibrator using 555 Timer.
13. Design Astable mutlivibrator using 555 Timer.

Note:
1. Experiments 1 to 6 to be implemented using simulation (Multisim or equivalent) and Hardware realization.
2. Experiments 7 to 13 to be implemented using Design and Hardware realization.

Online Resources:
Lectures on Analog Circuits Prof. Jayanta Mukherjee IIT Bombay https://nptel.ac.in/courses/108101094/

Course Outcomes:

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

1. Illustrate the utility of various modes of 555 timers, applications of semiconductor devices and Op-Amps.
2. Identify different types of DACs.
3. Set up circuits to interpret the different applications of Op-Amps.
4. Design, develop and test nonlinear wave shaping, Multivibrators, 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. ECE II-Semester **L T P C**
Course Code: PC11425 **- - 3 1.5**

ANALOG AND DIGITAL COMMUNICATIONS LAB

(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To analyze analog modulation techniques and simulate them using MATLAB software.
2. To implement and analyse sampling concepts and multiplexing
3. To implement and analyze the pulse digital modulation techniques.
4. To analyze Power Spectral Density of analog and digital modulation techniques using spectrum analyzer.

List of Experiments:

1. Implement and simulate Amplitude modulation and demodulation process using MATLAB software.
2. Implement and simulate DSB-SC Modulator & Detector using MATLAB software.
3. Design and implement SSB-SC Modulator & Detector (Phase Shift Method) using MATLAB software.
4. Design and implement Frequency modulation and demodulation using MATLAB software.
5. Implement and simulate Time Division Multiplexing & Demultiplexing using MATLAB software.
6. Implement, analyze and Simulate Sampling Theorem using MATLAB software.
7. Implement, analyze and simulate Pulse Position Modulation & Demodulation using MATLAB software.
8. Analyze AM and FM modulation schemes using Spectrum analyzer.
9. Implement and analyze PCM Generation and Detection.
10. Implement and analyze Differential Pulse Code Modulation.
11. Implement and analyze Delta Modulation.
12. Implement Frequency Shift Keying: Generation and Detection and Simulate using MATLAB software.
13. Implement Phase Shift Keying: Generation and Detection and Simulate using MATLAB software.
14. To implement Amplitude Shift Keying: Generation and Detection and Simulate using MATLAB software.

15. To implement QAM, and analyze the Spectral characteristics of QAM using Spectrum analyzer.
16. To implement QPSK: Generation and Detection and Simulate using MATLAB software.

Note: Minimum of 12 experiments to be conducted.

Online Resources:

1. http://onlinecources.nptel.ac.in/noc18_ee26 (Analog communications by Prof.Goutam Das, IIT Kharagpur)
2. http://onlinecources.nptel.ac.in/noc18_ee27 (Principles of Digital communications by Prof.S.N.Merchant,IITB,)

Course Outcomes:

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

1. Understand fundamentals in implementation and Simulation of Analog and Digital Communication concepts.
2. Comprehend the theoretical concepts and relate the same to the circuit schematics used in AM, FM, Pulse modulation and TDM technique.
3. Develop code for simulation of Analog modulation and Pulse modulation techniques, and analyse the performance of the system.
4. Analyse the implementation details of Digital Carrier modulation techniques, and Simulate the same in MATLAB.
5. Generate the Simulation code, to implement the concepts/application of Communications in MATLAB.
6. Develop the hardware for basic analog/digital communication concepts, and comprehend the Numerical results from experimental measurements.

II Year B.Tech. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC11432	**-**	**-**	**3**	**1.5**

MICROPROCESSORS AND MICROCONTROLLERS LAB

(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. Infer the basics of the microprocessor and its assembly language.
2. Extend the basics of assembly language to the microcontroller.
3. Provide foundation on interfacing the external devices to the micro controller.
4. Develop solutions for the real time applications.

List of Experiments:

Implement the following experiments using TASM/MASM assembler for 8086 and Keil µ Vision 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. NPTEL Material on Microprocessors by Dr. Pramod Agarwal,IIT Roorkee http://nptel.ac.in/courses/108107029/

Course Outcomes:

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

1. Understand the architecture of 8086 microprocessor and 8051 microcontroller.
2. Comprehend the knowledge of instruction set of 8086 microprocessor and 8051 microcontroller.
3. Develop algorithms to implement the given task using 8086 microprocessor.
4. Develop algorithms to implement the given task using 8051 microcontroller.
5. Design and build the 8086 microprocessor/8051 microcontroller based systems.
6. Verification and analysis of the programs and their results.

II Year B.Tech. ECE 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, Text book 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. ECE I-Semester **L T P C**
Course Code: PC115CM **3 - - 3**

VLSI DESIGN

(Common to ECE & ETE)

Prerequisites:1. Electronic Devices & Circuits 2. Digital System Design

Course Objectives:

1. To know electrical properties of MOS and BiCMOS devices and to analyze the behavior of inverters designed with various loads.
2. To draw the layout of any logic circuit with the specified design rules.
3. To provide concept to design different types of digital circuits using CMOS logic.
4. To understand Sub system design, basic programmable logic devices and testing of CMOS circuits.

UNIT 1: (~10 lecture hours)
Introduction: Introduction to MOS Technology – MOS, PMOS, NMOS, CMOS and BiCMOS technologies.
Basic Electrical Properties: Basic Electrical Properties of MOS ,CMOS and BiCMOS Circuits: IDS-VDS relationships, MOS transistor threshold Voltage, g_m, g_{ds}, figure of merit , Pass transistor, NMOS inverter, Various pull - ups, Determination of pull-up to pull-down ratio(Zpu / Zpd) , CMOS Inverter analysis and design, Bi CMOS inverters, Latch-up in CMOS circuits.

UNIT 2: (~10 lecture hours)
VLSI Circuit Design Processes : VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layouts, Lambda based design rules, Contact cuts , CMOS Lambda based design rules, Layout Diagrams for logic gates, Transistor structures, wires and vias, Scaling of MOS circuits- Scaling models, scaling factors, scaling factors for device parameters, Limitations of Scaling

UNIT 3: (~10 lecture hours)
Gate Level Design: Architectural issues, Switch logic networks: Gate logic, Alternate gate circuit: Pseudo-NMOS, Dynamic CMOS logic. Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area capacitance Units, Calculations, The delay unit T, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers.

UNIT 4: (~8 lecture hours)
Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs,

Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.
Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT 5: (~8 lecture hours)
Programmable Logic Devices: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.
CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

Text Books :
1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell- Essentials of VLSI Circuits and Systems, 1st Edition, PHI, 2005.
2. Neil H. E Weste, David Harris, Ayan Banerjee-CMOS VLSI Design – A Circuits and Systems Perspective, 3rd Edition, Pearson, 2009.

Reference Books:
1. Ming-BO Lin -Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2011.
2. John .P. Uyemura -CMOS Logic Circuit Design, Springer, 2007.
3. Wayne Wolf -Modern VLSI Design, 3rd Edition, Pearson Education, 1997.
4. M. Michael Vai -VLSI Design, CRC Press, 2001.

Online Resources:
1. NPTEL material on VLSI Design (Web) by Prof. A.N. Chandorkar, IIT Bombay https://nptel.ac.in/courses/117101058/.
2. https://www.tutorialspoint.com/vlsi_design/index.htm
3. https://www.udemy.com/topic/vlsi/
4. http://www.vlsiguru.com/
5. http://www.vlsi-expert.com/p/vlsi-basic.html

Course Outcomes:
At the end of this course, students will be able to
1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
2. Analyze modes of operation of MOS transistor and its basic electrical properties.
3. Design and develop various VLSI Data path subsystems.
4. Design and develop simple memories using MOS transistors.
5. Implementation of simple logic circuits using PLA, PAL, FPGA and CPLD.
6. Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

III Year B.Tech. ECE I-Semester **L T P C**
Course Code:PC115BY **3 1 - 4**

DIGITAL SIGNAL PROCESSING

(Common to ECE & ETE)

Prerequisites: Signals and Systems

Course Objectives:

1. To provide basics of Discrete Time Signals and Systems
2. To analyse Discrete Time Signals and Systems using different Transform Techniques
3. To design and implement FIR and IIR filters
4. To demonstrate Multirate Digital Signal Processing and analyse effects of Finite word length effects in DSP

UNIT 1: (~09 lecture hours)

Z-Transforms: Review of Discrete time Signals, The Z-Transform - The Direct Z-Transform, Inversion of Z-Transform – Power series expansion method, Partial fraction expansion method, Contour integration (Residue) method, Properties of Z-Transform, Analysis of Linear shift invariant (LSI systems) - Solution of difference equations using Z-Transform, Causality and stability.

UNIT 2:(~10 lecture hours)

Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)

Discrete Fourier Transform (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, DFT, The DFT as a Linear Transformation, Relationship of the DFT to Other Transforms, Properties of DFT - Periodicity, Linearity, Symmetry, Circular Convolution, Time reversal of a sequence, Circular time shift of a sequence, Circular frequency shift, Complex-Conjugate properties, Circular correlation, Multiplication of two sequences, Parseval's Theorem.

Fast Fourier Transform (FFT): FFT Algorithms - Radix-2 Decimation in time (DIT) and Decimation in frequency (DIF), Problems.

UNIT 3: (~09 lecture hours)

Design of Finite Impulse Response (FIR) Filters: Symmetric and Antisymmetric FIR filters, Design of Optimum Equiripple Linear -phase FIR filters, Design of Linear-phase FIR filters (Lowpass, Highpass, Bandpass and Bandstop filters) - Fourier Series method, Windowing method (Rectangular, Bartlett, Hanning, Hamming, Blackman

windows),Introduction to Kaiser window, Frequency-Sampling method, Implementation of Discrete time systems (Structures for FIR systems) – Direct form structures, Cascade-form structure.

UNIT 4:(~09 lecture hours)

Design of Infinite Impulse Response (IIR) Filters: Design of analog low pass filter using Butterworth and Chebyshev type-1 filters. IIR filter design (LPF only) by Impulse Invariance and Bilinear transformation techniques, Comparison of FIR and IIR filters, Implementation of Discrete time systems (Structures for IIR systems) – Direct form I and II structures, Cascade form structures, Parallel form structures.

UNIT 5: (~08 lecture hours)

Effect of finite register length in FIR filter design: Representation of Numbers: Fixed-Point Representation of Numbers, Binary Floating-Point Representation of Number, Errors Resulting from Rounding and Truncation, Quantization of Coefficients in FIR Filters.

Introduction to Multirate Signal Processing: Introduction, Decimation by a Factor Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D.

Applications of DSP: Linear Filtering Methods based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences.

Text Books:

1. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson, 2007.
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, 3rd Edition, Pearson, 2014.

Reference Books:

1. S.K.Mitra, Digital Signal Processing: A computer based approach, 4th Edition, TMH, 2013.
2. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, 1st Edition, Prentice Hall, 1975.

Online Resources:

1. Lecture Series on Digital Signal Processing by Prof.S. C Dutta Roy, Department of Electrical Engineering, IIT Delhi https://nptel.ac.in/courses/117102060/
2. Lecture Series on Digital Signal Processing by Prof.Alan V. Oppenheim https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

Course Outcomes:

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

1. Apply ZT to analyze discrete signals and systems.
2. Analyze the spectral characteristics of discrete-time signals using DFT. Implement FFT algorithms for efficient computation of DFT.
3. Design of different types of digital filters.
4. Distinguish between different Multi-rate signal processing techniques and identify finite word length effects.
5. Illustrate the applications of DSP.

