ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

ELECTRICAL AND ELECTRONICS ENGINEERING

FOR

B.TECH FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2022-23)

G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE

(AUTONOMOUS) (For Women)

Shaikpet, Hyderabad –500104.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT VISION

To impart quality education in Electrical and Electronics Engineering for women empowerment

DEPARTMENT MISSION

The vision can be accomplished by

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

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ACADEMIC REGULATIONS (R22)

For CBCS Based B.Tech. Degree Programmes

(Applicable for the students admitted into I year from the Academic Year **2022-23** and onwards)

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

G. Narayanamma Institute of Technology & Science (GNITS) - for Women, Hyderabad, an Autonomous College approved by AICTE, New Delhi, and affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, offers 4 Year (8 Semesters) Bachelor of Technology (B.Tech.) Degree Programme under Choice Based Credit System (CBCS) with effect from the Academic Year 2022 – 23 onwards in the following Branches of Engineering & Technology (Table 1.0):

S.No.	***Programme***
I.	Computer Science & Engineering **(CSE)**
II.	Electrical & Electronics Engineering **(EEE)**
III.	Electronics & Communication Engineering **(ECE)**
IV.	Electronics & Telematics Engineering **(ETE)**
V.	Information Technology **(IT)**
VI.	Computer Science & Engineering (Artificial Intelligence & Machine Learning) **(CSM)**
VII.	Computer Science & Engineering (Data Science) **(CSD)**
VIII.	Computer Science & Technology **(CST)**

Table 1.0

2.0 Eligibility for Admission

2.1 The Admission to the UGDP 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 Programme in E&T shall be ENGLISH only.

3.0 B.Tech. Degree Programme Structure

3.1 The B.Tech. Degree Programmes 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 areadopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed under Clauses **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 UGDP 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 2 components of evaluation - ‘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 refer to ‘Theory Subject’, or ‘Lab/Practical Course’, or ‘Design/ Drawing Subject’, or ‘Elective’, or ‘Open Elective”, or ‘Seminar’, or ‘Project’, or ‘Mini-Project’, or ‘Online Course’, as the case may be.

3.2.2 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.
- Mandatory Courses (MC) will not carry Credits.

3.2.3 Subject/ Course Classification

All the Subjects/ Courses offered for the UGDP 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 (OL - offered on MOOCS platform by NPTEL/ IITs) approved by JNTUH;
  - MC - No Credits allocated.

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course Structure Grouping for each UG Degree Programme (or B.Tech. Degree Course) is as listed below (along with AICTE specified % Range of Credits) in Table 3.2.4:

S. No.	*Broad Course Classifi-cation*	*Course Group/ Category*	*Course Description*	*Range of Credits (AICTE Model)*	*R22 Regula-tions at GNITS*
1)	**Foundation Courses (FnC)**	**BS – Basic Sciences**	Include - Mathematics, Physics, Chemistry, Biology Subjects	**15% - 20%**	**22.5 C (14.06 %)**
2)		**ES - Engineering Sciences**	Include fundamental engineering subjects	**15% - 20%**	**25 C (15.63 %)**
3)		**HS – Humanities & Social Sciences**	Include subjects related to Humanities, Social Sciences and Management	**5% - 10%**	**12 C (7.5 %)**
4)	**Core Courses (CoC)**	**PC – Professional Core**	Include core subjects related to the Parent Department/ Branch of Engg.	**30% - 40%**	**54.5 C (34.06 %)**
5)	**Elective Courses (EℓC)**	**PE – Professional Electives**	Include Elective subjects related to the Parent Department/ Branch of Engg.	**10% - 15%**	**18 C (11.25 %)**
6)		**OE – Open Electives**	Elective subjects include subjects from other Technical and/ or Emerging Subject Areas	**5% - 10%**	**9 C (5.62 %)**

7)	**Projects Related Courses (PW)**	**Project Work**	B.Tech. Project or UG Project or UG Major Project	**10% - 15%**	**19 C (11.88 %)**
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	**No Credits**	-
11)	**Additional Courses**	**ONLINE Courses (OL)**	Offered on MOOCS platform by NPTEL/ IITs	ADDI-TIONALs	24 C
Total Credits for UG (B. Tech.) Degree Programme				**160 (100%)**	**160 (100%)**

Table 3.2.4

4.0 Course Work

4.1 A student after securing admission, shall pursue the B.Tech. UG Degree Programme 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 UGDP, to enable the newly admitted students get acquainted with the new professional environment, to develop awareness and understanding of the engineering education requirements, and to get them prepared for the academic schedules ahead. The features, activities and pattern of the Induction Programme shall be as per the guidelines suggested in the Model Curriculum. Conventional class work shall commence only after the completion of the Induction Programme.

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

4.4 Each Semester is structured to provide 20 Credits (20 C), 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 UGDP, 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 (20 Credits) indicated in that semester workload of the respective UGDP Course Structure - this is termed as the 'Normal Work Load' (NWL).

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 (20 Credits) suggested in the respective semester credit load allocation of that UGDP Course Structure as the Normal Work Load (NWL), and the Maximum Work Load per semester (MWL) – with permissible additional courses within the Course Structure (subject to a maximum of 2 Theory Courses and 1 Lab Course) of her choice, is limited to a total work load of 28 Credits, 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/extra' Subjects/Courses to reach the Maximum Work Load (MWL) of 28 Credits (above the NWL specified) in each semester must be clearly indicated on a request letter, which needs the specific approvals and signatures of the Faculty Advisor/ Counselor and the HoD on the hardcopy.

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 correctly 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 NWL), 'within 15 Days of Time' from the beginning of the current semester.

5.10 For the Mandatory Courses, 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 (including Mandatory or Non-Credit Courses) for that semester. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject.

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.

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 will not be promoted to the next semester. She may seek re-registration for all those Subjects registered in that semester in which she got 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 available 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 (except for Seminar and Mini-Projects), if she secures not less than 35% (14 marks out of 40 marks) in CIE (Continuous Internal Evaluation), not less than 35% (21 marks out of 60 marks) in SEE (Semester End Examination), and a minimum of 40% (40 marks out of 100 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 (IV Year II Semester) and the Mini-Projects (II Year II Semester, and III Year II Semester), if she secures not less than 40% of the total marks (that is, 40 out of

100 marks allotted) for each of them. The student would be treated as failed, if she - (i) does not submit a report on her Mini-Projects, or does not make a presentation of the same before the Evaluation Committee as per specified schedule, or (ii) does not present the Seminar as required in the IV year II Semester, or (iii) secures less than 40% of marks (that is, 40 marks) in the Mini-Projects/ Seminar evaluations. She may reappear once for each of the Mini-Projects/ Seminar evaluations, as and when they are scheduled again; 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 20 Credits out of 40 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 48 Credits out of 80 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 72 Credits out of 120 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 - (i) 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, (ii) puts up all the Attendance and Academic requirements for 160 Credits securing a minimum of C Grade (Pass Grade) or above in each Subject, (iii) earns ALL 160 Credits securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$5.0, and (iv) satisfactorily completes all Mandatory Courses; to successfully complete the UG Degree Programme. **THERE IS NO EXEMPTION OF CREDITS IN ANY CASE**

8.7 **B.Tech. Degree Programme with HONORS/ MINOR DEGREE in EMERGING AREAS as per AICTE Norms and JNTUH Specifications (with effect from 2022-23 Academic Year):**

a) GNITS offers B.Tech. Degree Programme with HONORS in CSE Branch of CSE Department, with the JNTUH stipulated Regulations and Eligibility Conditions. Accordingly, students need to acquire

20 additional Credits in specified subjects offered from identified Emerging Areas during III Year and IV Year, for HONORS specialization in the same Major Discipline/Branch of Engineering.

The Academic Regulations, Eligibility Conditions, Registration and other details are listed in Annexure-H (enclosed).

b) GNITS offers B.Tech. Degree Programmes with MINOR DEGREE in the following Emerging Areas – (i) Artificial Intelligence & Machine Learning (AI & ML), (ii) Cyber Security (CS), (iii) Data Science (DS), (iv) Internet of Things (IoT), v) Advanced Web Development (AWD – under AICTE-LITE Programme - Online), with the JNTUH specified Regulations and Eligibility Conditions. Accordingly, students need to acquire 18 additional Credits in specified subjects offered from identified Emerging Areas, during III Year and IV Year, for MINOR DEGREE specialization from other Departments/Branches of Engineering.

The Academic Regulations, Eligibility Conditions, Registration and other details are listed in Annexure-M (enclosed).

c) Students who opt for the above HONORS/ MINOR DEGREE Programmes should not have any backlogs, as per JNTUH stipulations (details listed in Annexures - H and M).

d) If the student fails to get the JNTUH stipulated number of Credits (18 for Minor Degree and 20 for Honors) within 4 years from the date of commencement of their UGDP, then they shall get only the B.Tech. Degree with the Major Engineering Branch Specialization in which they were admitted in I Year, subject to completion of the required 160 C (as per NWL). All the other Credits they have acquired (beyond this 160 C) shall only be listed as ‘Additional Subjects/ Courses chosen’ in the Marks Memo along with the Grade obtained. The performances in these ‘Additional Subjects’ shall not be taken into account while calculating the SGPA and CGPA of the B.Tech. Degree Programme.

e) If a student takes prior permission and 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, without HONORS/ MINOR DEGREE considerations (as listed above), the performances in those ‘Additional Subjects’ (although evaluated and graded) shall not be taken into account while calculating the SGPA and CGPA of the B.Tech. Degree Programme. For such ‘Additional Subjects’ registered, the % of marks and/or the Letter Grade alone may be indicated in the Marks Memo 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 admissions 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 fulfilment 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 (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.

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 Engineering Graphics/ Engineering Drawing, or Elective Course, or Mini-Projects, or Seminar, or Project – I (Phase – I), or Project – II (Phase – II) etc. These evaluations shall be based on 40% CIE (Continuous Internal Evaluation) and 60% SEE (Semester End Examination) basis, 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: 40 Marks for the CIE and 60 Marks for the SEE for the entire UG Degree Programme.

9.3 **a)** For the Theory Subjects during the semester, the CIE assessment for 40 marks includes two Mid-Term Examinations. Each Mid-Term Examination is conducted for 30 marks, for a duration of 120 minutes, and it shall have two parts: i) Part-A (Objective/Quiz Paper) for 10 marks, and ii) Part-B (Descriptive Paper) for 20 marks. Average of these two Mid-Term Examinations is assessed for 30 marks.

The Objective/Quiz Paper is set with ten multiple choice/ fill-in the blanks/ match the following … type of questions for a total of 10 marks. The Descriptive Paper (for 20 marks) shall contain 6 full questions, out of which, the student has to answer 4 questions, each carrying 5 marks.

The remaining 10 marks of CIE are distributed as - i) 5 marks for Assignment (average of 2 Assignments submitted, each for 5 marks), and ii) 5 marks for - Subject Viva-voce/ PPT/ Poster Presentation/ Case Study on a topic in the concerned subject.