III Year B.Tech. ECE I-Semester **L T P C**
Course Code: PC115CD **3 - - 3**

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

Prerequisites: -Nil-

Course Objectives:
This is a structured foundation course, dealing with concepts, formulations and applications of Electromagnetic Theory and Transmission Lines, and is the basic primer for all electronic communication engineering subjects. The main objectives of the course are

1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magnetostatic Fields, and apply them to solve physics and engineering problems.
2. To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
3. To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
4. To conceptually understand the UPW Polarization features and Poynting theorem, and apply them for practical problems.
5. To determine the basic Transmission Line Equations and telephone line parameters and estimate the distortions present.
6. To understand the concepts of RF Lines and their characteristics, Smith Chart and its applications, acquire knowledge to configure circuit elements, QWTs and HWTs, and to apply the same for practical problems.

UNIT 1: (~12 lecture hours)
Electrostatics: Review of Co-ordinate systems & Vector Algebra, Coulomb's Law, Electric Field Intensity -Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance -Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT 2: (~10 lecture hours)

Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Illustrative Problems.

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface : Dielectric- Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

UNIT 3: (~10 lecture hours)

EM Wave Characteristics-I: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves-Definition, All Relations Between E &H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics-Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems.

EM Wave Characteristics-II: Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem – Applications, Illustrative Problems.

UNIT4: (~7 lecture hours)

Transmission Lines-I: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Losslessness /Low Loss Characterization, Distortion – Condition for Distortionlessness and Minimum Attenuation, Illustrative Problems.

UNIT 5: (~7 lecture hours)

Transmission Lines-II: Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines-Impedance Transformations, Significance of Z_{min} and Z_{max}, Smith Chart-Configuration and Applications, Single Stub Matching, Illustrative Problems.

Text Books:

1. Matthew N.O. sadikuand, S.V. Kulkarni-Principles of Electromagnetics, Oxford University Press, 6th Edition, Aisan Edition, 2015.

2. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI, 2000.

Reference Books:

1. William H. Hayt Jr. and John A. Buck -Engineering Electromagnetics, 7th Edition, McGraw Hill Education, 2006.
2. Nathan Ida, Engineering Electromagnetics, 2nd Edition, Springer (India) Pvt. Ltd., New Delhi, 2005.

Online Resources:

Introduction to Electromagnetic Theory by Dr. Manoj Kumar Harbola (IITK) https://onlinecourses.nptel.ac.in/noc16_ph03

Course Outcomes:

Having gone through this foundation course, the students would be able to

1. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
2. Analyze the Wave Equations for good conductors and good dielectrics, and evaluate the UPW Characteristics for several practical media of interest.
3. Establish the proof and estimate the polarization features, reflection and transmission coefficients for UPW propagation, distinguish between Brewster and Critical Angles, and acquire knowledge of their applications.
4. Determine the Transmission Line parameters for different lines, characterize the distortions and estimate the characteristics for different lines.
5. Analyze the RF Line features and configure them as SC, OC Lines, QWTs and HWTs, and design the same for effective impedance transformation.
6. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.

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

COMPUTER ORGANIZATION

(Professional Elective-1)
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To understand the basic structure and operation of a digital computer.
2. To realize the CPU design for a given instruction set.
3. To design functional units for floating point and fixed point operations.
4. To visualize the hierarchical memory system.
5. To understand the requirements of IO interfacing with the computer.
6. 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.
The 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.

Reference Books:
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 N|PTEL on Computer Organization and Architecture – https://nptel.ac.in/courses/106103068/pdf/coa.pdf

Course Outcomes:
At the end of this course, students will 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. ECE I-Semester **L T P C**
Course Code: PE115CC **3 - - 3**

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(Professional Elective-1)
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To provide an understanding of various measuring systems functioning and metrics for performance analysis.
2. To impart the knowledge of principles of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. To expose the students to many varieties of transducers, measuring instruments, their operating principles and construction.
4. To explain the use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

UNIT 1: (~10 lecture hours)
Block Schematics of Measuring Systems: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT 2: (~8 lecture hours)
Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators. Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications.

UNIT 3: (~10 lecture hours)
Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

Special Purpose Oscilloscopes: Dual Trace, Dual Beam Oscilloscope, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage Oscilloscope.

UNIT 4: (~10 lecture hours)
Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magnetostrictive Transducers.

UNIT 5: (~7 lecture hours)
Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.
Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure-High Pressure, Vacuum level, Temperature -Measurements, Data Acquisition Systems.

Text Books:
1. H.S.Kalsi, Electronic Instrumentation: 3rd Edition, McGraw Hill Education, 2010.
2. K. Lal Kishore, Electronic Measurements and Instrumentation, Pearson Education, 2010.

Reference Books:
1. David A. Bell, Electronic Instrumentation and Measurements, 3rd Edition, Oxford Univ. Press, 2013.
2. A.D.Helbincs, W.D. Cooper Modern Electronic Instrumentation and Measurement Techniques 5th Edition, PHI, 2003.

Online Resources: Nil

Course Outcomes:
At the end of this course, students will be able to
1. Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
2. Evaluate and perform accurate measurements for any engineering system with clear idea of the potential errors.
3. Understand the working principles of various transducers.
4. Select an appropriate transducer for given application.
5. Use instruments like spectrum analyser, DSO and other virtual instrumentation techniques for appropriate measurements.
6. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

III Year B.Tech. ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE115CF	**3**	**-**	**-**	**3**

INFORMATION THEORY AND CODING

(Professional Elective-1)

Prerequisites: Analog and Digital Communications

Course Objectives:

1. To enhance knowledge on Entropy and Mutual Information, apply Source coding for better information rate.
2. To analyze Channel Capacity of various channel models.
3. To study the Channel coding and decoding methods of Linear Block Codes and Cyclic Codes.
4. To understand coding and decoding of Convolution Codes.

UNIT 1: (~8 lecture hours)

Basics of Information Theory: Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship between Entropy and Mutual Information, Chain rules for Entropy, Relative Entropy and Mutual Information, Statements of Jensen's Inequality, Log Sum Inequality, Asymptotic Equipartition Property - Asymptotic Equipartition Property Theorem, Consequences of the AEP: Data Compression, High-Probability Sets and the Typical Set.

UNIT 2: (~11 lecture hours)

Source coding and Channel Capacity: Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Huffman Codes, Optimality of Huffman Codes, The Lempel-Ziv (LZ) Algorithm, Channel Capacity - Examples of Channel Capacity, Symmetric Channels, Properties of Channel Capacity, Preview of the Channel Coding Theorem, Definitions of Discrete Channel, Discrete Memoryless Channel (DMC), (M, N) Code, Conditional Probability of Error, Maximal Probability of Error, Average Probability of Error, Rate R of an (M, N) Code, Capacity, Jointly Typical Sequences, Channel Coding Theorem,

UNIT 3: (~9 lecture hours)

Linear Block Codes: Introduction to Error Correction Codes, Error probability with repetition in Binary Symmetric Channel, Parity Check bit coding for error detection, Block coding for error detection and correction, The Hamming distance, Upper bound of probability of error with coding, Matrix description of Linear Block Codes, Equivalent Codes,

Parity Check Matrix, Decoding of Linear Block Code, Syndrome Decoding, Error Probability after Coding, Perfect Codes, Hamming Codes, Extended codes, Optimal Linear Codes, Maximum Distance Separable Codes.

UNIT 4: (~10 lecture hours)
Cyclic Codes: Introduction to Cyclic Codes, The Division algorithm for polynomials, Generation of Cyclic Codes, Matrix description of Cyclic Codes, Burst Error Correction, Cyclic Redundancy Check (CRC) Codes, Circuit implementation of Cyclic Codes, Introduction to BCH Codes.

UNIT 5: (~8 lecture hours)
Convolutional Codes: Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial description of Convolutional codes, Distance notions for Convolutional codes, The Generating function, Matrix description of Convolutional Codes, Viterbi decoding of Convolutional Codes, Comparison of Error rates in coded and uncoded transmission.

Text Books:

1. Thomas M Cover, Joy A Thomas, Elements of Information Theory, 2nd Edition, Wiley, 2006.
2. Ranjan Bose, Information Theory Coding and Cryptography, 1st Edition, TMH, 2002.
3. Herbert Taub, Donald L Schilling, Goutam Saha, Principles of Communication Systems, 4th Edition, McGraw-Hill Education, 2013.

Reference Books:

1. Simon Haykin, Communication systems, 4th Edition, John Wiley & sons, INC.
2. Shu lin, Daniel J.Costello, Error Control Coding, 2nd Edition, Pearson.

Online Resources:

1. Lectures on Information Theory and Coding Prof. S.N. Merchant, IIT Bombay https://nptel.ac.in/courses/117101053/
2. Lectures on Error control coding: An introduction to linear block code (Video) Dr. Adrish Banerjee , IIT K https://nptel.ac.in/courses/117104121/
3. Lectures on Error Control Coding: An Introduction to Convolutional Codes (Video) by Dr. Adrish Banerjee , IITK https://nptel.ac.in/courses/117104120/

Course Outcomes:

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

1. Understand the applicability of Information concepts and various methods of error detection and correction.
2. Define the performance of different channel capacities, bounds.
3. Understand the capabilities of block codes and cyclic codes in terms of optimal encoding and decoding.
4. Analyze the performance of various data compression techniques.
5. Design codes for error detection and correction of sequential data with low error probability.
6. Compare error handling capabilities and circuit complexities.

III Year B.Tech. ECE I-Semester **L T P C**
Course Code: PC11538 **- - 3 1.5**

DIGITAL SIGNAL PROCESSING LAB
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:
1. To use relevant simulation software tools.
2. To demonstrate the concepts learnt in Digital Signal Processing using supporting software tools.
3. To enable students use graphical programming environment for modeling, simulating and analyzing few concepts of Digital Signal Processing using MATLAB Simulink software.
4. To prepare students on how to make use of relevant simulation software tools for various Engineering problems.

List of Experiments:
1. To find Z-Transform of given discrete time signal, locating the Zeros and Poles and plotting the Pole-Zero maps in Z-Plane for the given transfer function.
2. To find DFT / IDFT of given discrete time signal.
3. To find response of LTI system using graphical approach of Linear Convolution.
4. Determination of Power Spectrum of a given Signal using Wiener-Kintchine relation.
5. To Verify Parseval's theorem of Discrete Fourier Transform.
6. To find Frequency Response of a given System given in Transfer Function/ Difference equation form.
7. Implementation of FFT of given Sequence.
8. Implementation of Low Pass and High Pass FIR Filters using Windowing technique.
9. Implementation of Band Pass and Band Reject FIR Filters using Windowing technique.
10. Implementation of Low Pass Analog and Digital Butterworth IIR Filters.
11. Implementation of Low Pass Analog and Digital Chebyshev-Type 1 IIR Filters.
12. Implementation of Decimation Process.
13. Implementation of Interpolation Process.
14. Implementation of I/D Sampling Rate Converters.

15. Generation of DTMF Signals.
16. Filtering of long data sequences using DFT/IDFT.

Note:

l. Minimum 12 experiments should be conducted. All these experiments are to be implemented using software (MATLAB) / Hardware (DSP processor).
2. At least Two Experiments are to be simulated using Simulink.
3. Implement mini project based on the obtained knowledge.

Course Outcomes:

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

1. Recognize fundamental concepts & usage of simulation software in the field of Digital Signal Processing
2. Identify the specifications, requirements & built in functions to perform mathematical operations involving discrete sequences.
3. Implementation of various filters.
4. Develop code for analyzing Fourier and Z transforms and their utility.
5. Implement sampling rate converters.
6. Generate relevant simulation codes, with and without usage of built in functions & estimation of the numerical results with supporting plots.