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) There shall be 2 Assignments per semester, and 5 marks are allocated for each Assignment. 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 concerned subject teacher, and the Average of these two Assignments shall be taken into account for 5 marks.

d) Assessment (for 5 marks) for the Subject Viva-voce/ Poster Presentation/ Case Study on a topic in the subject concerned shall be carried out before the commencement of II Mid-Term Examinations.

e) Sum of these three components of marks - (i) Average of the two Mid-Term Examinations marks (for 30 marks), (ii) Average of the two Assignments marks (for 5 marks), and (iii) the Assessment for the Subject Viva-voce/ Poster Presentation/ Case Study on a topic in the subject concerned (for 5 marks) – shall be the final marks secured towards the CIE (40 marks) in that Subject/ Course. The student has to earn a minimum of 35 % (14 marks) out of these 40 marks allocated.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.
- *The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*
- *In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE*

- ***Special internal(Mid) examinations will not be conducted for the absent students in R22 academic regulations***

f) 60 marks are allocated for Semester End Examination (SEE), which is of 3 hours duration. The SEE Question Paper will have two parts: i) Part-A is for 10 marks and is compulsory - it consists of 10 questions of 1 marks each (Two questions from each unit) and ii) Part-B is for 50 marks – it consists of 5 questions of 10 marks each (one question from each unit, it may contain sub-questions); for each question there will be 'either/ or' choice, which means that there will be two questions from each unit and the student should answer one of these two.

9.4 For the Lab/Practical Subjects also, the Continuous Internal Evaluation (CIE) during the semester shall be for 40 Marks, and the End Semester Examination (SEE) shall be for 60 Marks. Out of the 40 Marks for internals (CIE), day-to-day assessment of the lab work shall be judged for 20 Marks; and one internal lab exam shall be conducted by the laboratory teacher concerned for 20 Marks, out of which 10 Marks are allocated for the viva-voce. The Semester End Examination (SEE) for Lab/Practical's shall be conducted at the end of the semester by Two Examiners nominated by the Head of the Department and approved by the Principal.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40%of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.
- *The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.*
- *In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE*

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: 40 Marks for CIE (20 Marks for the day-to-day work and 20 Marks for the internal test) and 60 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 from the internal tests for CIE. In case of Drawing SEE (*Semester End Examination) question paper there is no compulsory part(Part-A). Drawing will have only one part with either or type pattern. Two questions from each unit will be given,* *students has to answer one question from each unit and carries 12 marks.*

9.6 Open Electives (OE): 3 Open Elective Courses shall be offered in the 8 Semester UG Degree Programme. Students are to choose each Open Elective, from the set of options given, in 3 different semesters (in III and IV Years). The students have to choose three Open Electives (OE1, OE2, OE3) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by her own (parent) department, if she has not registered that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

9.7 There shall be a Seminar Presentation in the IV 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 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 two Mini-Projects – first one (Mini-Project 1 or MP1) will be during II Year II Semester (also termed Real Time Project, based on Laboratory Experiments and Teachers' advice); and the second one (Mini-Project 2 or MP2) is preferably in collaboration with an Industry with the relevant specialization (Industry Oriented Mini-Project), to be registered immediately after II Year II Semester examinations, and taken up during the summer vacation (between II and III Years) for about eight weeks duration. Students also have an option to choose Industry Internship (instead of Industry Oriented Mini-Project) for MP2, if they secure selection at any reputed Industry.

b) The Mini-Project Work shall be submitted in a Report form, and a presentation of the same shall be made before a Committee, which is evaluated for 100 marks by the Committee. The Committee shall consist of - 1) Head of the Department (for MP2) / a Professor of the Department (for MP1), 2) the Supervisor of Mini-Project, and 3) External Examiner (for MP2) / a Senior Faculty Member of the Department (for MP1). There shall be no internal marks for Mini-Projects. Performance evaluation of MP1 and MP2 shall be included in the II Year II Semester Grade Card and III Year II Semester Grade Card, respectively. The External Examiner for MP2 shall be nominated by the Principal from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the Head of Department. Performance Evaluations of MP1 and MP2 Mini-Projects will be included in the II Year – II Semester, and III Year – II Semester Grade Cards, respectively.

c) Industry Internship (for MP2, in place of collaborative Mini-Project) is exclusively meant for those students who have been considered eligible and selected accordingly by the Industry. Based on such selection letters from Industry, approvals will be given to students by the Principal of the Institution to carry out the Industry Internship for the specified period. The work performed during the Internship and the outcomes shall be reported in a Report form, which will also be evaluated in the same format (same as that of MP2 as stated in 9.8 b above).

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, 40 marks shall be for the CIE (Continuous Internal Evaluation/CIE), and 60 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 and her presentations at the Project Review Committee (PRC) Meetings in the Department, during the two Project Work Phases/periods. The PRC shall be constituted by the Head of the Department, and shall consist of the Head of the Department (HoD), Project Supervisor, and a Senior Faculty Member of the Department. The PRC shall monitor and review the progress of the Project Work, based on the PRC presentations and performance evaluations. 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 the Semester End Examinations, at the Department Level by the Project (Phase – I) Evaluation Committee comprising of HoD or One Professor (nominated by the HoD), Supervisor (no External Examiner).

d) For the Project Phase – II Viva-voce (or Final Project Viva-voce) shall be conducted by a Project (Phase -II) Evaluation Committee comprising of an External Examiner, HoD and the Project Supervisor at the end of the IV Year II Semester, before the commencement of the Semester End Examinations. The External Examiner shall be nominated by the Principal from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HoD.

e) The student would be treated as failed, if she - (i) does not submit a Report on her Projects (Phase – I or Phase – II), or does not make a presentation of the same before the Evaluation Committee as per specified schedule, or (ii) secures less than 40% of marks (that is, 40 marks) in the sum total of the CIE and SEE taken together, in her Projects evaluations. She may reappear once for each of the Projects evaluations, as and when they are scheduled again; 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.

9.10 For the Mandatory Non-Credit Course offered in a semester, a 'Satisfactory grade letter(s)" will be awarded in Grade Memo only after securing ≥ 75% attendance in the Course.

9.11 ONLINE Courses (OL) – offered on MOOCs platform (by NPTEL/ IITs): Provision is made to offer some identified Courses, PEs and OEs (or their nearest equivalent courses, along with the number of credits and period of duration, as notified by the HoD) over 'ONLINE' mode, in addition to the conventional 'OFFLINE' mode (regular class-room teaching), from III Year onwards. Students may choose any mode out of these two, within one week from the commencement of the current semester; however, for ONLINE mode choice, prior intimation and approval from the Head of the Department and Principal is necessary. If any student wishes to discontinue the ONLINE mode, she can switch back to OFFLINE mode with prior intimation to the Head of Department, preferably within 2 weeks from the beginning of the current semester. Prior to Registration of these ONLINE Courses (on MOOCS platform – offered by NPTEL/IITs), formal approval of the Courses by JNTUH is essential. On successful completion of the

ONLINE Course, the performance Grade – based on the certification from the 'MOOCS Course Conducting Authorities' (NPTEL/IITs), will be appropriately awarded to the student and the same will be recorded on her Grade Card.

9.12 a) student can re-register for subjects in a semester:

- ***If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Vivavoce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.***

  They may seek re-registration for all those subjects registered in that semester in which the student is failed. The student has to re-appear for CIE and SEE as and when offered.

  A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. His Continuous Internal Evaluation marks for 40 obtained in the previous attempt stand cancelled. The student has to obtain fresh set of marks for 40 allotted for CIE (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject). Head of the Dept. will take care of this

10.0 Grading Procedure

10.1 Marks shall be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practical, 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 (Table 10.2) 'Letter Grades and corresponding percentage of marks' shall be followed:

% of Marks Secured	***Letter Grade (Class Intervals)***	***Grade Points (UGC Guidelines)***
90% and above ($\geq 90\%$, $\leq 100\%$)	O (Outstanding)	10
Below 90% but not less than 80% ($\geq 80\%$, $< 90\%$)	A^+ (Excellent)	9
Below 80% but not less than 70% ($\geq 70\%$, $< 80\%$)	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

Table 10.2

10.3 The Grade Designations include 7 categories, namely … O, A+, A, B+, B, C and F.

10.3.1 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 later. In such cases, her Internal Marks (CIE Marks) in those Subject(s) will remain the same as those obtained earlier.

10.3.2 If a student fails to appear for SEE of any Subject (s) for any reason whatsoever, she is deemed to have 'failed', and she will get F Grade in all such failed Subject (s). She will be required to reappear as 'Supplementary Candidate' in the End Semester Examination (SEE), as and when conducted later. In these cases also, 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 Point 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 (SCP) 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., upto and inclusive of S semesters, $S \geq 2$),

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 SGPA of a semester will be mentioned in the Semester Grade Card or Grades Memorandum, if all the subjects of that semester are passed in first attempt. Otherwise, the SGPA shall be mentioned on the Grade Card, only when the student passes all subjects of that semester.

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 grade' 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.

11.0 Declaration of Results

a. Computation of SGPA and CGPA are done using the procedure listed under Clauses 10.6 – 10.10.

b. 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 Programme) 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)** 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 Programme, and secures the required number of 160 Credits (with Final CGPA $\geq$ 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.

b) B.Tech. with Honors/ Minor Degree shall be awarded by JNTUH to those successful and acquired 20 Credits (for Honors) and 18 Credits (for Minors) in addition to the stipulated 160 Credits for B.Tech. Degree, as per norms listed Clause 8.7 and Annexures H-M.

12.2 A student who qualifies for the Award of the Degree as listed under Clause 12.1, shall be placed in the following Classes (Table 12.2):

AWARD OF CLASS BASED ON FINAL CGPA
(at the end of the UG Degree Programme)

First Class with Distinction	Final CGPA 8.00 or more ##
First Class	Final CGPA below 8.00 but not less than 7.00
Second Class	Final CGPA below 7.00 but not less than 6.00
Pass Class	Final CGPA below 6.00 but not less than 5.00

Table 12.2

Note:

a) A student with Final CGPA (at the end of the UG Degree Programme) $\geq$ 8.00, and fulfilling the following conditions -

i) should have passed all the Subjects/ Courses within the first 4 Academic Years (or 8 Sequential Semesters) from the Date of Commencement of her First Academic Year,

ii) 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'.

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

b) A student with Final CGPA (at the end of UG Degree Programme) $\geq$ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

c) A student with Final CGPA (at the end of the UG Degree Programme) < 5.00 will not be eligible for the Award of the Degree.

12.3 Award of 2-Year Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. program and requests for the 2 -Year B. Tech. (UG) Diploma Certificate.