III Year B.Tech. ECE I-Semester **L T P C**
Course Code: PC11539 **- - 3 1.5**

e-CAD AND VLSI LAB

Prerequisites: 1. Electronic Devices & Circuits 2. Digital System Design

Course Objectives:

1. To verify the functionality of basic logic gates, combinational circuits, using Verilog/VHDL programming language.
2. To verify the functionality of sequential circuits, using Verilog/VHDL programming language.
3. To implement various combinational and Sequential circuits using FPGA kits.
4. To perform the circuit simulation for various combinational and Sequential circuits.

List of Experiments:

Design and implementation of the following CMOS digital/analog circuits using **Cadence / Mentor Graphics/ Synopsys /Equivalent** CAD tools. The design shall include Gate-level design, Transistor-level design, Hierarchical design, Verilog HDL/VHDL design, Logic synthesis, Simulation and verification, Scaling of CMOS Inverter for different technologies, study of secondary effects (temperature, power supply and process corners), Circuit optimization with respect to area, performance and power, Layout, Extraction of parasitics and back annotation, modifications in circuit parameters and layout consumption, DC/transient analysis, Verification of layouts (DRC, LVS)

Part A: e-CAD programs: Programming can be done using any complier. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels) and logic analyzer apart from verification by simulation with any of the front end tools.

1. HDL code to realize all the logic gates
2. Design of 2-to-4 decoder
3. Design of 8-to-3 encoder (without and with priority)
4. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
5. Design of 4 bit binary to gray code converter
6. Design of 4 bit comparator
7. Design of Full adder using 3 modeling styles
8. Design of flip flops: SR, D, JK, T

9. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
10. Finite State Machine Design of sequence detector.

Part B: VLSI circuit design experiments:

Introduction to layout design rules. Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis of the following:

1. Basic logic gates
2. CMOS inverter
3. CMOS NOR/ NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Implementation of 2x1 MUX using Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate).
9. Analog Circuit simulation (AC analysis) – CS & CD amplifier

Note: Any SIX of the above experiments from each part are to be conducted (Total 12)

Course Outcomes:

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

1. Develop the concepts of digital design and VLSI Design.
2. Simulate, synthesize and implement various combinational and sequential logic circuits.
3. Analyze the static and dynamic characteristics of CMOS inverter.
4. Perform circuit simulation, physical verification, DC/Transient analysis, static timing analysis, layout verification of various digital CMOS circuits and pass transistor logic circuits.
5. Design and analyze Analog circuits.
6. Interpret and verify the results of various combinational and sequential circuit designs.

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

EMPLOYABILITY AND SOFT SKILLS LAB

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

Pre-requisite:-Nil-

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 and Binod Mishra, Communication Skills for Engineers and Scientists, PHI Learning Pvt.Ltd., 2011.
3. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford Higher Education, 2nd 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. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: HS116DE	**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. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PC116DJ	**3**	**-**	**-**	**3**

PRINCIPLES OF COMPUTER NETWORKS

(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To clarify network terminology.
4. To expose students to emerging technologies and their potential impact.

UNIT 1: (~10 Lecture Hours)

Introduction: Uses of Computer Networks, Network Hardware, Network Software, Reference models OSI, TCP/IP, Example networks.

Physical Layer: Bandwidth-Limited Signals, channel data rate, Guided Transmission Media: Magnetic Media, Twisted Pair, Coaxial Cable, Fiber Optics, Wireless transmission, Digital Modulation and Multiplexing.

UNIT 2: (~8 Lecture Hours)

Data Link Layer: Design issues, services provided to the network layer, Framing, Error Control, Flow Control, Error detection and correction, Elementary Protocols: stop and wait, Sliding Window, Go Back N, Selective Repeat, Data Link Layer in HDLC and Internet.

Medium Access Sub Layer: Channel Allocation, Multiple Access Protocols, Ethernet, Wireless LAN's, Data Link Layer Switching.

UNIT 3: (~10 Lecture Hours)

Network Layer : Design issues, Routing algorithms - the Optimality Principle, Shortest Path routing, flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast & Multicast Routing, Routing for Mobile hosts.

Internetworking: How Networks Differ, How Networks can be Connected, Tunneling, Internetwork Routing, Packet Fragmentation.

Network Layer in the Internet : IP Version 4 protocol, IP Addresses, IP Version 6, Internet Control Protocols, OSPF, BGP, Internet multicasting, Mobile IP.

UNIT 4: (~10 Lecture Hours)
Transport Layer : The Transport service, Elements of Transport Protocols, The Internet Transport Protocols: UDP, The Internet Transport Protocols: TCP, SCTP.
Quality Of Service : Application Requirements, Traffic Shaping, Packet Scheduling, Admission Control, Integrated Services, Diffrentiated Services, Approaches to congestion control algorithms, Congestion control algorithms.

UNIT 5: (~10 Lecture Hours)
Application Layer : Domain Name System: DNS Name Space, Resource Records, Name Servers.
Electronic mail: Architecture and services, User Agent, Message Formats, Message, Transfer and Final delivery. Streaming Audio and Video Digital Audio, Digital Video, Streaming Stored Media, Streaming Live Media, Real-Time Conferencing, Introduction to network security.

Text Books:
1. Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson Education/PHI.

Reference Books:
1. Behrouz A. Forouzan, Data Communications and Networking, 3rd Edition, TMH.
2. James F Kurose, Keith W Ross, Computer Networking A Top-Down Approach, 5th Edition, Pearson Education Inc.

Online References:
1. https://onlinecourses.nptel.ac.in/
2. https://www.coursera.org/

Course Outcomes:
At the end of this course, students will be able to
1. Independently understand basic computer network technology, different types of network topologies and protocols.
2. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
3. Identify the different types of network devices and their functions within a network.
4. Understand and building the skills of subnetting and routing mechanisms.
5. Acquaint with the knowledge of various routing protocols.
6. Familiarity with various types of messages being exchanged at different layers of an Internet.

III Year B.Tech. ECE II -Semester	**L**	**T**	**P**	**C**
Course Code: PC116DC	**3**	**-**	**-**	**3**

LINEAR CONTROL SYSTEMS

Prerequisites: Ordinary Differential Equations & Laplace Transform, Linear Algebra, Mathematics I

Course 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 design various compensators to improve system performance.

UNIT 1: (~10 Lecture hours)
Introduction: Introduction, time variant, time invariant open loop and closed loop Control System. Development of Block diagrams and Transfer Function of physical/Mechanical and Electrical systems. Feedback elements of closed loop Control Systems: DC and AC Servo motors, Synchro's, Tachometer. Block diagram reduction, signal flow graphs, Mason's gain formula, numerical problems.

UNIT 2: (~8 Lecture hours)
Time Domain Analysis: Unit step ,ramp and impulse signals, Steady state error using error constants, step and ramp response of first order and second order systems, time domain specifications, derivations, problems, P, PD, PI, PID controllers with derivations.

UNIT 3: (~9 Lecture hours)
Stability Analysis: Concept of stability, Absolute stability, Conditional stability, Relative stability, Limited stability, Routh Hurwitz criterion, Problems.
Root Locus: Construction of Root locus, Effect of addition of poles and zeros in transfer function on stability.

UNIT 4: (~10 Lecture hours)
Nyquist, Bode plots and compensators: Frequency domain specifications, Bode plot, finding frequency domain specifications from plot, Effect of gain K, frequency domain specifications with the help of Bode plot. Nyquist plot of different systems including systems with dead

time, Performance specifications like ω_c, ωg Gain margin, Phase margin. **Compensators:** Lead, Lag compensators, Lead-Lag compensators. Design of system using compensators.

UNIT 5: (~8 Lecture hours)
State Variable Analysis: Concept of state, State Equations, State Transition matrix, State Transition Equation, Transfer Function from differential equations and state equations, State equations from differential equations, State models, Controllability, Observability

Text Books :

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

Reference Books :

1. Katsuhiko Ogata, Modern Control Engineering, 3rd Edition, Prentice Hall of India Pvt.Ltd., 1998.
2. M. Gopal, Control Systems Principles and Design, 2nd Edition, Tata McGraw-Hill.
3. A.Nagoorkani, Control Systems, 1st Edition, RBA Publications.
4. A K. Jairath, Solutions and Problems of Control Systems, CBS publications and distributors.

Online Resources:
Lecture Series on Control Engineering by Dr. Rama Krishna Pasumarthy, Associate Professor, Department of Electrical Engineering, IIT Madras. https://nptel.ac.in/courses/108106098/

Course Outcomes:
At the end of this course, students will be able to
1. Differentiate open-loop & closed-loop systems and discuss RH and Root locus techniques to determine the stability
2. Formulate Transfer function of Mechanical and Electrical systems.
3. Analyze first and second order systems with different inputs and design in time domain for a given specifications
4. Investigate the stability of given system using appropriate techniques such as Nyquist and Bode plot in frequency domain.
5. Design different types of compensators for feedback control systems to improve system performance
6. Apply state space analysis to solve problems on continuous control systems.

III Year B.Tech ECE II-Semester **L T P C**
Course Code: PE116CQ **3 - - 3**

ANTENNAS AND WAVE PROPAGATION

(Professional Elective-2)
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:
This can be termed a middle level course in the electronic communication engineering domain. The course deals with antenna basics, different types of antennas, some design features, antenna measurements and wave propagation, and has the following main objectives:

1. To study the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
2. To distinguish between UHF, VHF and Microwave Antennas, their requirements, specifications, characteristics and design relations.
3. To analyze the characteristics of yagi-uda antennas, helical antennas, pyramidal horns, microstrip patch antennas and parabolic reflectors and identify the requirements to facilitate their design.
4. To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
5. To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
6. To distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

UNIT 1: (~12 lecture hours)
Antenna Basics: Introduction, Basic Radiation Equation, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height, Antenna Theorems, Fields from Oscillating Dipole, Field Zones, Radiation – Maxwell's Equations Approach, Retarded Potentials.
Thin Linear Wire Antennas-Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Linear Antennas of Different

Lengths, Illustrative Problems. Loop Antennas - Introduction, Small Loop, Comparison of Radiation Characteristics of Small Loop and Short Dipole (Qualitative Treatment).

UNIT 2: (~8 lecture hours)
VHF, UHF and Microwave Antennas-I : Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas -Helical Geometry, Helix Modes, Practical Design Considerations for Mono filar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

UNIT 3: (~8 lecture hours)
VHF, UHF and Microwave Antennas-II: Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas-Geometry and Parameters, Feeds, Characteristics of Microstrip Antennas. Reflector Antennas-Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors-Geometry, Pattern Characteristics, Feed Methods, Reflector Types-Related Features, Illustrative Problems.

UNIT 4: (~8 lecture hours)
Antenna Arrays: Point Sources-Definition, Patterns**,** arrays of 2 Isotropic Sources - **Different** Cases, Principle of Pattern Multiplication, Uniform Linear Arrays-Broadside Arrays, End fire Arrays,, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions-General Considerations and Binomial Arrays, Illustrative Problems.
Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-AntennaMethods)

UNIT 5: (~9 lecture hours)
Wave Propagation-I: Introduction, Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation (Qualitative Treatment) – Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections. Space Wave Propagation-Introduction, Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation.
Wave Propagation-II: Sky Wave Propagation – Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

Text Books:

1. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan-Antennas and Wave Propagation, 4th Edition (Special Indian Edition), McGraw Hill Education, New Delhi, 2010.
2. E.C. Jordan and K.G. Balmain- Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI, 2000.