2. The student once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.

3. The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.

4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in next Academic Year in the same college and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program)

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

A. For students detained due to shortage of attendance:

1. A student who has been detained in any semester of I, II, III and IV years of R18 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from thatsemester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

1. A student of R18 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R18 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

1. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
2. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. There is NO exemption of credits in any case.
3. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

Note: If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

15.0 Student Transfers

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

ANNEXURE - H:

H1) JNTUH stipulated Regulations for B.Tech. Degree Course with Honors:

H1.1 Academic Regulations:

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.

b) For B. Tech with Honors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Honors program, their respective credits weightage and semester-wise break-up of the course are enclosed below in Clause H1.4. All these 20 credits need to be completed in III year and IV year only.

c) After registering for the Honors program, if a student is unable to pass all courses in first attempt and earn the required 20 credits, she shall not be awarded Honors degree. However, if the student earns all the required 160 credits of B. Tech., she will be awarded only B. Tech degree in the concerned branch.

d) There is no transfer of credits from courses of Honors program to regular B. Tech. degree course & vice versa.

e) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related departments in the college as well as from the MOOCS platform.

f) For the courses selected under MOOCS platform following guidelines may be followed:

i) Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

ii) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honors course structure provided by the University.

iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Honors grade memo.

iv) Any expenses incurred for the MOOCS courses are to be met by the students only.

g) The choice to opt/take the Honors program is purely on the choice of the students.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Honors program at any time; and in that case the student will be awarded only B. Tech. degree in the concerned branch on earning the required credits of 160.

i) The students of every branch can choose Honors program in their respective branches if they are eligible for the Honors program. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

j) The B. Tech. with Honors program shall be offered at GNITS (W) from the AY 2022-23 onwards. The students who are pursuing their III year I semester in the current academic year can register for the Honors program if they fulfil the eligibility criteria.

k) A student can graduate with Honors if she fulfils the requirements for her regular B. Tech. program as well as fulfils the requirements for Honors program.

l) The institute shall maintain a record of students registered and pursuing their Honors programs branch-wise. The same report needs to be sent to the University once the enrolment process is complete.

m) The department shall prepare the time-tables for each Honors program offered at their respective departments without any overlap/clash with other courses of study in the respective semesters.

H1.2 Eligibility conditions of the students for the Honors degree:

a) A student can opt for B.Tech. degree with Honors, if she passed all subjects in first attempt in all the semesters till the results announced and maintaining 7.5 or more CGPA.

b) If a student fails in any registered course of either B. Tech. or Honors in any semester of four years program, she will not be eligible for obtaining Honors Degree. She will be eligible for only B. Tech. degree.

c) Prior approval of mentor and Head of the Department for the enrolment into Honors program, before commencement of III year I Semester (V Semester), is mandatory.

d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the CGPA secured by the students till II year I semester.

e) The department concerned should be preferably NBA accredited and shall offer at least one M. Tech. Program.

f) Successful completion of 20 credits earmarked for Honors program with atleast 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honors) degree.

g) For CGPA calculation of B. Tech. course, the 20 credits of Honors program will not be considered.

H1.3 Registration for the course in Honors Program:

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Honors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Honors is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is Rs. 1000/- per one credit.

e) A fee for late registration may be imposed as per the norms.

H1.4 Academic Regulations/ Course Structure for Honors degree in B. Tech. Programs (Table H1.4):

S. No.	***Year/ Semester***	***Course to be Chosen From/ Studied***	***Mode of Learning***	***No. of Credits***
1	III-1	PE1 OR PE2	Blended/ Conventional	3
2	III-2	Research Methodologies	Conventional	3
3	III-2	PE3	Conventional	3
4	IV-1	PE4	Conventional	3
5	IV-1	PE5	Conventional	3
6	IV-2	Technical Paper Writing	Under the Mentorship of a Supervisor	2
7	IV-2	PE6 or an Inter-disciplinary Subject as suggested by University	MOOCS	3
		TOTAL CREDITS		20

Table: H1.4

Notes:

A) Professional Elective (PE) course should be selected (which is not studied) from each Professional Electives list provided in regular B. Tech. course.

B) Courses can be chosen as in above table.

C) **Technical paper writing:**

a) The student shall take up a problem/topic of engineering branches (inter-disciplinary nature) and apply the knowledge which she acquired while pursuing their engineering branch. It is expected to analyse, design and develop an application for the identified problem and write a technical paper/document.

Alternatively, the student - i) shall identify a research topic, analyse the problem, carryout the experiments, write a technical paper and publish in /communicate for a Scopus indexed journal/any journal with decent reputation, or ii) demonstrate a talent/an idea/ development of an innovative product.

b) The evaluation shall be done by the same committee which is constituted for project evaluation, along with the final semester project work.

c) The students should start exploration for the Technical Paper Writing immediately after the semester exams of III-II semester. Only the evaluation part shall be carried in IV-II semester.

D) The institute shall offer a course on Research Methodologies by combining the students of all branches (if the number of students is more, multiple parallel sessions may be conducted). The time slots in the time-tables of respective branches should be aligned. The external evaluation of Research Methodologies course shall be done by the University.

E) If the blended course option is chosen, for the subject in III-I semester, the learning should be partially in online mode and partially in offline mode. The external evaluation shall be done by the University; however, for the internal evaluation component, online assessment should also be taken into account while finalising the internal marks by the course teacher.

ANNEXURE - M:

M1) JNTUH stipulated Regulations for B.Tech. Degree Course with Minors:

M1.1 Minor Courses and the Offering Departments (Table M1.1):

S. No.	*Minor Programme*	*Eligible Branches of Students*	*Offering Depart-ments @*	*Award of Degree*
1	Artificial Intelligence & Machine Learning	All Branches, except B.Tech. in CSE (AI & ML)/ B.Tech. (AI & ML)/B.Tech. (AI) / B.Tech. CSE (AI)	CSE	B.Tech. in Branch Name with Minor in Artificial Intelligence & Machine Learning
2	Cyber Security	All Branches, except B.Tech. in CSE (Cyber Security)/ B.Tech. (Cyber Security)	CSE	B.Tech. in Branch Name with Minor in Cyber Security
3	Data Science	All Branches, except B.Tech. in CSE (Data Science)/ B.Tech. (Data Science)	CSE	B.Tech. in Branch Name with Minor in Data Science
4	IOT	All Branches, except B.Tech. in CSE (IOT)/ B.Tech. (IOT)	ECE	B.Tech. in Branch Name with Minor in IOT
5	Innovation and Entrepre-neurship	All Branches	Manage-ment Science/ MBA	B.Tech. in Branch Name with Minor in Innovation and Entrepreneurship

@ as per AICTE guidelines.

Table: M1.1

M1.2 Academic Regulations for B. Tech. Degree with Minor Programs:

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.

b) For B. Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B. Tech degree). The list of courses of each Minor program, their respective credits weightage and semester-wise break-up of the courses are as specified by JNTUH authorities. All these 18 credits need to be completed in III year and IV year only.

c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of

B.Tech., he/she will be awarded only B. Tech degree in the concerned branch.

d) There is no transfer of credits from Minor program courses to regular B. Tech. degree course & vice versa.

e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCS platform.

f) For the course selected under MOOCS platform following guidelines may be followed:

i) **Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential.** University, before the issue of approval, considers the parameters like the Institute / Agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.

ii) Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.

iii) Only Pass-grade/marks or above shall be considered for inclusion of grades in Minor grade memo.

iv) Any expenses incurred for the MOOCS courses are to be met by the students only.

g) The choice to opt/take a Minor program is purely on the choice of the students.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at any time; and in that case the student will be awarded only B. Tech. degree in the concerned branch on earning the required credits of 160.

i) The student can choose only one Minor program along with her basic engineering degree. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

j) The B. Tech. with a Minor program shall be offered from the AY 2021-22 onwards. The students who are pursuing their III year I semester in the current academic year can register for the Minor program if they fulfil the eligibility criteria.

k) A student can graduate with a Minor if she fulfils the requirements for her regular B. Tech. program as well as fulfils the requirements for Minor program.

l) The Institute shall maintain a record of students registered and pursuing their Minor programs, minor program-wise and parent branch-wise. The same report needs to be sent to the University once the enrolment process is complete.

m) The Institute / Department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

M1.3 Eligibility conditions for the student to register for Minor Course:

a) A student can opt for B.Tech. degree with Minor program if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year I Semester (V Semester), is mandatory.

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

M1.4 Registration for the courses in Minor Program:

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is Rs. 1000/- per one credit.

e) A fee for late registration may be imposed as per norms.

ACADEMIC REGULATIONS (R22)

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

(Applicable for the students admitted into II year from the Academic Year **2023-24** and onwards)

A) Eligibility for Admission ~

A.1 The Admission to the B.Tech. Programme (UG Degree Programme) 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 Programme in the previous year); and their UGDP 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 Programme 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 (120 Credits) required for the completion of the UGDP 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 40 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 80 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 120 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 120 Credits securing a minimum of C Grade (Pass Grade) or above in each Subject, and earns ALL 120 Credits securing SGPA $\geq$ 5.0 (in each semester), and CGPA (at the end of each successive semester) $\geq$ 5.0, to successfully complete the B.Tech. Degree Programme.

C.4 A student who fails to earn 120 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 Programme), 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 Programme, and secures the required number of 120 Credits (with final CGPA $\geq$ 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 (Table D.2):

AWARD OF CLASS BASED ON FINAL CGPA
(at the end of the UG Degree Programme)

First Class with Distinction	Final CGPA 8.00 or more ##
First Class	Final CGPA below 8.00 but not less than 7.00
Second Class	Final CGPA below 7.00 but not less than 6.00
Pass Class	Final CGPA below 6.00 but not less than 5.00

Table: D.2

Note:

a) A student with Final CGPA (at the end of the UG Degree Programme) $\geq$ 8.00, and fulfilling the following conditions -

i) should have passed all the Subjects/ Courses within the first 3 Academic Years (or 6 Sequential Semesters) from the Year of Admission,

ii) 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'.

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

b) A student with Final CGPA (at the end of UG Degree Programme) $\geq$ 8.00, but not fulfilling the above conditions, shall be placed in 'FIRST CLASS'.

c) A student with Final CGPA (at the end of the UG Degree Programme) < 5.00 will not be eligible for the Award of the Degree.

E) Other Regulations ~

All the Academic Regulations as applicable for the B.Tech. 4 Year (Regular) Degree Programme 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.

F) LES Students are not eligible for the 2-Year UG Diploma Certificate (that provision is available for the Regular 4 Year B.Tech. Course Students only).

B.Tech. 4 Year (8 semesters) Regular Programme in 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 beexpelled from examination hall. The student isalso 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, 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 chiefsuperintendent/assistant – superintendent / any officer on duty or misbehaves or creates disturbance of anykind 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, eitherspoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	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 awayanswer script or intentionally tears of the script or any part there of inside oroutside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject andall the other subjects the student has already appeared including practical examinations andproject work and shall not be permitted for theremaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work andall university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.

8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall andcancellation of the performance in that subjectand 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 university for further action to award suitable punishment.	

B.Tech. 4 Year (8 Semesters) Regular Programme in
ELECTRICAL & ELECTRONICS ENGINEERING
COURSE STRUCTURE
(Applicable for the Batches admitted from the Academic Year 2022-23)

I YEAR **I SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	121AB	Applied Physics	3	0	0	3
2	BS	121AA	Applied Chemistry	3	0	0	3
3	BS	121AG	Linear Algebra and Multivariable Calculus	3	1	0	4
4	ES	121AH	Programming for Problem Solving	3	0	0	3
5	HS	121AF	English for Skill Enhancement	2	0	0	2
6	BS	12102	Applied Physics Lab	0	0	3	1.5
7	BS	12101	Applied Chemistry Lab	0	0	2	1
8	ES	12108	Programming Lab	0	0	3	1.5
9	HS	12105	English Language and Communication Skills Lab	0	0	2	1
10	MC	12107	Gender Sensitization	0	0	2	-
			TOTAL	**14**	**1**	**12**	**20**

I YEAR **II SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	122AK	Numerical Techniques and Transform Calculus	3	1	0	4
2	ES	122AJ	Data Structures	3	0	0	3
3	ES	122AC	Basic Electrical Engineering	3	0	0	3
4	ES	122AE	Engineering Graphics	1	0	3	2.5
5	ES	12204	Engineering Workshop	1	0	3	2.5
6	ES	12209	Data Structures Lab	0	0	3	1.5
7	ES	12203	Basic Electrical Engineering Lab	0	0	3	1.5
8	ES	122AD	Design Thinking	2	0	0	2
9	MC	12206	Environmental Science and Technology	2	0	0	-
			TOTAL	**15**	**1**	**12**	**20**

B.Tech. 4 Year (8 Semesters) Regular Programme in
ELECTRICAL & ELECTRONICS ENGINEERING
COURSE STRUCTURE

(Applicable for the Batches admitted from the Academic Year 2022-23)

II YEAR **I SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	123AX	Special Functions and Complex Variable Theory	3	0	0	3
2	ES	123AV	Python Programing	2	0	0	2
3	PC	123AL	Analog Electronics	3	0	0	3
4	PC	123AS	Field Theory and DC Machines	3	1	0	4
5	PC	123AQ	Electrical Circuit Analysis	3	1	0	4
6	ES	12314	Electrical Circuit Analysis Lab	0	0	3	1.5
7	ES	12317	Python Programing Lab	0	0	2	1
8	PC	12310	Analog Electronics Lab	0	0	3	1.5
9	MC	12312	Constitution of India	2	0	0	-
			TOTAL	**16**	**2**	**8**	**20**

II YEAR **II SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	BS	124BQ	Transform Techniques and Applications	3	0	0	3
2	PC	124BM	Power Systems-I	3	0	0	3
3	PC	124AY	AC Machines	3	0	0	3
4	PC	124BF	Digital Electronics	3	0	0	3
5	PC	124BD	Control Systems	3	0	0	3
6	PC	12421	Electrical Machines Lab	0	0	3	1.5
7	PC	12420	Digital Electronics Lab	0	0	3	1.5
8	PW	12424	Mini Project - 1 (Real Time Project)	0	0	4	2
9	MC	12422	Human Values and Professional Ethics	2	0	0	-
			TOTAL	**17**	**0**	**10**	**20**

B.Tech. 4 Year (8 Semesters) Regular Programme in
ELECTRICAL & ELECTRONICS ENGINEERING
COURSE STRUCTURE

(Applicable for the Batches admitted from the Academic Year 2022-23)

III YEAR **I SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	PC	125DC	Power Systems-II	3	0	0	3
2	PC	125DB	Power Electronics	3	1	0	4
3	PC	125CY	Microprocessors and Micro Controllers	3	0	0	3
4	PE1	Professional Elective - 1(Offline/Online (MOOCs/SWAYAM))		3	0	0	3
		125CG	Digital Control Systems				
		125BK	JAVA Programming				
		125DE	Programmable Logic controllers and Applications				
		125DL	Sensors and Transducers				
5)	PE2	Professional Elective - 2 (Offline/Online (MOOCs/SWAYAM))		3	0	0	3
		125PA	Computer Organization				
		125DM	Special Machines				
		125PA	Electrical Machine Modeling and Analysis				
		125CM	Fuel Cell Technologies				
6	HS	12528	Advanced Communication Skills Lab	0	0	2	1
7	PC	12535	Microprocessors and Micro Controllers Lab	0	0	3	1.5
8	PC	12532	Control Systems Lab	0	0	3	1.5
			TOTAL	**15**	**1**	**8**	**20**

III YEAR **II SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	HS	126EG	Managerial Economics and Financial Analysis	3	0	0	3
2	PC	126EL	Power Systems Protection	3	0	0	3
3	PC	126EK	Power System Analysis	3	1	0	4
4	PE3	Professional Elective- 3 (Offline/Online (MOOCs/SWAYAM))		3	0	0	3
		126ER	Utilization of Electrical Energy				
		126EN	Smart Electric Grid				
		126DZ	High Voltage Engineering				
		126DP	Computer Aided Machine Design				
5	OE1	Open Elective - 1(Offline/Online (MOOCs/SWAYAM))		3	0	0	3
6	PC	12646	Power Electronics Lab	0	0	2	1
7	PC	12636	JAVA Programming Lab	0	0	2	1
8	PW	12644	Mini Project-2(Industry Oriented Mini Project/ Industry Internship: during Summer between 2nd and 3rd years)	0	0	4	2
			TOTAL	**15**	**1**	**8**	**20**

B.Tech. 4 Year (8 Semesters) Regular Programme in
ELECTRICAL & ELECTRONICS ENGINEERING
COURSE STRUCTURE

(Applicable for the Batches admitted from the Academic Year 2022-23)

IV YEAR **I SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	HS	127FN	Fundamentals of Management	3	0	0	3
2	PC	127FE	Electric and Hybrid Vehicles	3	0	0	3
3	PE4	Professional Elective - 4		3	0	0	3
		127DV	Digital Signal Processing				
		127FF	Electrical & Electronics Measurements and Instrumentation				
		127FV	Power Semi-Conductor Drives				
4	PE5	Professional Elective - 5 (Offline/Online (MOOCs/SWAYAM))		3	0	0	3
		127FW	Power System Operation and Control				
		127FU	Power Quality and FACTS				
		127FG	Electrical Distribution Systems				
		127FP	HVDC Transmission				
5	PC	12762	Power Systems Lab	0	0	2	1
6	OE2	Open Elective - 2 (Offline/Online (MOOCs/SWAYAM))		3	0	0	3
7	PC	Lab (Linked to PE4)		0	0	2	1
		12740	Digital Signal Processing Lab				
		12755	Electrical & Electronics Measure-ments and Instrumentation Lab				
		12761	Power Semiconductor Drives Lab				
8	PW1	12763	PROJECT WORK (Phase – I)	0	0	6	3
			TOTAL	**15**	**0**	**10**	**20**

IV YEAR **II SEMESTER**

S. No.	Group	Subject Code	Subject	L	T	P	Credits
1	HS	128GW	Entrepreneurship and Project Management (Offline/Online)	2	0	0	2
2	PE6	Professional Elective - 6 (Offline/Online (MOOCs/SWAYAM))		3	0	0	3
		128GN	AI Techniques in Electrical Engineering				
		128HB	Grid Integration of Renewable Energy Sources				
		128HJ	VLSI Design				
		128GV	EHVAC Transmission				
3	OE3	Open Elective - 3 (Offline/Online (MOOCs/SWAYAM))		3	0	0	3
4	PW	12870	Seminar(Presentation with Report before 1st Mid Exams)	1	0	2	2
5	PW2	12869	PROJECT WORK (Phase – II)	0	0	20	10
			TOTAL	**9**	**0**	**22**	**20**

List of Open Elective offered by various Departments for B.Tech. Programme
(Applicable for the Batches admitted from the Academic year 2022-23 onwards)

S. No.	Name of the Department Offering	Open Elective-1 (B. Tech. III Year II Semester)	Open Elective-2 (B. Tech. IV Year I Semester)	Open Elective-3 (B.Tech. IV Year II Semester)
1	CSE/ IT/ CST	• Fundamentals of Data Structures (126KF) • Fundamentals of Database Management Systems(126KG) • Operating Systems (126KK) • Software Engineering (126KQ)	• Internet of Things(127KY) • Cyber Security (127KT)	• Cloud Computing(128LE) • Blockchain Technologies (128LD)
2	CSE (AI & ML)	• Fundamentals of Artificial Intelligence (126KD)	• Machine Learning Basics (127KZ)	• Introduction to Natural Language Processing (128LL)
3	CSE (Data Science)	• Fundamentals of Data Science(126KE) • R Programming (126KP)	• Data Visualization using Python (127KU)	• Data Mining (128LF)
4	ECE	• Biomedical Electronics and Applications (126KA) • Principles of Communication Technologies (126KN) • Verilog HDL(126KR)	• Sensors and Actuators (127KV) • Elements of Satellite Communications (127LR)	• Wearable Devices and its Applications (128LP) • Systems Engineering (128LG)
5	ETM	• Principles of Communications (126KM)	• Telecommunication Switching Systems (127LC)	-
6	EEE	• Engineering Materials (126KC)	• Renewable Energy Sources(127LA)	• Waste Management Techniques and Power Generation (128LN)
7	Mech. Engg.	• Operations Research (126KL)	• Research Methodology (127LB)	-
8	H&M	• Introduction to Data Analytics(126KJ) • Intellectual Property Rights(126KH)	• Industrial Management (127KX) • Behavioral Skills and Professional Communication (127KS)	• Marketing Management (128LM)
9	BS	• Disaster Management (126KB)	-	• Environmental Impact Assessment (128LH)

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 Elective Subject from all other departments/branches except Open Electives offered by CSE Dept.

I Year B. Tech, EEE I Semester	**L T P C**
Course Code: 121AB	**3 0 0 3**

APPLIED PHYSICS

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

Through this course the student is to:

1. Understand the fundamentals of quantum mechanics and study the behaviour of a particle quantum mechanically.
2. Analyze the semiconductors and semiconductor devices.
3. Be able to classify the types and properties of dielectric and magnetic materials
4. Understand the construction and working principle of different types of lasers and light propagation through optical fiber.
5. Learn the fundamentals of nano material synthesis and characterizations.

UNIT 1: Quantum Mechanics (~9 Lecture Hours)

Introduction to quantum physics, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

Kronig-Penny model (using Bloch theorem, qualitative analysis and conclusions), Energy bands in solids. E-k diagram, classification of materials: Metals, Semiconductors and Insulators. Density of states (Qualitative) and electron occupation probability (Fermi-Dirac Distribution function analysis)

UNIT 2: Semiconductor Physics (~9 Lecture Hours)

Intrinsic and Extrinsic semiconductors, Carrier concentrations of Intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination (Qualitative), Hall effect and calculation of Hall Coefficient (R_H).