Reference Books:

1. C.A. Balanis-Antenna Theory, 3rd Edition, John Wiley & Sons, 2005.
2. K.D. Prasad, Satya Prakashan- Antennas and Wave Propagation, Tech India Publications, New Delhi, 2009.
3. Sisir K.Das, Annapurna Das-Antenna and Wave Propagation , Tata McGraw Hill Education Private Limited, New Delhi, 2016 Reprint.

Online resources:

Antennas Prof. BY Girish Kumar (IIT Bombay)
https://nptel.ac.in/courses/108101092/

Course Outcomes:

Having gone through this course on Antenna Theory and Techniques, and Wave Propagation, the students would be able to

1. Explain the mechanism of radiation, distinguish between different antenna characteristic parameters, establish their mathematical relations, and estimate them for different practical cases. Distinguish between short dipoles, half-wave dipoles, quarter-wave monopoles and small loops, configure their current distributions, derive their far fields and radiation characteristics and sketch their patterns.
2. Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of folded dipole, Yagi-Uda Antenna, Helical Antennas, Horn Antennas, and to acquire the knowledge of their analysis, design and development.
3. Analyze a microstrip rectangular patch antenna and a parabolic reflector antenna, identify the requirements and relevant feed structure, carry out the design and establish their patterns.
4. Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.
5. Carry out the Linear Array Analysis, estimate the array factor and characteristics and sketch the pattern for 2-element array, N-element BSA, EFA, Binomial Arrays.
6. Classify the different wave propagation mechanisms, identify their frequency ranges, determine the characteristic features of ground wave, ionospheric wave, space wave, duct and tropospheric propagations, and estimate the parameters involved.

III Year B.Tech ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE116DK	**3**	**-**	**-**	**3**

SPEECH AND AUDIO SIGNAL PROCESSING

(Professional Elective-2)

Prerequisites: 1.Signals and Systems, 2. Probability Theory and Stochastic Processes, 3. Advanced Digital Signal Processing.

Course Objectives:

1. To understand the anatomy and physiology of Speech Production system and perception model and to design an electrical equivalent of Acoustic model for Speech Production.
2. To understand the articulatory and acoustic interpretation of various phonemes and their allophones.
3. To analyze the speech in time domain and extract various time domain parameters which can be used for various applications like pitch extraction, end point detection, Speech Compression etc.,
4. To study the concept of Homomorphic system and its use in extracting the vocal tract information from speech using Cepstrum this is a bye product of Homomorphic processing of Speech.
5. To study various Speech Signal Processing applications Ex: Speech Enhancement.
6. To study various Audio coding techniques based on perceptual modelling of the human ear.

UNIT 1: (~10 lecture hours)

Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The Process of Speech Production, The Acoustic theory of speech production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

Perception: Anatomical pathways from the Ear to the Perception of Sound, The Peripheral Auditory system, Hair Cell and Auditory Nerve Functions, Properties of the Auditory Nerve. Block schematics of the Peripheral Auditory system.

UNIT 2: (~10 lecture hours)

Time Domain models for Speech Processing: Introduction-Window considerations, Short time energy, average magnitude, average zero crossing rate, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using a parallel processing approach, the short time autocorrelation function, average magnitude difference function, pitch period estimation using the autocorrelation function.

Linear Predictive Coding (LPC) Analysis: Basic principles of Linear Predictive Analysis : The Autocorrelation Method, The Covariance method, Solution of LPC Equations : Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, comparison between the methods of solution of the LPC Analysis Equations, Applications of LPC Parameters : Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT 3: (~9 lecture hours)
Homomorphic Speech Processing: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder.
UNIT 4: (~6 lecture hours)
Speech Enhancement : Speech enhancement techniques: Single Microphone Approach, Spectral Subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi Microphone Approach.

UNIT 5: (~9 lecture hours)
Audio Coding: Lossless Audio Coding, Lossy Audio coding, Psychoacoustics, ISO-MPEG-1 Audio coding , MPEG - 2 Audio coding, MPEG - 2 Advanced Audio Coding, MPEG - 4 Audio Coding.

Text Books :

1. L.R. Rabiner and S. W. Schafer- Digital Processing of Speech Signals, 1st Edition, Pearson Education, 1979.
2. Udo Zolzer -Digital Audio Signal Processing, 2nd Edition, Wiley, 2008.

Reference Books :

1. Thomas F. Quateri-Discrete Time Speech Signal Processing: Principles and Practice, 1st Edition, PE, 2001.
2. L.R Rabinar and R W Jhaung -Digital Processing of Speech Signals, 1st Edition, PHI, 1978.
3. Douglas O'Shaughnessy -Speech Communications: Human & Machine, 2nd Edition, EEE Press, 2000.
4. Ben Gold & Nelson Morgan -Speech & Audio Signal Processing, 1st Edition, Wiley, 1999.

Online Resources:

1. https://nptel.ac.in/courses/117105145/ ,Digital speech processing, Prof S K Das Mandal.

2. https://onlinecourses.nptel.ac.in/noc17_ec13/preview, Digital speech processing, Prof S K Das Mandal.
3. https://freevideolectures.com/course/2504/elec9344-speech-and-audio-processing, Speech and Audio Processing, Professor E. Ambikairajah.

Course Outcomes:

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

1. Model an Electrical Equivalent of Speech Production System.
2. Feature extraction of the LPC coefficients to Synthesize or Compress the Speech.
3. Analyze the speech signal in Cepstrum domain for extraction of Pitch and d Formants etc.
4. Design a Homomorphic Vocoder for coding and decoding of Speech.
5. Enhance the speech using various Filters
6. Design basic audio coding methods for coding the audio signal.

III Year B. Tech. ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE116CS	**3**	**-**	**-**	**3**

BIO-MEDICAL ELECTRONICS

(Professional Elective-2)

Prerequisites :-Nil-

Course Objectives:

1. To acquire knowledge on basics of human physiology and cardiovascular systems.
2. To study different bioelectrodes, biomedical transducers and measurements of physiological parameters.
3. To deal with ECG, EEG &EMG machines, recordings and their interpretations.
4. To learn how electronic instruments works in various departments and laboratories of a hospital and solve engineering problems related to medical field.

UNIT 1: (~8 lecture hours)

Human physiological Systems: Brief introduction to human physiology, cells and their structure, transport of ions through the cell membrane, Resting and action potentials, Bioelectric potentials, Nerve tissues and organs, Different systems of human body.

UNIT 2: (~11 lecture hours)

Biomedical Transducers: The transducer and transduction principles, active transducers, passive transducers, transducers for biomedical applications.

Bio-electrodes: Electrode theory, Biopotential Electrodes, Biochemical transducers.

UNIT 3: (~10 lecture hours)

Bioelectric potentials and Measurements: Resting and action potentials, propagation of action potentials, Bioelectric potentials for ECG, EMG and EEG machines.

UNIT 4: (~8 lecture hours)

Cardiovascular System and Measurements: The heart and Cardiovascular System, measurement of blood pressure, measurement of blood flow, Impedance plethysmography, temperature measurements, ultrasonic measurement, X-ray and nuclear imaging.

UNIT 5: (~8 lecture hours)

Prosthetic Devices: Pacemakers, Defibrillators, heart-lung machine, kidney machine.

Safety aids: Introduction, radiation safety instrumentation, Microshock and macroshock hazards, aids for the handicapped, devices to protect against electric hazards.

Text Books:

1. Leslie Cromwell, F.J.Weibell, E.A.Pfeiffer, Biomedical Instrumentation and Measurements, 2nd Edition, PHI, 2004.
2. John G. Webster, Medical Instrumentation, Application and Design, 3rd Edition, John Wiley, 2001.
3. Dr. M. Arumugam, Biomedical Instrumentation, 2nd Edition, Anuradha Publications, 2007.
4. J.J. Karr & J.M. Brown, Introduction to Biomedical Technology, 4th Edition, Pearson Publications, 2001.

Reference Books:

1. L.A. Geoddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, 3rd Edition, John Wiley and Sons, 1991.
2. R.S. Khandpur, Hand-book of Biomedical Instrumentation, 2nd Edition, McGraw-Hill, 2003.
3. A. M. Cook and J.G. Webster(eds.), Therapeutic Medical Devices: Application and Design, Prentice-Hall, 1982.
4. Arun Ghosh, Introduction to measurements and instrumentation, 3rd Edition, PHI learning, 2010.
5. W. F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical, Publishers, 1977.

Online Resources:

Lectures on Biomedical Signal Processing by Prof. Sudipta Mukhopadhyay, IIT KGP. https://nptel.ac.in/courses/108105101/

Course Outcomes:

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

1. Describe the functioning of human physiological systems.
2. Understand the origin of Bioelectric Potential and their measurements using electrodes and transducers.
3. Explore the applications of the electronic systems in biological and medical applications namely the ECG, EMG and EEG machines.
4. Analyse the biological processes like other electronic processes and measure non-electrical parameters of human system.
5. Examine the various medical imaging techniques and discuss about therapeutic and assist devices.
6. Evaluate the practical limitations on the electronic components while handling bio-substances.

III Year B.Tech ECE II-Semester **L T P C**
Course Code: PC11644 **- - 3 1.5**

COMPUTER NETWORKS LAB

(Common to ECE & ETE)

Prerequisites: Principles of Computer Networks

Course Objectives:

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To clarify network terminology.
4. To expose students to emerging technologies and their potential impact

List of Experiments

1. Understand working of ARP, and IP forwarding within a LAN and across a router.
2. Understand VLAN operation in L2 and L3 switches
3. Understand the public IP addresses and NAT
4. Understand the working of basic networking commands (Ping, Route Add/ Delete/ Print, ACL)
5. Understand the working of "connection establishment" in TCP.
6. Mathematical modelling of TCP and understand the fundamental relationship between packet loss probability and TCP performance.
7. Observe how throughput and error of a wireless LAN network changes as the distance between the access point and the wireless nodes is varied
8. Understand the working of slow start and congestion avoidance, fast retransmit and fast recovery congestion control algorithms in TCP.
9. Generate routing table of interior routing protocols, i.e. RIP and OSPF.
10. Observe how queuing delay of M/D/1 Queuing varies
11. OSPF: Open Shortest Path First: A Routing Protocol based on the Link State Algorithm
12. Analyze the performance of FIFO, priority and WFQ Queuing techniques.
13. Observe how the throughput of LTE network varies as the distance between the ENB and UE (User Equipment) is increased.

14. Observe how the throughput of LTE network varies as the channel bandwidth changes in the ENB (Evolved node)
15. Configure network with a secure router and verify their connectivity between two PCs
16. Establish a static routing between two routers.

Note:

1. The Experiments can be performed using software's like NETSIM, OPNET, NS2, QUALNET, Packet Tracer or Equivalent Software.
2. Minimum of 12 Experiments are to be performed.

Course Outcomes:

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

1. Understand working of different TCP/IP protocols.
2. Simulate simple LAN, WAN network models with multiple scenarios, collect statistics on network performance.
3. Apply mathematical foundation to understand the fundamental relationship between packet loss probability and TCP performance.
4. Analyze the performance of different switching techniques, routing protocols.
5. Compare different switching schemes.
6. Acquaint with the concepts of LTE.

III Year B.Tech. ECE II-Semester **L T P C**
Course Code: PC11645 **- - 3 1.5**

ELECTRONIC DESIGN LAB

Prerequisites: 1.VLSI Design 2.Analog and digital communication 3. Microprocessors and Microcontrollers

Course Objectives:

1. To practically interface sensors/output devices using Arduino.
2. To perform functional verification, synthesize, implementation and Analysis of various combinational and sequential circuits.
3. To understand the concepts of Communication by simulating in SDR/ MATLAB/Lab View.
4. Design, simulate and fabricate different types of Antennas.

Part A

List of Experiments

Arduino Based Experiments

1. Control LED intensity by varying Potentiometer
2. Push Button interface to control LED
3. Light sensor using LDR to control LED
4. Temperature measurement using LM35
5. Humidity and Temperature Measurement using DHT11

e-CAD VLSI Experiments

1. 4-bit adder Designing in verilog
   Xilinx : Simulation And Synthesis and Implementing on FPGA Board and Performance testing using Pattern generator.
2. 4-bit adder designing using Mentor Graphics tool:
   (a) Simulation (b) Netlist, Area, Power, Timing Reports Generation
   (c) Layout Generation (d) Post Layout Simulation And Analysis
3. 4 bit Counter Designing in Verilog
   Xilinx : Simulation And Synthesis and Implementing on FPGA Board and Performance testing using Pattern generator.
4. 4 bit counter Designing using Mentor Graphics tool:
   (a) Simulation (b) Netlist, Area, Power, Timing Reports Generation
   (c) Layout Generation (d) Post Layout Simulation and Analysis

Communication Experiments:

1. Simulation of Analog communication concepts i.e., AM, FM transmitter and receiver using SDR/MATLAB/Lab View.

2. Study of SNR Vs BER for different digital carrier modulation schemes i.e., BPSK, BFSK, QPSK, QAM using SDR/MATLAB/Lab View .
3. Design and implementation of RF Transmitter and Receiver.
4. OFDM simulation in MATLAB/SIMULINK.
5. Simulate and Study of Antenna diversity concepts in SDR

HFSS Experiments

1. Design and fabrication of Rectangular Microstrip patch Antenna
2. Design and fabrication of Microstrip Dipole Antenna.

Course Outcomes:

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

1. Connect and control the data from or to Sensors/Output devices using Aurdino.
2. Simulate, synthesize, implement and analyse combinational and sequential logic circuits.
3. Interpret the results for further development of circuit features and subsequent applications.
4. Simulate the different modulation schemes in SDR/MATLAB/Lab View
5. Analyse and understand Analog/digital modulation concepts in study of SNR Vs BER.
6. Analyse, design and simulate Antennas for various applications

IV Year ECE B.Tech I-Semester	L	T	P	C
Course Code:HS117EC	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.

IV Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code:PC117EJ	**3**	**-**	**-**	**3**

MICROWAVE ENGINEERING

(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

This course comes under Microwave Communications domain covering contents related to Microwave Theory and Techniques. The main objectives of the course are:

1. To get used to the Frequency band designation based on wavelength size, uses with Applications of microwaves and limitations and the losses that encounter with conventional tubes at these frequencies.
2. To understand the concepts and characteristics of Microwave transmission lines like rectangular waveguides, microstrip lines and familiarise various waveguide components and ferrite devices.
3. To differentiate various microwave tubes and solid-state devices, know their structures, principle of power generation, performance characteristics and applications.
4. To develop basic microwave circuit theory with analysis of microwave junctions using scattering parameters by knowing the properties of S matrix
5. To establish microwave bench set up for precision measurements with microwave meters and familiarise various methods of measurements like VSWR, frequency, phase shift, Impedance, Power, etc.

UNIT 1: (~10 lecture hours)

Microwave Transmission Lines-I: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Impossibility of TEM Mode. Illustrative Problems, Micro strip Lines– Introduction, Zo Relations, Effective Dielectric Constant.

UNIT 2: (~9 lecture hours)

Cavity Resonators– Introduction, Rectangular Cavities, Dominant Modes and Resonant Frequencies, Q Factor and Coupling Coefficients, Illustrative Problems Waveguide Components and Applications: Coupling Mechanisms -Probe, Loop, Aperture types. Waveguide Discontinuities, Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide

Attenuators, Different Types, Resistive Card and Rotary Vane Attenuators, Waveguide Phase Shifters: Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions: E plane and H plane Tees, Magic Tee. Directional Couplers: Two Hole, Bethe Hole types, Illustrative Problems

Ferrites–Composition and Characteristics, Faraday Rotation, Ferrite Components: Gyrator, Isolator, Circulator.

UNIT 3: (~9 lecture hours)

Microwave Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes: O Type and M Type Classifications, O-type Tubes : Two Cavity Klystrons: Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory, Expressions for output Power and Efficiency. Reflex Klystrons: Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and output Characteristics, Illustrative Problems. Helix TWTs: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

UNIT 4: (~9 lecture hours)

M-Type Tubes: Introduction, Cross-field Effects, Magnetrons: Different Types, Cylindrical Traveling Wave Magnetron, Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics, Illustrative Problems

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs: Introduction, Gunn Diodes: Principle, RWH Theory, Characteristics, Modes of Operation -Gunn Oscillation Modes, Introduction to Avalanche Transit Time Devices.

UNIT 5: (~8 lecture hours)

Scattering Matrix– Significance, Formulation and Properties, S Matrix Calculations for two port Junctions, E plane and H plane Tees, Magic Tee, Circulator and Isolator, Illustrative Problems.

Microwave Measurements: Description of Microwave Bench: Different Blocks and their Features, Errors and Precautions, Microwave Power Measurement, Bolometers. Measurement of Attenuation, Frequency. Standing Wave Measurements: Measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

Text Books:

1. Samuel Y. Liao- Microwave Devices and Circuits, 3rd Edition, Pearson, 2003.

2. Herbert J. Reich, J.G. Skalnik,P.F. Ordung andH.L. Krauss- Microwave Principles, CBS Publishers and Distributors, New Delhi, 2004.

Reference Books:

1. R.E. Collin,-Foundations for Microwave Engineering, 2nd Edition, IEEE Press, John Wiley, 2002.
2. David M. Pozar- Microwave Engineering, 4th Edition, John Wiley Inc, 2019 Reprint.
3. Peter A. Rizzi-Microwave Engineering Passive Circuits, PHI, 1999.
4. G.S.Raghuvanshi- Microwave Engineering, Cengage Learning India Pvt. Ltd., 2012.

Online Resources

1. Lectures on Basic Tools of Microwave Engineering(Video) by Prof. Amitabha Bhattacharya IIT KGP https://nptel.ac.in/courses/117105122/
2. Lectures on Basic Building Blocks of Microwave Engineering (Video) by Dr.Amitabha Bhattacharya, IIT Kharagpur https://nptel.ac.in/syllabus/11710513
3. Lectures on Microwave Theory and Techniques (Video) by Prof. Girish Kumar, IITB https://nptel.ac.in/courses/108101112/
4. Lecture Videos on Microwave integrated circuits (Video) by Prof. Jayanta Mukherjee IIT Bombay https://nptel.ac.in/syllabus/117101119.

Course Outcomes:

Having gone through this course covering different aspects of microwave theory and techniques, the students would be able to

1. To analyze completely the rectangular waveguides and their mode characteristics and apply them for solving practical microwave transmission line problems.
2. To distinguish between the different types of waveguide and ferrite components, explain their functioning and select proper components for engineering applications.
3. To distinguish between the methods of power generation at microwave frequencies, establish the performance characteristics of 2-Cavity and Reflex Klystrons, Magnetrons, TWTs and estimate their efficiency levels, and solve related numerical problems
4. To realize the need for solid state microwave sources, understand the concepts of TEDs, RWH Theory and explain the salient features of Gunn Diodes and ATT Devices.
5. To establish the properties of Scattering Matrix, formulate the S-Matrix for various microwave junctions, and understand the utility of S-parameters in microwave component design.
6. To set up a microwave bench, establish the measurement procedure and conduct the experiments in microwave lab for measurement of various microwave parameters identifying the possible errors.

IV Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE117DS	**3**	**-**	**-**	**3**

DIGITAL IMAGE AND VIDEO PROCESSING

(Professional Elective-3)

Prerequisites: Digital Signal Processing

Course Objectives:

1. Provide the student with fundamentals of Digital Image Processing.
2. Give the student idea of general applications for the theories taught in the subject.
3. Have the notion of practical approach to image processing operations.
4. Give the students a useful skill base in the area of Image & Video processing that creates interest in doing projects.

UNIT 1: (~8 lecture hours)

Fundamentals of Image Processing and Image Transforms : Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Basic relationships between Pixels. Introduction to DFT and its properties, DCT, Walsh Transform, Hadamard Transform, Haar Transform, Hotelling Transform.

UNIT 2: (~10 lecture hours)

Image Enhancement: Basic intensity level transformations, Histogram processing, Basics of Spatial filtering, Smoothening Spatial filters, Sharpening Spatial filters, Filtering in frequency domain, Smoothening frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering.

Image Segmentation: Point, Line and Edge detection, Thresholding- Basic Global, Optimum global thresholding, Region –based Segmentation

UNIT 3: (~11 lecture hours)

Image Restoration & Color Image Processing : Model of Image degradation/ restoration process, Periodic noise reduction by Frequency domain filtering, Linear, position Invariant degradations, Estimating the Degradation function, Inverse filtering, Minimum mean square error filtering, Constrained Least Squares Filtering, Geometric mean filter.
Color fundamentals, Color models, Pseudocolor image processing, Basics of full color image processing.

UNIT4: (~8 lecture hours)

Image Compression : Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Arithmetic Coding, LZW Coding, Predictive Coding, Block Transform Coding, JPEG 2000 Standards.

UNIT 5: (~8 lecture hours)

Introduction to Video Processing: Digital Video signal and standards, Optical flow, General methodologies, Block matching Algorithm-EBMA, Fractional Accuracy Search, Fast Algorithms, Phase Correlation Method, Multiresolution motion Estimation.

Text Books:

1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, 3rd Edition, PHI, 2006.
2. Yao Wang, Joem Ostermann and Ya–quin Zhang, Video Processing and Communications, 1st Edition, PHI, 2002.

Reference Books:

1. A K Jain -Fundamentals of Digital Image Processing, PHI, 1989.
2. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, TMH, 2010.
3. Rafael C Gonzalez and Richard E Woods, Digital Image Processing using MATLAB, 2nd Edition, McGraw Hill Education, 2010.
4. Murat Tekalp. Digital Video Processing 2nd Edition, Prentice Hall Press, Upper Saddle River, NJ, USA. 2015.
5. Alan C. Bovik.. Handbook of Image and Video Processing. Academic Press Series in Communications, Networking and Multimedia, Orlando, FL, USA 2005.

Online Resources

1. Lecture on Digital Image Processing(Video) by Prof. P. K. Biswas IITK https://nptel.ac.in/courses/117105135/
2. Web material on Digital Video Signal Processing (Web) by Prof. Sumana Gupta. IITK https://nptel.ac.in/downloads/117104020/

Course Outcomes:

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

1. Analyze the need for various advanced image transforms, types and their properties.
2. Apply different techniques used for enhancement of images both in spatial, frequency domain and also use basic segmentation algorithms.
3. Explore image degradation function, model few basic degradation functions to obtain restored image.
4. Comprehend the different Color models and basics of Color Image processing.
5. Study and Compare the various image coding techniques used for image compression
6. Understand the basic concepts of Motion Estimation in Video processing.

IV Year B.Tech ECE I-Semester **L T P C**
Course Code:PE117EH **3 - - 3**

LOW POWER VLSI DESIGN

(Professional Elective-3)

Prerequisites: VLSI Design

Course Objectives:

1. To know the various power dissipations in digital circuits.
2. To identify different sources of power dissipation in CMOS devices.
3. To understand the circuit techniques for dynamic and static reduction.
4. To analyze the power dissipation in combinational and sequential circuits.