Semiconductor Devices

Radiative and non-radiative recombination in semiconductors (Qualitative), Direct and Indirect band gap semiconductors, Diffusion and Drift currents, p-n junction diode, Zener diode and their V-I Characteristics, LED and Solar cell : construction, principle of operation and characteristics.

UNIT 3: Dielectric and Magnetic materials (~9 Lecture Hours)

Dielectric materials: Electric dipole, Dipole moment, Oscillating dipole, Dielectric constant, Polarizability, Electric susceptibility, Displacement vector, Polarization Vector, Qualitative study of electronic, ionic and orientation polarizations, Local field (Qualitative treatment) and Clausius-Mossotti equation; Ferro-electricity –Behaviour of $BaTiO_3$, Piezoelectricity, Pyro-electricity.

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, Domain theory(Qualitative), Hysteresis curve based on domain theory, soft and hard magnetic materials, properties of antiferro and ferri magnetic materials.

UNIT 4: Lasers and Fibre Optics (~9 Lecture Hours)

Lasers**:** Characteristics of Lasers, Absorption, Spontaneous and stimulated emission process, Pumping, Population

inversion, Lasing action, Einstein's Coefficients and their relations. Types of Lasers: Ruby laser, Carbon dioxide (CO_2) laser, Semiconductor diode laser, Applications of laser.

Fibre Optics: Introduction, Optical fiber as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Types of Optical fibers, Losses associated with optical fibers, Applications of optical fibers (communication system, sensors).

UNIT 5: Nanomaterials: (~8 Lecture Hours)

Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-Gel, Precipitation, Combustion Methods; Top-Down Fabrication: Ball milling method, Chemical Vapor Deposition, Physical Vapor Deposition, Characterization Techniques (XRD, SEM & TEM) and Applications.

Text Books:

1. M.N.Avadhanulu, P.G.Kshirsagar & T.V. S.Arun Murthy, "A Text book of Engineering Physics"-S.Chand Publications, 11th Edition, 2019.
2. J.P Srivastava, "Elements of Solid state physics", second edition, Prentice Hall India Publishers.
3. Donald A, Neamen, "Semiconductor Physics and Devices-Basic Principle", McGraw Hill, 4th Edition, 2021.
4. Palani Swamy, "Applied Physics", Scitech Publications.
5. Narasimha Reddy Katta, "Essentials of Nano science& Nanotechnology", Typical Creatives NANO DIGEST, 1st Edition, 2021.

Reference Books:

1. H.C.Verma, "Quantum Physics", TBS Publication, 2nd Edition2012.
2. Halliday, Resnick and Walker, "Fundamentals of Physics", John Wiley & Sons, 11th Edition, 2018.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley Eastern, 2019.

4. S.L.Gupta and V.Kumar, “Elementary Solid State Physics”, Pragathi Prakashan,2019.
5. A.K. Bhandhopadhya, “Nano Materials”, New Age International, 1st Edition, 2007.
6. Aliaksandr S. Bandarenka, “Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage” CRC Press Taylor & Francis Group.
7. M.C.Narayan, “International encyclopedia of Nanotechnology, Science and Physics”.

Online Resources:

1. https://www.youtube.com/channel/UCNNlt5I3Z-Qbswfo_7KAzNA/videos.

Course Outcomes:

After completion of the course, student will be able to

1. Explain the quantum mechanical aspects in physics and apply the same in differentiating the conductingproperties of solids.
2. Assesand modifythecarrier concentration of different types of semi-conductors and also be able to understand the working of semiconducting devices.
3. Choose materials on the basis of their electric and magnetic behaviour for different engineering applications.
4. Differentiate different types of Lasers, optical fibers and realize their application in engineering fields. Understand the underlying principles of Lasers and fiber optics
5. Appreciate the importance of nano materials and their applicability in modern engineering applications.
6. The student will be able to apply the tools and principles of modern physics to comprehend engineering applications.

* * *

I Year B. Tech, EEE I Semester **L T P C**
Course Code: 121AA **3 0 0 3**

APPLIED CHEMISTRY

(Common to EEE, ECE, ETE, CST)

Prerequisites: -Nil-

Course Objectives:

1. To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineer.
2. To acquire the knowledge of water treatment, electrochemistry and corrosion which are essential for the Engineers and in industry.
3. To acquire the skills pertaining to Polymers and Energy sources to apply them for various engineering fields etc.
4. To impart then knowledge of engineering materials and their aspects useful for understanding material chemistry.

UNIT 1: Water and its treatment: (~8 Lecture Hours)

Introduction to hardness of water: Causes of hardness and its units. Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications: Steps involved in the treatment of potable water, Disinfection of potable water by chlorination and break-point chlorination. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of boiler feed water: Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods: Softening of water by Ion exchange process. Desalination of Brackish water–Reverse osmosis.

UNIT 2: Electrochemistry and corrosion: (~8 Lecture Hours)

Electrochemistry: Electrochemical cells, Electrode potential, Standard electrode potential. Nernst equation: derivation and significance. Electrochemical series and its applications. Construction and functioning of Hydrogen and Calomel electrode. pH determination using Calomel electrode. Batteries: Primary and Secondary batteries. Construction, working of Lithium Cell and Lithium-ion battery and its applications to electrical vehicles. Fuel cells: Construction and applications of Methanol Oxygen fuel cell.

Corrosion: Causes and effects of corrosion. Theories of chemical and electrochemical corrosion. Mechanism of electrochemical corrosion. Types of corrosion: Galvanic corrosion, Concentration cell corrosion, Waterline and Pitting corrosion. Factors affecting rate of corrosion. Corrosion control methods-Cathodic protection: Sacrificial anodic protection and Impressed current cathodic methods. Surface coatings: Metallic coatings – Methods of coatings: Hot dipping, galvanization, tinning.

UNIT 3: Polymeric materials: (~8 Lecture Hours)

Definition of polymers, Classification of polymers with examples. Types of polymerization: Addition Polymerization (free radical mechanism) and condensation polymerization with examples – Nylon 6:6, Terylene. **Plastics:** Definition and characteristics. Plastics: thermosetting and thermoplastics. Preparation, properties and engineering applications of PVC , Bakelite, Teflon . **Rubbers:** Natural rubber and its vulcanization. **Elastomers:** Characteristics, preparation, properties and applications of Buna-S, Butyl and Thiokol rubber. **Conducting polymers:** Characteristics and Classification with examples, mechanism of conduction in trans- polyacetylene and applications of conducting polymers. **Biodegradable polymers:** Concept and advantages of biodegradable polymers. Preparation of Polylactic acid and poly vinyl alcohol and their applications.

UNIT 4: Energy sources: (~8 Lecture Hours)

Fuels-Introduction, Calorific value of fuel: HCV, LCV, Dulong's formula. Classification of fuels: Solid fuels: coal, analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels: Petroleum and its refining. Cracking types: Moving bed catalytic cracking. Knocking: Octane and Cetane rating. Synthetic petrol - Fischer-Tropsch's process. Gaseous fuels: Composition and uses of natural gas, LPG and CNG. Combustion: Definition, Calculation of air required for the combustion of fuel, numerical problems related to calorific value and combustion. Solar cells: Introduction and applications of Solar cells. Biodiesel: Transesterification and applications. 2G-Ethanol: Synthesis and applications.

UNIT 5: Engineering Materials: (~8 Lecture Hours)

Cement: Portland cement, its composition, setting and hardening of Portland cement. Special cement: Properties and uses of High alumina cement, White cement, and Waterproof cement. **Refractories:** Classification and Characteristics of a good refractory. Properties- Refractoriness and RUL**.** **Lubricants:** Functions and Classification of lubricants with examples. Characteristics of good lubricants. Mechanism of Lubrication: Thick film, thin film, and extreme pressure. Properties: Viscosity, Cloud and pour point, Flash and fire point.

Text Books:

1. P.C.Jain and M.Jain, Engineering Chemistry, Dhanpatrai Publishing Company, 2010.
2. Rama Devi and Rath, Engineering Chemistry, Cengage learning, 2022.
3. M. Thirumala Chary, E. Laxminarayana and K.Shashikala, AText book of Engineering Chemistry, Pearson Publications, 2021.
4. Y. Bharathi kumari, A Text book of Engineering Chemistry, VGS publications.

Reference Books:

1. Shikha Agarwal, Engineering Chemistry, Cambridge University Press, Delhi, 2015.
2. Shashi Chawla, Engineering Chemistry, Dhanpatrai and Company(P) Ltd. Delhi, 2011.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106170/
2. https://nptel.ac.in/courses/113105028
3. https://nptel.ac.in/courses/115107116

Course Outcomes:

After completion of the course, student will be able to

1. Understand the concepts, to identify and analyze the hardness of water and its softening techniques in industry and daily usage.
2. Apply the working principles of batteries and their applications in automobile field, corrosion and its prevention.
3. Learn the concepts of various types of polymers, conducting polymers, biodegradable polymers and their applications in industrial and medical fields.
4. Identify different types of energy sources and their applications in various engineering fields.
5. Analyze the usage and applications of various types of cements, lubricants and refractories in engineering field.
6. Learn the potential applications of chemistry in practical utility to become good engineers and entrepreneurs.

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I Year B. Tech, EEE I Semester	**L T P C**
Course Code: 121AG	**3 1 0 4**

LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To learn the concepts of rank of a matrix and applying it to understand the consistency of the system of equations.
2. To solve a 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 and higher order ODE.
6. To evaluate the double and triple integrals for functions of several variables.

UNIT 1: Linear System of Equations (~ 8 Lecture Hours)

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: Eigen values and Eigen vectors (~8 Lecture Hours)

Eigen values, Eigen vectors and their properties. Cayley - Hamilton theorem (only statement), Inverse and powers of a matrix using Cayley - Hamilton theorem, Diagonalization.

UNIT 3: Functions of Several Variables (~10 Lecture Hours)

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 4: Ordinary Differential Equations (~12 Lecture Hours)

First Order ODE – Exact Differential Equations, Differential Equations reducible to exact, Orthogonal trajectories, Law of natural growth & decay.

Linear differential equations of higher order with constant coefficients: Non-homogeneous differential equations with RHS term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax}V(x)$, $xV(x)$, Method of variation of parameters, Applications to Electrical circuits.

UNIT 5: Multiple Integrals and its Applications (~10 Lecture Hours)

Multiple Integrals - Double and Triple integrals, Change of variables, Change of order of integration.

Applications: Finding area as double integrals and volume as triple integrals.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, 43rd 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, SubodhC.Bhunia, Engineering Mathematics, 1st Edition, Oxford Higher Education.
4. R K Jain & S R K Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishers.

Online Resources:

1. https://nptel.ac.in/courses/111106051
2. https://www.youtube.com/watch?v=mIeeVrv447s

Course Outcomes:

After completion of the course, students will be able to

1. Solve and analyse 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.

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I Year B. Tech, EEE I Semester **L T P C**
Course Code: 121AH **3 0 0 3**

PROGRAMMING FOR PROBLEM SOLVING

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE(AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To use the syntax and semantics of C Programming Language.
4. To decompose a problem into functions and to develop modular reusable code.
5. To implement C programs in structured programming approach 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: (~9 Lecture Hours)

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

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.

UNIT 3: (~10 Lecture Hours)

Arrays: Concepts, using arrays in C - declaration and definition, accessing elements in array, storing values in arrays, array applications- linear search, binary search and bubble sort, two dimensional arrays, multi-dimensional arrays.

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, pointers to void, strings - concepts, C strings, string input / output functions, arrays of strings, string manipulation functions.

UNIT 4: (~9 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: (~8 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 during file operations, random access to files, command line arguments, preprocessor commands.

Text Books:

1. B.A.Forouzan and R.F.Gilberg, Computer Science: A Structured 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 Edition, McGraw-Hill.
2. E.Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.
3. B.W.Kernighan and Dennis Ritchie, C Programming Language, 2nd Edition, PHI.

Online Resources:

1. https://drive.google.com/file/d/1Yvq27 sSPOxjJakf1c XpWq76L0F0cu_/view
2. https://cs50.harvard.edu/college/2022/spring/

Course Outcomes:

After completion of the course, students will be able to

1. Relate various computing environments and formulate solutions to problems using algorithms and flowcharts.
2. Understand data types and control structures to solve problems.
3. Divide a problem into functions and synthesize a complete program.
4. Use arrays, pointers and strings to formulate programs.
5. Apply user defined data types to model real world data.
6. Develop solutions to problems using file-handling functions.

I Year B. Tech, EEE I Semester **L T P C**
Course Code: 121AF **2 0 0 2**

ENGLISH FOR SKILL ENHANCEMENT

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: This course will enable the students to

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Equip students to studyengineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

UNIT 1: (~7 Lecture Hours)

Chapter entitled **'Toasted English'** by R.K.Narayan from *"English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.

Reading: Reading and Its Importance- Techniques for Effective Reading.

Writing: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT 2: (~7 Lecture Hours)

Chapter entitled **'Appro JRD'** by Sudha Murthy from "*English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing: Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

UNIT 3: (~6 Lecture Hours)

Chapter entitled **'Lessons from Online Learning'** by F.Haider Alvi, Deborah Hurst et al from *"English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English. **Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses **Reading:** Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/ Resume.

UNIT 4: (~6 Lecture Hours)

Chapter entitled **'Art and Literature' by Abdul Kalam** from *"English: Language, Context and Culture"* published by Orient Blackswan, Hyderabad.

Vocabulary: Standard Abbreviations in English.

Grammar: Redundancies and Clichés in Oral and Written Communication.

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing: Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

UNIT 5: (~6 Lecture Hours)

Chapter entitled **'Go, Kiss the World'** by Subroto Bagchifrom *"English: Language, Context and Culture"*

published by Orient Blackswan, Hyderabad.

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)

Reading: Reading Comprehension-Exercises for Practice

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) - Types of Reports - Writing a Report.

Note: ***Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.***

Note: 1. As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year is **Open- ended**,* besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the teachers collectively** in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.

Note: **2**. Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents. They are advised to teach 40 percent of each topic from the syllabus in blended mode.

Text Book:

1. "English: Language, Context and Culture" published by Orient BlackSwan Pvt. Ltd, Hyderabad. 2023 Print.
2. Fusion: Integrated Reading & Writing by Kepler published by CENGAGE [e-Book].

Reference Books:

1. Effective Academic Writing by Liss and Davis (OUP).
2. Richards, Jack C, Interchange Series. Introduction, 1,2,3. Cambridge University Press, 2022.
3. Wood,F.T., Remedial English Grammar. Macmillan, 2007.
4. Chaudhuri, Santanu Sinha. Learn English: AFun Book of Functional Language, Grammar and Vocabulary. 2nd Edition, Sage Publications India Pvt. Ltd., 2018.
5. Technical Communication. Wiley India Pvt. Ltd., 2019.
6. Vishwamohan, Aysha. English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd, 2013.
7. Swan, Michael. Practical English Usage. Oxford University Press. Fourth Edition, 2016.

Online Resources:

1. https://nptel.ac.in/courses/109106116 [English Language for Competitive Exams by Prof.Aysha Iqbal, IIT Madras.]
2. https://onlinecourses.nptel.ac.in/noc22_hs77/preview [Developing Soft skills and Personality by Prof.T.Ravichandran, IIT Kanpur.]

Course Outcomes:

After completion of the course, student will be able to

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

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I Year B. Tech, EEE I Semester **L T P C**
Course Code: 12102 **0 0 3 1.5**

APPLIED PHYSICS LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives: Through this course the student is to

1. Determineandclassifymagneticmaterialsandelectro-magnetization.
2. Determinethetype of semiconductorand Studythe temperaturedependence of resistivity.
3. Bring out the basic characteristics of semiconductor devices.
4. Construct basic electrical circuits and understand the effect of different components of the circuit on the electric parameters.
5. Learn the fundamentals of fiber optics and apply diffraction phenomenon.

Any of the following Ten experiments to be performed:

List of Experiments:

1. Biot – Savart's law to verify Magnetic field along the axis of current carrying coil – Stewart and Gees method.
2. Study B-H curve of a magnetic material.
3. To determine Energy gap of a material taken in the form of p-n junction diode.
4. Determination of Hall co-efficient and carrier concentration of a given semiconductor.
5. To study V-I characteristics of a solar cell.
6. V-I characteristics of a p-n junction diode and Zener diode.
7. Measurement of Time constant of an R-C circuit (Charging and Discharging).
8. Resonance Phenomena & Q-factor of L-C-R circuit (Series/Parallel).
9. Evaluation of numerical aperture of a given optical fiber.
10. Bending and attenuation losses of fibers.
11. Dispersive power of the material of a prism – Spectrometer.
12. Wavelength of light and determining the LPI of unknown grating of a diffraction grating using laser.
13. To find Rigidity modulus of given material using Torsional pendulum experiment.
14. Melde's experiment – Transverse and longitudinal modes.
15. Quantum dots.
16. Polarimeter-Polarization of light.

Text Books:

1. Laboratory Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (V.G.S Publishers)
2. Engineering Physics - 2nd Edition NEW AGE Publications by M R Srinivasan.

Reference Books:

1. Experiments In Engineering Physics (A Lab. Manual & W.B) - M.N.Avadhanulu, A.A.Dani & P.M.Pokley. Publisher, S. Chand Limited.
2. Science and Technology of PHOTOVOLTAICS - 2nd Edition- BS Publications by P.Jayarama Reddy.

Online Resources:

1. https://www.vlab.co.in/broad-area-physical-sciences
2. http://www.bsauniv.ac.in/UploadImages/Downloads/PHYSICS-LAB-MANUAL2017-(new-regulation).pdf
3. http://jnec.org/Lab-manuals/FE/Physics.pdf
4. https://www.myphysicslab.com/**(simplesimulations)**
5. https://www.iist.ac.in/departments/physics-lab
6. https://wci.llnl.gov/simulation

Course Outcomes:

After completion of the course, students will be able to

1. Students are introduced to handling different instruments, interpret the data and correlate the same with their understanding of its theory.
2. Study the electro-magnetization characteristics and determine hysteresis loss.
3. Determine hall coefficient and energy gap of the semiconductor (taken as a diode)
4. Differentiate Zener and p-n junction diode and to determine fill factor of a semiconductor solar cell.
5. Determine the time constant, resonance and quality of the circuit consisting of R, C &/ L components.
6. Determine wavelength of laser light and differentiate different types of lasers, optical fibers losses.

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I Year B. Tech, EEE I Semester **L T P C**
Course Code: 12101 **0 0 2 1**

APPLIED CHEMISTRY LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

1. To estimate the hardness of water to check its suitability for drinking purpose.
2. To perform the estimation of acids and bases using conductometry, potentiometry and pH metry methods.
3. To prepare polymers such as Bakelite and nylon-6 in the laboratory.
4. The skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.

List of Experiments:

I. Volumetric Analysis:

1. Estimation of hardness of water complexometric titration by using EDTA
2. Estimation of ferrous iron by Dichrometry.
3. Estimation of ferrous iron by Permanganometry.

II. Conductometry:

Estimation of the amount of given acid by Conductometry.

III. Potentiometry:

1. Estimation of the amount of given acid by Potentiometry.
2. Estimation of the amount of Fe^{2+} by Potentiometry using Potassium dichromate.

IV. pH Metry:

Determination of an acid concentration using pH meter.

V. Colorimetry:

Estimation of Copper using Colorimetry.

VI. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon – 6

VII. Lubricants:

1. Estimation of saponification value of a given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VIII. Virtual lab experiments

1. Batteries for electrical vehicles.
2. Functioning of solar cell and its applications.

Text Books:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007)

Reference Books:

1. Vogel's text book of practical organic chemistry 5th edition
2. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.

Online Resources:

1. https://www.youtube.com/watch?v=EGV9MBzqdoA
2. http://www.titrations.info/EDTA-titration-water-hardness
3. https://www.youtube.com/watch?v=_0MteudoAqA
4. https://archive.nptel.ac.in/content/storage2/courses/104103071/pdf/mod16.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand the concepts of error, its analysis and also to develop the skills to tabulate the experimental data and derive valid conclusions.
2. Have hands on experience in performing the electro-analytical techniques such as Conductometry, Potentiometry and pHmetry.
3. Gain the ability to prepare polymeric materials like Bakelite and Nylon-6.
4. Estimate the Saponification value and viscosity of Lubricant oil.
5. Compare the experimental results with those introduced in lecture, draw relevant conclusions and substantiate.
6. Apply theoretical knowledge to real world situations, emphasizing the practical applications of chemical principles.

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I Year B. Tech, EEE I Semester **L T P C**

Course Code: 12108 **0 0 3 1.5**

PROGRAMMING LAB

(Common to EEE, ECE, CSE, IT, ETE, CST, CSM & CSD)

Prerequisites: -Nil-

Course Objectives:

1. To gain familiarity with the programming environment to edit, compile, run and debug programs.
2. To apply the syntax and semantics of C Programming Language.
3. To develop modular, reusable and readable C programs using the concepts like arrays, functions etc.
4. To implement programs using file handling functions.

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: 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 3 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 6: 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 7: Applications of 1D Array

a. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user using Sieve of Eratosthenes algorithm.
b. Write a C program to implement linear search on a list of integers.
c. Write a C program to implement binary search on a list of integers.
d. Write a C program to implement Bubble sort to sort a given list of integers in ascending order.

Week 8: Applications of 2D arrays

a. Write a C program that reads two matrices and performs Addition of two matrices using functions.
b. Write a C program that reads two matrices and performs Multiplication of two matrices using functions.

Week 9: 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.

d. Write a C program to sort array of strings.

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 element 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: File Handling

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 Edition, McGraw-Hill.
2. Yashavant P. Kanetkar, Let Us C, 13th Edition, Bpb Publications.
3. B.W.Kernighan & Dennis Ritchie, 2nd Edition, C Programming Language, PHI.
4. E.Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill.