UNIT 1: (~10 lecture hours)

Physics of Power dissipation in MOSFET devices: MIS Structure, Need for Low Power Circuit Design, Threshold Voltage, Body Effects, Short Channel Effects-Surface Scattering, Punch Through, Velocity Saturation, Impact Ionization, Hot Electron Effects, Drain Induced Barrier Lowering, Narrow Width Effects.

UNIT 2: (~8 lecture hours)

Sources Of Power Dissipation in CMOS: Switching Power Dissipation, Short Circuit Power Dissipation, Glitching Power Dissipation, Leakage Power Dissipation, Transistor Leakage Mechanisms of Deep Submicron Transistors.

UNIT 3: (~10 lecture hours)

Circuit Techniques for Dynamic Power Reduction: Dynamic Power Consumption Components, Circuit Parallelization, Memory Parallelization, Voltage Scaling-Based Circuit Techniques: Multiple Voltages Techniques, Low Voltage Swing, Precomputation, Retiming, Synthesis of FSM with Gated Clocks, Circuit Technology-Dependent Power Reduction, Path Balancing.

UNIT 4: (~10 lecture hours)

Circuit Techniques for Leakage Reduction: Leakage Components, Subthreshold Leakage Gate Leakage , Source/Substrate and Drain/Substrate P-N Junction Leakage, Circuit Techniques to Reduce Leakage in Logic, Dual Threshold CMOS, Multiple Supply Voltage, Runtime Standby Leakage Reduction Techniques , Leakage Control Using Transistor Stacks (Self-Reverse Bias), Sleep Transistor, Variable Threshold CMOS (VTCMOS), Dynamic V_{dd} Scaling (DVS), Dynamic V_{TH} Scaling (DVTS).

UNIT 5: (~10 lecture hours)

Low-Power Arithmetic Circuits: Introduction, Addition, 1-bit Addition Cells, Sequential Adder, Propagate and Generate Mechanisms, Carry Select Adder, Carry Skip Adder, Logarithmic Adders, Power-Delay Comparison.

Low Power Very Fast Dynamic Logic circuits: Single-clock Latches and Flip-Flops, TSPC Latches and Flip-Flops, Differential Single-Clock Latches and Flip-Flops, Power- delay Comparison.

Text Books :

1. Kaushik Roy, Sharat Prasad, Low power CMOS VLSI circuit design, John Wiley sons Inc., 2000.
2. Christian Piguet, Low power CMOS VLSI circuits, Taylor & Francis., Inc., 2010.

Reference Books :

1. J.B.Kulo and J.H Lou, Low voltage CMOS VLSI Circuits, Wiley, 1999.
2. A.P.Chandrasekaran and R.W.Broadersen, Low power digital CMOS design, Kluwer, 1995.
3. Gary Yeap, Practical low power digital VLSI design, Kluwer, 1998

Online resources:

1. http://studyvlsidesign.blogspot.com/2014/10/low-power-vlsi-design.html.
2. https://www.scribd.com/doc/95548112/Low-Power-CMOS-VLSI-Circuit-Design-by- Kaushik-Roy.

Course Outcomes:

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

1. Identify the types of power dissipation in MOSFET devices and understand its impact on system performance and reliability.
2. Understand various sources of power dissipation in CMOS devices.
3. Analyze different circuit techniques for dynamic power reduction.
4. Categorize different circuit techniques for static power reduction.
5. Analyze the power dissipation in low-power arithmetic circuits.
6. Examine the power dissipation in very fast dynamic logic circuits such as latches and flip-flops.

IV Year B.Tech ECE I-Semester **L T P C**
Course Code:PE117GH **3 - - 3**

PRINCIPLES OF WIRELESS COMMUNICATIONS

(Professional Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. To enable the student to analyze wireless communication systems over a stochastic fading channel
2. To provide the student with an understanding of radio propagation and diversity reception techniques
3. To provide the student with an understanding of different equalization techniques
4. To provide the student with an understanding of advanced multiple access techniques

UNIT 1: (~8 Lecture hours)
Cellular Communication Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and system capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems–cell splitting, sectoring, Illustrative problems, Evolution of Wireless communication system 1G to 5G.

UNIT 2: (~9 Lecture hours)
Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Fresnel Zone Geometry, Knife-edge Diffraction Model, Link budget analysis, Scattering, Log normal shadowing, Outdoor Propagation Models- Okumura Model, Hata Model, PCS Extension to Hata Model, Indoor Propagation Models-introduction, Attenuation Factor Model, outage probability under path loss and shadowing.

UNIT 3: (~11 Lecture hours)
Mobile Radio Propagation: Small –Scale Fading and Multipath: Small Scale Multipath propagation, Impulse Response Model of a multipath channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread-Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Illustrative problems Statistical Models for multipath Fading Channels-Clarke's model for flat fading, Simulation of Clarke and Gans Fading Model**.**

UNIT 4: (~8 Lecture hours)
Equalization, Diversity: Fundamentals of Equalization, Training a Generic

Adaptive Equalizer, Equalizers in a communications receiver, classification of equalization techniques, Linear Equalizers, Diversity techniques, Space diversity, Receiver diversity-Selection combining, Threshold combining, Equal gain combining, Maximal Ratio combining, Transmitter diversity-Channel known at the transmitter, Channel unknown at the transmitter, frequency diversity, polarization diversity, Time diversity.

UNIT 5: (~8 Lecture hours)
Multiple Access Techniques: Introduction to Multiple Access, FDMA, TDMA and Space Division Multiple Access, and their comparison, Multicarrier Modulation-OFDM, Discrete Implementation of OFDM.
Spread Spectrum: Spread-Spectrum Principles, Direct-Sequence Spread Spectrum (DSSS)- DSSS System Model, Spreading Codes for ISI Rejection: Random, Pseudorandom, and m-Sequences, Synchronization, RAKE Receivers, Frequency-Hopping Spread Spectrum (FHSS)

Text Books:
1. T.S.Rappaport- Wireless Communications, Principles and Practice, 2nd Edition, PHI, 2002.
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.

References Books:
1. William C.Y.Lee,- Mobile Cellular Telecommunications Analog and Digital Systems, TMH, 2nd Edition, 1995.
2. Kaveh Pah Laven and P. Krishna Murthy-Principles of Wireless Networks, PE, 2002.

Online Resources:
1. Lectures on Wireless Communication (Video) by Prof. Rajan Bose, IIT Delhi https://nptel.ac.in/courses/117102062/
2. Resource for Evolution of Wireless communication system 1G to 5G https://nptel.ac.in/courses/117105132/ by Prof. Suvra Sekhar Das IIT Kharagpur.

Course Outcomes:
At the end of this course, students will be able to
1. Apply frequency-reuse concept in Mobile Communications and analyze effects of Interference, System Capacity, Handoff Techniques
2. Develop appropriate wireless channel path loss model for outdoor and indoor propagations
3. Distinguish different types of fading
4. Design methods to combat fading
5. Apply appropriate equalization technique for the given channel
6. Distinguish various multiple-access techniques for mobile communications.

IV Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE117DN	**3**	**-**	**-**	**3**

ARTIFICIAL INTELLIGENCE

(Professional Elective-4)

Prerequisites: Basic Knowledge of Mathematics and Data Structures

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, Norvig, Artificial intelligence, A Modern Approach, 3rd Edition, Pearson Education, 2014.
2. Rich, Knight, Nair: Artificial intelligence, 3rd Edition, Tata McGraw Hill, 2009.

Reference Books:

1. Deepak Khemani: A First Course in Artificial Intelligence, McGraw-Hill Education, 2013.
2. SarojKaushik. Artificial Intelligence. Cengage Learning, 2011.

Online websites / Materials

1. https://faculty.psau.edu.sa/filedownload/doc-7-pdf-a154ffbcec538a4161a406abf62f5b76-original.pdf
2. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
3. Lectures on Artifical Intelligence by Prof. S. Sarkar IIT Kharagpur and Prof.Anupam Basu IIT Kharagpur http://nptel.ac.in/courses/106105077/
4. https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-4

Online Courses

- NPTEL
- Coursera
- edX

Course outcomes:

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

1. To 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. To interpret architectures of different intelligent agents and Expert Systems.
4. Able to interpret probabilistic and logical reasoning for knowledge
5. To analyze different Machine Learning approaches for problem solving.
6. Ability to recognize basics of Natural Language Processing.

IV Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE117EA	**3**	**-**	**-**	**3**

FIBER OPTIC COMMUNICATIONS

(Professional Elective-4)
(Common to ECE & ETE)

Prerequisites:-Nil-

Course Objectives:

1. To understand the principles of fiber-optic communication, the components and different types of fiber materials.
2. To analyze the channel impairments (like losses and dispersion), power launching and performance metrics.
3. To analyze and understand the operation principles of lasers, LEDs, and detectors
4. To know about multiplexing techniques and measurements in optical communications

UNIT 1: (~ 8 lecture hours)
Overview of optical fiber communication: Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture. Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fiber materials- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers.

UNIT 2: (~10 lecture hours)
Signal distortion in optical fibers : Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity determination, Group delay, Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, Intermodal dispersion, Pulse broadening. Optical fiber Connectors- Connector types, Single mode fiber connectors, Connector return loss. Fiber Splicing- Splicing techniques, splicing single mode fibers. Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.

UNIT 3: (~10 lecture hours)
Optical sources: LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies. Reliability of LED & ILD. Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture.

UNIT 4: (~8 lecture hours)
Optical detectors: Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit.

UNIT 5: (~10 lecture hours)
Optical system design: Considerations, Component choice, Multiplexing. Point-to- point links, System considerations, Link power budget with examples, Rise time budget with examples Transmission distance, Line coding in Optical links, WDM, Principles, types of WDM, Measurement of Attenuation and Dispersion, Eye pattern.

Text Books:
1. J. Keiser, Fibre Optic communication, 3rd Edition, McGraw-Hill, 2000.
2. John M. Senior-Optical Fiber Communications, 3rd Edition, PHI, 2009.

Reference Books
1. D.K.Mynbaev, S.C.Gupta and Lowell L.Scheiner-Fiber Optic Communications, Pearson Education, 2005.
2. Govind P. Agrawal, Fiber optic Communication Systems, 3rd Edition, John Wiley and sons, New York, 2004.
3. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, NewYork,1990.

Online Resources
Lectures on Fiber-Optic Communication Systems and Techniques by Prof. Pradeep Kumar K, IITK https://nptel.ac.in/courses/108104113/

Course Outcomes:
At the end of this course, students will be able to
1. Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.
2. Estimate the signal degradations and of an optical signal in different types of fibers.
3. Understand the concept of pulse broadening effects, connectors, different types of splicing techniques.
4. Analyze various types of optical sources and swiches and their functionalities.
5. Discriminate the characteristics of optical detectors, power budget analysis
6. Analyze multplexing techniques and measurements.

IV Year B.Tech ECE I-Semester	**L**	**T**	**P**	**C**
Course Code: PE117DX	**3**	**-**	**-**	**3**

EMBEDDED SYSTEM DESIGN

(Professional Elective-4)
(Common to ECE & ETE)

Prerequisites:1. Microprocessors and Microcontrollers, 2. Computer Organization.

Course Objectives:

1. Discuss the major components that constitute an embedded system.
2. Implement small programs to solve well-defined problems on an embedded platform.
3. Develop familiarity with tools used to develop in an embedded environment.
4 Design, describe, validate and optimize embedded electronic systems in different industrial application areas.

UNIT 1: (~10 lecture hours)
Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT 2 : (~12 lecture hours)
Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT 3: (~8 lecture hours)
Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT 4: (~8 lecture hours)
RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT 5: (~10 lecture hours)

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques, Device Drivers, Choice of RTOS.