Online Resources:

1. https://drive.google.com/file/d/1Yvq27-qsSPOxjJakf1cXpWq76L0F0cu_/view
2. https://cs50.harvard.edu/college/2022/spring/

Course Outcomes:

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

1. Use tools to compile, debug, run and test the program.
2. Translate algorithms into executable programs.
3. Implement programs using control structures and arrays.
4. Develop modular and reusable code using functions.
5. Demonstrate usage of pointers, strings and structures.
6. Solve problems using file concepts.

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I Year B. Tech, EEE I Semester	**L T P C**
Course Code: 12105	**0 0 2 1**

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

(Common to EEE, ECE, ETE & CST)

Prerequisites: -Nil-

Course Objectives:

1. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
2. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
3. To improve the fluency of students in spoken English and neutralize the impact of dialects.
4. To train students to use language appropriately for public speaking, group discussions and interviews.

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

a. Computer Assisted Language Learning (CALL) Lab.
b. Interactive Communication Skills (ICS) Lab.

Listening Skills:

Objectives

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

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

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

Speaking Skills:

Objectives

1. To involve students in speaking activities in various contexts.
2. To enable students express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities
- Just A Minute (JAM) Sessions

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

Exercise 1:

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening. *Practice*: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise 2:

CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern in sentences – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern in sentences – Intonation - *Testing Exercises.*

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise 3:

CALL Lab:

Understand: Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.

-*Testing Exercises*

ICS Lab:

Understand: Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

Exercise 4:

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests - *Testing Exercises*

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks - Non- verbal Communication - Presentation Skills.

Practice: Making a Short Speech – Extempore- Making a Presentation.

Exercise 5:

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests -*Testing Exercises*

ICS Lab:

Understand: Group Discussion

Practice: Group Discussion

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

   The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

   System Requirement (Hardware component):

   Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

   i) Computers with Suitable Configuration.

   ii) High Fidelity Headphones.

2. **Interactive Communication Skills (ICS) Lab:**

   The Interactive Communication Skills Lab: ASpacious room with movable chairs and audio- visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

Source of Material (Master Copy):

Exercises in Spoken English. Part 1,2,3. CIEFL and Oxford University Press.

Note: *Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.*

Suggested Software:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. Grammar Made Easy by Darling Kindersley.
3. Punctuation Made Easy by Darling Kindersley.
4. Oxford Advanced Learner's Compass, 10th Edition.
5. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.

6. English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
7. English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
8. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
9. Digital All Orell Digital Language Lab (Licensed Version)

Referred Lab Manual: English Language Communication Skills – Manual cum Workbook published by CENGAGE, 2022.

ReferenceBooks:

1. *English Language Communication Skills–Lab Manual cum Workbook,* Cengage Learning India Pvt. Ltd, 2022.
2. Shobha KN & Rayen J.Lourdes, *Communicative English–A workbook,* Cambridge University Press, 2019.
3. Kumar Sanjay & Lata Pushp, *Communication Skills: A Workbook,* Oxford University Press, 2019.
4. Board of Editors, *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities,*Orient Black Swan Pvt. Ltd, 2016.
5. Mishra, Veerendraetal, *English Language Skills: A Practical Approach,* Cambridge University Press, 2020.

OnlineResources:

1. https://nptel.ac.in/courses/109103183 [PhoneticsandPhonology: AbroadoverviewbyProf.ShakuntalaMahanta,IITGuwahati]
2. https://nptel.ac.in/courses/109104031 [CommunicationSkillsby Dr.T.Ravichandran,IITKanpur]

Course Outcomes:

After completion of the course, student will be able to

1. Differentiate between the letters of the alphabet and the phonetic symbols.
2. Demonstrate the right pronunciation of the words in English using phonetic transcription and word stress.
3. Speak with proper intonation, voice modulation and tonal groups.
4. Maximise the listening comprehension skills through various language modules.
5. Develop Speaking skills 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 discuss in teams to present the topics and demonstrate their public speaking skills and presentation skills through various aids like posters, PPTs etc.,

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I Year B. Tech, EEE I Semester **L T P C**
Course Code: 12107 **0 0 2 -**

GENDER SENSITIZATION

(Mandatory Course) (Common to EEE, ECE, ETE & CST)

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:

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:

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:

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:

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:

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 Book:

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

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_hs51/preview [Contexualising Gender by Prof.Rasmi Gaur, IIT Roorkee]
2. https://onlinecourses.nptel.ac.in/noc19_hs57/preview

   [Gender justice and Workplace security by Prof.Dipa Dube, IIT Kharagpur]

Course Outcomes:

After completion of the course, student will be able to

1. Relate the understanding of gender sensitization to basic dimensions of the biological, sociological, psychological and legal aspects of gender through discussion of materials derived from research, facts, everyday life, literature and film.

2. Develop a finer grasp of how gender discrimination works in our society and how to counter it.
3. Maximize their insight into the gendered division of labour and its relation to politics and economics.
4. Perceive the genders Men and women as professionals equipped to work and live together as equals.
5. Develop a sense of appreciation of women in all occupations.
6. Identify, Understand and respond to Gender issues and to address them legally protecting and safeguarding the individual's rights.

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I Year B. Tech, EEE II Semester **L T P C**
Course Code: 122AK **3 1 0 4**

NUMERICAL TECHNIQUES AND TRANSFORM CALCULUS
(Common to EEE, ECE, CSE, IT, ETE, CST, CSM & CSD)

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: Numerical Techniques – I (~9 Lecture Hours)

Numerical Solutions of Algebraic and Transcendental Equations: Introduction, Bisection Method, Regula- Falsi 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: Numerical Techniques – II (~9 Lecture Hours)

Numerical integration: Newton-Cote's Quadrature Formula, Trapezoidal Rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ Rule. **Numerical solution 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 method, Fourth Order Runge-Kutta Method.

UNIT 3: Laplace Transforms (~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 (only statement), First and Second shifting theorem.

Applications of Laplace Transforms to Ordinary Differential Equations.

UNIT 4: Vector Differentiation (~10 Lecture Hours)

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: Vector Integration and Integral Theorems (~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 (onlystatements) and their verification.

Text Books:

1. Dr.B.S Grewal, Higher Engineering Mathematics, 43rd 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' Outlilne Series.
3. S.S.Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd.

Online Resources:

1. https://nptel.ac.in/courses/111106101
2. https://nptel.ac.in/courses/111107108

Course Outcomes:

After completion of the course, students will be able to

1. Find the root of the algebraic and transcendental equation and solution of a linear system of equations.
2. Fit a curve for the given data.
3. Find the Numerical solutions for a given first order initial value problem and evaluate definite integral numerically.
4. Learn Laplace Transform techniques and apply for solving ODE.
5. Understand the concepts of Gradient, Divergence and Curl of a Vector and scalar point functions.
6. Evaluate the line, surface and volume integrals.

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I Year B. Tech, EEE II Semester **L T P C**
Course Code: 122AJ **3 0 0 3**

DATA STRUCTURES

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: Programming for Problem Solving

Course Objectives:

1. Understand the notations used to analyze the performance of algorithms.
2. Understand and analyze various searching and sorting algorithms.
3. Understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, graphs and their representations.
4. Choose an appropriate data structure for a specified application.

UNIT 1: (~10 Lecture Hours)

Basic Concepts: Algorithm-Introduction, Performance analysis – Time Complexity and Space Complexity, Asymptotic Notation – Big O, Omega and Theta notations, Complexity Analysis Examples.

Introduction to Data Structures: Linear and Non-linear data structures.

Review of Pointers: Pointers, Self-referential structures

Linear List: Array and Linked Representations, Singly Linked List, Operations – Insertion, Deletion and Searching, Circularly Linked List, Operations – Insertion, Deletion and Searching, Doubly Linked List, Operations– Insertion, Deletion and Searching, Applications of Linked List – Sparse matrix.

UNIT 2: (~9 Lecture Hours)

Stack: Definition, Array and Linked implementations, Applications– Infix to Postfix Conversion, Postfix Expression Evaluation, Recursion.

Queue: Definition, Array and Linked implementations, Circular Queues– Insertion and Deletion Operations.

UNIT 3: (~8 Lecture Hours)

Trees: Definitions, Terminology, Applications, Properties, Binary Tree - Array and Linked representations, Binary Tree Traversals, Threaded Binary Tree-Definition.

Priority Queues: Definition and Applications, Max Priority Queue – Implementation, Max Heap - Definition, Insertion and Deletion.

UNIT 4: (~8 Lecture Hours)

Searching: Linear Search, Binary Search,Hashing: Introduction, Hash Tables, Hash Functions, Overflow Handling. **Dictionaries:** Linear List Representation, Hash Table Representations, Operations - Insertion, Deletion and Searching.

Sorting: Insertion Sort, Selection Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Methods.

UNIT 5: (~ 10 Lecture Hours)

Graph: Definitions, Terminology, Applications, Properties, Graph Representations - Adjacency Matrix, Adjacency Lists, Graph Traversal Methods – DFS and BFS

Search Trees: Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion.

Balanced Search Trees: AVL Trees- Definition and Insertion, B-Trees- Definition and Examples, Comparison of Search Trees.

Text Books:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson.

Reference Books:

1. Reema Thareja, Data structures using C, 2nd Edition, Oxford higher education.
2. A. S. Tanenbaum, Y. Langsam and M.J. Augenstein, Data Structures using C, PHI/Pearson Education.
3. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
4. D. Malhotra, N. Malhotra, Data Structures and Program Design Using C: A Self-Teaching Introduction, Mercury Learning and Information.
5. D. Samanta, Classic Data Structures, 2nd Edition, PHI.

Online Resources:

1. www.geeksforgeeks.org/data-structures
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

Course Outcomes:

After completion of the course, students will be able to

1. Determine and analyze the complexity of given algorithms.
2. Use basic data structures such as linked list, stack and queue.
3. Implement various kinds of searching and sorting techniques.
4. Design programs using advanced data structures like hash tables, binary trees, heaps and graphs.
5. Build and compare search trees and balanced search trees.
6. Choose appropriate data structures as applied to specified problem definition.

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I Year B.Tech. EEE II –Semester	**L T P C**
Course Code: 122AC	**3 0 0 3**

BASIC ELECTRICAL ENGINEERING

(Common to EEE, ECE, ETM & CST)

Prerequisites: Applied Physics (121AB)

Course Objectives:

1. Concepts of Basic Magnetic and Electrical AC&DC Circuits.
2. Understand the concepts of Electrical Machines
3. To understand the VI characteristics of various Electronic components like Diode, BJT and SCR.