Text Books :

1. Shibu K.V, Introduction to Embedded Systems, 2nd Edition, McGraw Hill, 2016.
2. Dr. K.V. K. K. Prasad, Embedded Real Time Systems programming, 1stEdition, Dreamtech Press, 2003.

Reference Books :

1. Frank Vahid, Tony Givargis, Embedded System Design A Unified Hardware Software Introduction, 3rd Edition, John Wiley India, 2014.
2. David E.Simon, An Embedded Software Primer, 2nd Edition, Addison-Wesley, 2006.

Online Resources

1 https://www.tutorialspoint.com/embedded_systems/
2 Lectures on Embedded Systems Design (Video) by Prof. Anupam Basu IIT KGP, https://nptel.ac.in/syllabus/106105159/
3 https://openlabpro.com/guide/embedded-systems-design/
4 https://www.elprocus.com/embedded-systems-real-time-applications/

Course Outcomes:

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

1. Explain the basic characteristics of general computing systems and embedded systems..
2. Describe the Core of the Embedded System with peripherals.
3. Compare and distinguish memories, general purpose processors and domain specific purpose processors.
4. Learn the method of designing an Embedded System for any type of applications.
5. Introduce concepts of Real-Time Operating Systems.
6. Design and implement an embedded system using RTOS.

IV Year B.Tech ECE I-Semester **L T P C**
Course Code: PC11757 **- - 2 1**

MICROWAVE ENGINEERING LAB

Prerequisites:-Nil-

Course Objectives:

1. The lab course will give a practical exposure to students to learn the characteristics of Microwave components.
2. To gain the practical hands on experience by exposing the students to various microwave components.

List of Experiments

1. Study of Microwave Bench
2. Reflex Klystron Characteristics
3. Gunn Diode Characteristics
4. Directional Coupler Characteristics
5. VSWR Measurement of Matched load, Horn Antenna
6. Measurement of Waveguide Parameters
7. Measurements on Inductive and Capacitive Diaphragms
7. Measurement of Impedance of a given load
8. Scattering Parameters of an E plane Tee
9. Scattering Parameters of a H plane Tee
10. Scattering Parameters of a Magic Tee
11. Scattering Parameters of Circulator and Isolator
12. Attenuation Measurement
13. Antenna Pattern Measurements

Content beyond syllabus

14. Study of HFSS tool and its Applications
15. Design and development of a Microstrip Patch Antenna

Note: Minimum of 12 experiments to be conducted

Course outcomes:

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

1. Relate the functionality of each microwave component and distinguish between different microwave sources.
2. Classify and specify microwave components needed for each experiment.
3. Distinguish and overcome the errors associated with microwave measurements taking necessary precautions.
4. Model a microwave bench set up for any type of microwave lab measurement in X band.
5. Design a set output for antenna pattern measurement and compare the experimental results with theoretical ones and justify the results obtained.
6. Interpret the results for further development of applications.

IV Year B.Tech ECE 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, Mc. Graw Hill, 9th Edition, 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 ECE II-Semester	**L**	**T**	**P**	**C**
Course Code:PE118FL	**3**	**-**	**-**	**3**

GLOBAL NAVIGATION SATELLITE SYSTEM

(Professional Elective-5)

Prerequisites:-Nil-

Course Objectives:

1. To explain the basic satellite communication operation.
2. To classify the various constellations under GNSS and make the students understand the GNSS segments and signal structure
3. To distinguish between the coordinates systems likely to be encountered by GPS users
4. To demonstrate an understanding of error sources in GPS observations, and explain the uses and critical factors of Differential GPS techniques.
5. To make the students interpret the GPS navigation and observation files and determine the position.
6. To demonstrate the necessity of augmentation systems and help the students understand their operation.

UNIT 1: (~9 lecture hours)

Satellite Communication Fundamentals: Orbit and Description, Satellite Frequency Bands, Applications, Orbital Period and Velocity, Coverage angle and slant Range, Eclipse.

Satellite Subsystems: Communication Subsystem, Telemetry Command and Ranging Subsystem, Attitude Control Subsystem, Electrical Power Subsystem, Placement of a Satellite in a Geo-Stationary orbit.

UNIT 2: (~9 lecture hours)

GNSS Basics: Overview of GNSS segments, Space Segment, Ground Segment and Control Segment.

Overview of GNSS Constellations: GPS, GLONASS, GALILEO, IRNSS (NAVIC), Beidou, Concept of Ranging Using TOA Measurements, Orbital mechanics and Satellite position determination, Time references. Dilution of precision: HDOP, VDOP and GDOP, GNSS applications.

UNIT 3: (~10 lecture hours)

Coordinate systems and Sources of Error:

Coordinate Systems: Geodetic reference systems: Earth-Centered Inertial Coordinate System, Earth-Centered Earth-Fixed Coordinate System, World Geodetic System, Indian Geodetic System (IGS),

Sources of error in GNSS: Satellite and Receiver clock errors, ephemeris error, Multipath error, atmospheric errors, Hardware bias error,

and Pseudorange error budget. Effects of Satellite Outages on GPS Availability.

UNIT 4: (~8 lecture hours)
GNSS Segments and Signal Structure: Overview of Space Segment, Control Segment and User Segment, GPS Signal Structure, SPS and PPS services, GPS Receivers, Pseudorange Measurements, Carrier Phase Measurements, Cycle Slips, Signal Acquisition, GPS Observables, GPS navigation and observation data formats (RINEX).

UNIT 5: (~9 lecture hours)
Differential GPS (DGPS), Local Area DGPS (LADGPS), Wide Area DGPS (WADGPS).
GPS Augmentation systems: Need for augmentation, Types of augmentation systems: Space Based Augmentation system (SBAS), GPS Aided GEO Augmented Navigation (GAGAN). Ground Based Augmentation System (GBAS).

Text Books:

1. Tri T.Ha, Digital Satellite Communications, 2nd Edition, Tata McGraw-Hill, 2009.
2. Ahmed El-Rabbany, Introduction to GPS, 2nd Edition, Artech House Publishers, Boston, 2006.
3. Elliot D Kaplan and Christopher J Hegarty, Understanding GPS Principles and Applications, 2nd Edition, Artech House Publishers, Boston & London, 2005.

Reference Books:

1. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, GPS Theory and Practice, 5th Edition, Springer Verlog, 2008.
2. Bradford W.Parkinson and James J.Spilker, Global Positioning system: Theory and Application, Vol.II, American Institution of Aeronautices and Astronautics Inc., Washington, 1996.

Online Resources:
Weblinks for IGS, IRNSS and GAGAN:

1. https://nptel.ac.in/courses/105104100/lectureB_8/B_8_10Indiandatum.htm
2. https://deeppradhan.heliohost.org/gis/indian-grid/
3. https://www.sac.gov.in/SACSITE/GAGAN%20&%20IRNSS.pdf
4. https://www.insidegnss.com/auto/julyaug17-IRNSS.pdf
5. http://insidegnss.com/wp-content/uploads/2018/01/janfeb16-GAGAN.pdf

Course Outcomes:

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

1. Explain the operation of basic satellite communication.
2. Differentiate between various GNSS constellations and describe the three GNSS segments and explain the signal structure of GNSS.
3. Frame various coordinate systems for estimating position.
4. Estimate the various errors and their effect on position estimation.
5. Determine user position from Navigation and Observation data formats.
6. Apply DGPS principle and can also analyze various augmentation systems.

IV Year B.Tech ECE II-Semester	L	T	P	C
Course Code: PE118EY	3	-	-	3

ADAPTIVE SIGNAL PROCESSING

(Professional Elective-5)

Prerequisites:1.Probability Theory and Stochastic Process, 2. Digital Signal Processing

Course Objectives:

1. To introduce some practical aspects of signal processing, and in particular adaptive systems.
2. Differentiate random variables and random processes, covariance matrices; Z transforms of stationary random processes.
3. Describe error surfaces and minimum mean square error, principle of orthogonality.
4. Formulate discrete time Wiener filter as constrained optimization problem.
5. Analyze steepest descent - convergence issues; Stochastic gradient descent LMS and RLS, its convergence case study.
6. Formulate the Kalman filter.

UNIT 1: (~10 Lecture hours)

Introduction to Adaptive Systems: Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner-Description, Weight Vectors, Desired Response Performance function -Gradient & Mean Square Error.

UNIT 2: (~8 Lecture hours)

Development of Adaptive Filter Theory: Introduction to Filtering – Smoothing and Prediction-Linear Optimum Filtering, Problem statement, Principle of Orthogonality-Minimum Mean Square Error, Wiener-Hopf equations, Wiener filter, Error Performance-Cost function, Minimum Mean Square Error. Applications in estimation theory.

UNIT 3: (~8 Lecture hours)

Steepest Descent Algorithms: Searching the performance surface – Methods & Ideas of Gradient Search methods – Gradient Searching Algorithm & its Solution – Stability & Rate of convergence – Learning Curves Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

UNIT 4: (~10 Lecture hours)

LMS Algorithm & Applications: Overview -LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms -LMS Gradient & Stochastic algorithms-Convergence of LMS algorithm. LMS Applications.

UNIT 5: (~10 Lecture hours)

Design and Implementation of Kalman Filter: Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Example-Estimation of State from observations of Noisy observed Narrow Band Signals.

Text Books :

1. Bernard Widrow, Samuel D.Strearns, Adaptive Signal Processing, 1st Edition, PE, 2005.
2. Simon Haykin, Adaptive Filter Theory, 4th Edition, PE Asia, 2002.

Reference Books:

1. S.Thomas Alexander, Adaptive signal processing-Theory and Applications, Springer-Verlag, 1986.
2. James V.Candy, Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988.
3. L.Sibul, Adaptive Signal Processing, IEEE Press, 1987.
4. Ali H. Sayed, Fundamentals of Adaptive Filtering, John Wiley, 2003.

Online Resources :

1 Lectures on Adaptive Signal Processing by Prof. Mrityunjoy Chakraborty, IIT KGP https://nptel.ac.in/courses/117105075/
2 http://www.ee.iitm.ac.in/~skrishna/ee5040/

Course Outcomes:

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

1. Apply the basic probability theory to model random signals in terms of second order statics of Random Processes.
2. Evaluate the covariance matrices to describe the Wiener filter for signals with known second order statistics.
3. Design and implement discrete time Wiener filter.
4. Determine suitable LMS step size to trade off convergence time and misadjustment.
5. Derive and apply the RLS algorithm for iteratively estimating the Wiener filter weights.
6. Design and implement the Kalman filter.

IV Year B.Tech ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118FW	**3**	**-**	**-**	**3**

RADAR SYSTEMS

(Professional Elective-5)
(Common to ECE & ETE)

Prerequisites: 1.Signals and System, 2.Electromagnetic and Transmission Lines, 3. Antennas and Wave Propagation, 4. Microwave Engineering, 5.Analog and Digital Communications

Course Objectives:

1. To understand the working principle of a radar, identify the frequency bands, and formulate the complete radar range equation, listing out all the losses to be accounted for.
2. To identify the need for modulation and Doppler effect; to get acquainted with the working principles of CW radar, FM-CW radar.
3. To impart the knowledge of functioning of MTI radar and its variants; to establish the DLC features and to bring out the MTI radar performance limitations.
4. To establish the principle of Tracking Radar and differentiate between different types of tracking radars, identifying their principle of operation with necessary schematics.
5. To explain the concept of a Matched Filter in radar receiver, and to configure its response characteristics; to impart the working knowledge of different receiver blocks-duplexers, displays, phased array antennas, their requirements and utilities.

UNIT 1: (~10 Lecture Hours)

Basics of Radar: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems.

Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets , Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

UNIT 2: (~8 Lecture Hours)

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF

Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems

FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics, FM- CW altimeter.

UNIT 3: (~8 Lecture Hours)

MTI and Pulse Doppler radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers-Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

UNIT 4: (~12 Lecture Hours)

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar - Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT 5: (~10 Lecture Hours)

Detection of Radar Signals in Noise : Introduction, Matched Filter Receiver-Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

Radar Receivers – Noise Figure and Noise Temperature, Displays – types. Duplexers-Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas-Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

Text Books:

1. Merrill I.Skolnik-Introduction to Radar Systems, 2nd Edition, McGraw-Hill Education, Special Indian Edition, 2007.

Reference Books:

1. Merrill I. Skolnik -Introduction to Radar Systems, 3rd Edition, McGraw-Hill Education, 2005.
2. Mark A.Richards,James A.Scheer, William A.Holm,Yesdee- Principles of Modern Radar:Basic Principles, 2013.

Online resource:

1. http://ieee-aess.org/first-course-radar-systems-dr-robert-odonnell http://aess.cs.unh.edu/radar%20se1.html.

2. NPTEL Web material on Navigation, Guidance and Control by Debasish Ghose, IISc https://nptel.ac.in/courses/101108056/

Course Outcomes:

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

1. Explain the working principle of a pulse radar and establish the complete radar range equation, identifying the significance and choice of all parameters involved, and solve numerical problems to establish the radar characteristics.
2. Account for the need and functioning of CW, FM-CW and MTI radars, identifying the complete block diagrams and establishing their characteristics.
3. Illustrate the DLC characteristics, account for the range gated Doppler filter bank, and estimate the MTI radar performance characteristics and limitations.
4. Distinguish between Sequential Lobbing, Conical Scan, Mono-pulse type of Tracking Radars, specify their requirements and compare their characteristic features.
5. Derive the matched filter response characteristics for radar applications and account for correlation receivers; to distinguish between different radar displays and duplexers.
6. Account for the electronic scanning principle, and implement the same through phased array antennas, knowing their requirements and utilities.

IV Year B.Tech ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118FS	**3**	**-**	**-**	**3**

INTERNET OF THINGS

(Professional Elective-6)

Prerequisites:1.Programming for Problem Solving 2. Digital Electronics. 3. Embedded Systems.

Course Objectives:

1. To introduce the terminology, technology and its applications.
2. To introduce the concept of M2M (machine to machine) with necessary protocols.
3. To introduce the Python Scripting Language which is used in many IoT devices.
4. To introduce the Raspberry Pi platform, that is widely used in IoT applications.
5. To introduce the implementation of web based services on IoT devices.

UNIT 1: (~9 Lecture Hours)

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT-IoT Protocols, IoT Communication Models, IoT Communication APIs.

IoT enabled Technologies: Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates.

Domain Specific IoTs: Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT 2: (~9 Lecture Hours)

IoT and M2M: Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCONF, YANG-NETCONF, YANG, and SNMP NETOPEER.

UNIT 3: (~9 Lecture Hours)

Introduction to Python: Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.

UNIT 4: (~9 Lecture Hours)

IoT Physical Devices and Endpoints: Introduction to Raspberry Pi-Interfaces (serial, SPI, I^2C) Programming – Python program with Raspberry

Pi with focus of interfacing external gadgets, controlling output, and reading input from pins.

UNIT 5: (~9 Lecture Hours)
IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs Webserver-Web server for IoT, Cloud for IoT, Python web application framework, designing a RESTful web API.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547.
2. Matt Richardson and Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350239759.

Reference Books:

1. David, Hanes and Salgueiro Gonzalo, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Pearson 2017.
2. Dirk Slama and Frank Puhlmann, Enterprise IoT: Strategies and Best Practices for Connected Products and Services by 2015.

Online Resources:

1. https://www.tutorialspoint.com.
2. https://www.edureka.co.
3. https://www.pnlinecourses.nptel.ac.in

Course Outcomes:

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

1. Understand the IoT Systems.
2. Understand the concept of M2M (machine to machine) with necessary protocols.
3. Create programs using python scripting language in IoT devices.
4. Create programs for Raspberry Pi interfaces.
5. Understand to communicate with IoT Systems through web-interface.
6. Apply IoT principles for domain specific applications.

IV Year B.Tech ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118EZ	**3**	**-**	**-**	**3**

ADHOC WIRELESS NETWORKS

(Professional Elective-6)
(Common to ECE & ETE)

Prerequisites: Principles of Computer Networks.

Course Objectives:

1. To provide the knowledge on various concepts related to WLANS and wireless adhoc networks.
2. To give an overview of the designing issues of MAC, Routing and Transport protocols of Adhoc Networks
3. To provide in depth analysis of various MAC, Routing and Transport protocols and their performance evaluation.
4. To inculcate regarding the security issues in Adhoc networks.
5. To provide analysis of energy management in Adhoc networks.

UNIT 1: (~10 Lecture Hours)
Wireless Local Area Networks: Introduction, wireless LAN Topologies, Wireless LAN Requirements, Physical Layer- Infrared Physical Layer, Microwave based Physical Layer Alternatives, Medium Access Control Layer- HIPERLAN 1 Sublayer, IEEE 802.11 MAC Sublayer and Latest Developments-802.11a, 802.11b, 802.11g.
Ad-Hoc Wireless Networks: Introduction; Cellular and Ad-Hoc Wireless Networks; Issues in Ad-Hoc Wireless Networks.

UNIT 2: (~10 Lecture Hours)
Medium Access Control Protocols: Introduction; Issues in Designing a MAC protocol: Design goals of a MAC protocol; Classification of MAC protocols; Contention-based protocols: Contention-based protocols with reservation mechanisms; Contention-based MAC protocols with scheduling mechanisms; MAC protocols that use directional antennas.

UNIT 3: (~10 Lecture Hours)
Routing Protocols: Introduction, Issues in designing a routing protocol for adhoc wireless networks, Classification of routing protocols, Table-driven protocols, On-demand routing protocols, Hybrid routing protocols, Routing protocols with efficient flooding mechanisms, Hierarchical routing protocols, Power-aware routing protocols.

UNIT 4: (~8 Lecture Hours)
Transport Layer and security protocols : Introduction to transport layer protocols, Issues in designing a transport layer protocol for adhoc wireless networks, Design goals of transport layer protocol for adhoc wireless networks, Classification of transport layer solutions, TCP over adhoc wireless networks, other transport layer protocols for adhoc wireless

networks. Security in adhoc wireless networks, network security requirements, Issues and challenges in security provisioning, network security attacks.

UNIT 5: (~8 Lecture Hours)
Energy Management: Introduction, need for energy management in adhoc wireless networks, Classification of energy management schemes, Battery management schemes, Transmission power management schemes, System power management schemes.

Text Books:
1. C. Siva Ram Murthy, Ad Hoc Wireless Networks, Pearson Education, 2004.
2. P Nicopolitidis and M. S. Obaidat, Wireless Networks, Wiley India Edition, 2003.
3. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, Wiley, 2010.

Reference Books:
1. C.K.Toh, Ad-Hoc Mobile Wireless Networks: Protocols and Systems, 1st Edition, Pearson Education.
2. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, Ad Hoc and Sensor Networks, World Scientific, 2011.
3. Kazen Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks, Wiley Student Edition, 1991.
4. C.S. Raghavendra, Krishna M.Siva Lingam, Wireless Sensor Networks, Springer, 2004.
5. Jagannathan Sarangapani, Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control, CRC Press.

Online Resources:
1. http://nptel.ac.in/syllabus/106105160/
2. http://www.cse.wustl.edu/~jain/

Course Outcomes:
At the end of this course, students will be able to
1. Demonstrate knowledge on various concepts related to WLANs and adhoc wireless networks.
2. Understand the designing issues of MAC, Routing and Transport protocols of Adhoc Networks.
3. Apply different MAC, Routing and Transport protocols, security issues and Energy management schemes for real time scenarios.
4. Analyze various MAC, Routing and Transport protocols, security issues and Energy management schemes
5. Evaluate the performance of adhoc wireless network protocols in all the layers.
6. Design protocols for adhoc wireless networks for better performance.

IV Year B.Tech ECE II-Semester	**L**	**T**	**P**	**C**
Course Code: PE118FE	**3**	**-**	**-**	**3**

ARTIFICIAL NEURAL NETWORKS

(Professional Elective-6)

Prerequisites:-Nil-

Course Objectives:

1. To study the biological neural network and to model equivalent neuron models. Solve problems by acquiring knowledge of machine language programming.
2. To understand the architecture, learning algorithms.
3. To know the issues of various feed forward and feedback neural networks.
4. To explore the Neuro dynamic models for various problems.

UNIT 1: (~10 lecture hours)

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.

UNIT 2: (~8 lecture hours)

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment.

Multilayer Perceptrons: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.

UNIT 3: (~8 lecture hours)

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

UNIT 4: (~8 lecture hours)

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map,

Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification.

UNIT 5: (~10 lecture hours)
Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm.
Hopfield Models: Hopfield Models, restricted Boltzmann machine.

Text Books :

1. Simon S Haykin, Neural Networks a Comprehensive Foundations, 2nd Edition, PHI, 2005.

Reference Books :

1. B. Yegnanarayana , Artificial Neural Networks, Prentice Hall of India Pvt Ltd, 2005.
2. Jacek M.Zurada , Introduction to Artificial Neural Systems, 1st Edition, JAICO Publishing House, 2006.
3. Li Min Fu , Neural Networks in Computer Intelligence, TMH, 2003.
4. James A Freeman David M S Kapura, Neural Networks, 1st Edition, Pearson Education, 2004.

Online Resources:

1. Lectures on Neural networks and applications, by Prof.S.Sengupta IITKGP. https://nptel.ac.in/courses/117105084/
2. Lectures on Artificial neural networks by Dr. Nandan Sudarsanam and Dr. Balaraman Ravindran IITM https://nptel.ac.in/courses/110106072/34
3. https://www.edutechlearners.com/neural-networks-fuzzy-logic-notes, Neural Networks & Fuzzy Logic Notes

Course Outcomes:

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

1. Recall and infer the similarity of Biological networks and Neural networks.
2. Observe the training of neural networks using various learning rules.
3. Interpret the concepts of forward propagation in Neural networks.
4. Analyze the learning mechanism of backward propagation in Neural networks for classification.
5. Illustrate the concepts of Self-Organization Maps.
6. Analyze and build the Hopfield models.

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.

	L	T	P	C
III Year B.Tech. I-Semester				
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)

Prerequisites:-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: (~8 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.

	L	T	P	C
III Year B.Tech. I-Semester				
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.

	L	T	P	C
III Year B.Tech. I-Semester/II-Semester				
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.

	L	T	P	C
III Year B.Tech. II-Semester				
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

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III Year B.Tech. II-Semester				
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: (~8 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:

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.

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III Year B.Tech. II-Semester				
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:

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: (~9 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: (~9 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.

IV Year B. Tech. I-Semester	**L**	**T**	**P**	**C**
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.

IV Year B.Tech. I-Semester **L T P C**
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 References:

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.

	L	T	P	C
IV Year B.Tech. I-Semester				
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: (~ 8 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: (~ 8 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: (~7 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:

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, 3rd Edition, Pearson Education, 2014.
2. Rich, Knight and Nair, Artificial intelligence, 3rd Edition, Tata McGraw Hill, 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)

Prerequisites:-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, Mc Graw 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

PO1 **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specializa-tion to the solution of complex engineering problems.

PO2 **Problem Analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design & Development 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.

PO4 **Investigation 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.

PO5 **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 **Engineering & Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment & Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual & Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management & finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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.