UNIT 1: Magnetic Circuits and DC Circuits (~11 Lecture Hours)

Magnetic Circuits: Flux, flux density, Magnetic field Intensity, reluctance, MMF, Faraday's laws of Electromagnetic induction – statically & dynamically induced EMF-Lenz's law - Fleming's rules, Simple problems **DC Circuits:** Electrical Circuit elements: R, L and C, voltage and current sources, KCL & KVL, Analysis of simple DC Circuits, Nodal and Mesh analysis of simple circuits with DC excitation, Simple problems.

UNIT 2: Single Phase AC Circuits (~10 Lecture Hours)

Network Theorems: Superposition, Thevenin's and Norton's Theorems with independent sources (DC excitation only), Simple Problems.

1-ϕ AC Circuits: Representation of sinusoidal waveforms, Average and RMS values, phasor representation, power factor; Impedance and Power triangles, Resonance in Series RLC Circuit.

UNIT 3: DC Machines & Batteries (~9 Lecture Hours)

DC Machines:

DC Generators: Construction, principle of operations and types, EMF equations, simple problems.

DC Motors: Principle of operation, significance of Back EMF, Torque equation, Characteristics & applications, losses & efficiency, Direct Load test.

Batteries: Types, ratings and Applications.

UNIT 4: AC Machines (~7 Lecture Hours)

Transformers: Construction, Principle of Operation, EMF Equation, Losses and efficiency (Direct Load Test)

Induction motors: Construction, Principle of Operation, Production of rotating magnetic field, Speed-Torque characteristics, Applications, simple Problems.

Synchronous Generators – Construction, Classification, Principle of Operation.

Synchronous Motors – Principle of operation and applications.

UNIT 5: Basic Electronics (~7 Lecture Hours)

Operation of PN Junction Diode, BJT & SCR and their Static Characteristics, Half wave and Full Wave Diode bridge rectifiers.

Text Books:

1. T.K.Nagasarkar and M.S.Sukhija, Basic Electrical Engineering, Oxford University Press, 3rd Edition, 2018.
2. D.P.Kothari and I.J.Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 3rd Edition, 2010.
3. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, 2001.
4. D.P.Kothari and I.J.Nagrath Theory and problems of Basic Electrical Engineering, PHI, 2016.

Reference Books:

1. P. S. Bimbhra, Power Electronics, Khanna Publications, 2018.
2. D.C.Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 1st Edition, 2009.

Online Resources:

1. https://nptel.ac.in/courses/108108076

Course Outcomes:

After completion of the course, students should be able to

1. Understand the concept and analyze the Magnetic & DC circuits.
2. Analyze the 1x Ac circuits and Network theorems with DC excitation.
3. Demonstrate and analyze the DC Electrical machines.
4. Demonstrate and analyze the Transformers.
5. Demonstrate and analyze the rotating AC Machines.
6. Understand the Basic Electronic devices.

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I Year B.Tech. EEE II –Semester	**L T P C**
Course Code: 122AE	**1 0 3 2.5**

ENGINEERING GRAPHICS

(Common to EEE, ECE, ETM & CST)

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 viewsvice-versa.
6. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products.

UNIT 1: (~3 Lecture Hours and 9 Practical Hours)

Introduction to Engineering Graphics: Principles of Engineering Graphics and their significance.

Scales- Plain & diagonal.

Conic Sections- Construction of ellipse, parabola and hyperbola (general method only).

Cycloidal curves: Cycloid, Epicycloid and Hypocycloid (general methods only).

UNIT 2: (~3 Lecture Hours and 9 Practical Hours)

Orthographic Projections: Principles of orthographic projections-conventions- Projections of points in all positions; projection of straight lines-line inclined to one reference plane and with two reference planes (excluding traces and midpoint problems).

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

Projections of Planes: Plane inclined to one reference plane and with two reference planes.

Projections of Solids: Projections of solids (prisms, pyramids, cylinders and cones) in simple position and axis inclined to one reference plane only.

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: (~ 4 Lecture Hours and 12 Practical Hours)

Isometric Projection: Principles of Isometric Projection – Isometric Scale Isometric Views – Isometric views of Lines, Planes and Simple Solids only.

Orthographic Views: Conversion of Isometric Views to Orthographic Views.

Introduction to computer aided drafting (**For internal evaluation weightage only**) Introduction to Computer Aided Drafting, views and commands, orthographic projection of points, lines, planes and solids. Conversion of orthographic projection into isometric view.

Note: Syllabus for external examination will be from 1-5 units in conventional mode and introduction to computer aided drafting is exempted from the external examination.

Text Books:

1. Basanth Agrawal and Agrawal C.M., Engineering Graphics, 1st Edition, Tata McGrawHill, 2018.
2. Bhatt N.D.,Engineering Drawing, 53rd Edition, Charotar Publishing house Pvt.Ltd., 2016.

Reference Books:

1. Venugopal.K, Engineering Drawing and Graphics Plus Autocad, New Age International (P) Ltd., New Delhi, 2010.
2. Dhananjay A Jolhe, Engineering Drawing, Tata McGrawHill, 2014.
3. T. Jeyapoovan, Vikas: Engineering Drawing and graphics Using AutoCAD, 3rd Edition, S. Chand and company Ltd.
4. K Balaveera Reddy, Computer Aided Engineering Drawing, CBS Publishers & distributors, 2015.

Online Resources:

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

Course Outcomes:

After completion of the course, students will be able to

1. Acquire proficiency in instrumental drawing and will be able to visualize the object, draw conic sections and cycloidal curves.
2. Draw and understand about orthographic projections of points, straight lines.
3. Improve visualization skills in different types of planes and solids.
4. Draw and understand about the development of surfaces of various solids.
5. Ability to read, understand and interpret engineering drawings.
6. Apply computer aided drafting tools to create objects.

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I Year B.Tech. EEE II –Semester **L T P C**
Course Code: 12204 **1 0 3 2.5**

ENGINEERING WORKSHOP

(Common to EEE, ECE, ETM & CST)

Prerequisites: -Nil-

Course Objectives: The course will enable the students

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

I) Trades for Exercises: (~12 Lectures + 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:

i) Plumbing ii) Welding

Text Books:

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

Reference Books:

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

Online Resources:

1. www.technologystudent.com

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate and understand the Engineering workshop safety regulations.
2. Identify and use marking and measuring tools to the prescribed accuracy on the work piece.
3. Understand the practical difficulties encountered in industries during any assembly work.
4. Do simple electrical work through their career.
5. Design different prototype in the fitting, carpentry, foundry, and sheet metal work.
6. Understand the operations of black smithy, welding and plumbing.

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I Year B. Tech EEE II-Semester	**L T P C**
Course Code: 12209	**0 0 3 1.5**

DATA STRUCTURES LAB

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) &
CSE (Data Science))

Prerequisites: Programming for Problem Solving (121AH))

Course Objectives:

1. Write data structure programs using arrays, structures and pointers.
2. Develop applications using linear data structures such as linked lists, stacks and queues.
3. Learn to write programs to implement various sorting and searching algorithms.
4. Write programs to implement various non-linear data structures like trees, graphs and search trees.

List of Experiments:

Week 1: Write a C program to create structure with the name – student, which contains the fields - name, rollno and gender. With the help of pointer read and display the student details.

Week 2: Write a C program that uses functions to perform the following operations on a singly linked list of integers:

a. Creation b. Insertion c. Deletion d. Display

Week 3: Write a C program that uses functions to perform the following operations on a doubly linked list:

a. Creation b. Insertion c. Deletion d. Display

Week 4: Write a C program to implement stack using an array and a linked list.

Week 5: Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent. Implement the stack using an array.

Week 6: Write a C program to implement a queue using an array and a singly linked list.

Week 7: Write a C program that uses functions to perform the following:

a. Search for a key element in a list of elements using linear search.
b. Search for a key element in a list of sorted elements using binary search.
c. To arrange a list of elements in ascending order using insertion sort.

Week 8:

a. Write a C program that implements selection sort algorithm to arrange a list of elements in descending order.

b. Write a C program that implements heap sort algorithm for sorting a list of integers in ascending order.

Week 9:

a. Write a C program that implements quick sort algorithm to arrange a list of elements in ascending order.
b. Write a C program that implements merge sort algorithm for sorting a list of integers in ascending order.

Week 10: Write a C program to implement all the functions of a dictionary using hashing.

Week 11: Write a C program that uses functions to perform the following:

a. Create a binary search tree of integers.
b. Traverse the above binary search tree recursively in preorder, inorder and postorder.
c. Search for an integer key in the above binary search tree recursively.
d. Traverse the above binary search tree non-recursively in inorder.

Week 12: Write a C program to perform the following:

a. Traverse a given graph using DFS algorithm.
b. Traverse a given graph using BFS algorithm.

Text Books:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson.

Reference Books:

1. Reema Thareja, Data structures using C, 2nd Edition, Oxford higher education.
2. A. S. Tanenbaum, Y. Langsam and M.J. Augenstein, Data Structures using C, PHI/Pearson Education.
3. R. F. Gilberg and B.A. Forouzan, Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
4. D. Malhotra, N. Malhotra, Data Structures and Program Design Using C: A Self-Teaching Introduction, Mercury Learning and Information.
5. D. Samanta, Classic Data Structures, 2nd Edition, PHI.

Online Resources:

1. www.geeksforgeeks.org/data-structures
2. https://www.tutorialspoint.com/data_structures_algorithms/index.htm

Course Outcomes:

After completion of the course, students will be able to

1. Use arrays, structures and pointers for implementing various data structures.
2. Implement various kinds of searching algorithms.
3. Implement various internal and external sorting algorithms.
4. Develop the programs for various linear data structures like stack, queue and linked list.
5. Implement non-linear data structures like graphs and trees.
6. Choose the appropriate data structure for solving real world problems.

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I Year B. Tech EEE II-Semester **L T P C**
Course Code: 12203 **0 0 3 1.5**

BASIC ELECTRICAL ENGINEERING LAB

(Common to EEE, ECE, ETE & CST)

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 understand the VI characteristics of various Electronic components like Diode, BJT and SCR.

PART-A (Compulsory)

1. Verification of KCL&KVL.
2. Verification of Superposition theorem with DC excitation.
3. Verification of Thevenin's & Norton's theorems with DC excitation.
4. Direct Load Test on Single Phase Transformer
5. OCC Test on DC Shunt Generator
6. Torque-Speed characteristics of a 3-ϕ Induction Motor by conducting Load Test.
7. V-I Characteristics of PN Junction Diode and Zener Diode.
8. V-I Characteristics of SCR.

PART-B (Any two experiments)

1. Study of different types of batteries.
2. Determination of Resonant frequency & Bandwidth for a series RLC resonance circuit.
3. Output waveforms of Half wave and full wave bridge Rectifiers.
4. Static output and input characteristics of BJT.

Text Books:

1. T.K.Nagasarkar and M.S.Sukhija, Basic Electrical Engineering, Oxford University Press, 3rd Edition, 2018.
2. D.P.Kothari and I.J.Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 3rd Edition, 2010.
3. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, 2001.
4. D.P.Kothari and I.J.Nagrath Theory and problems of Basic Electrical Engineering, PHI, 2016.

Reference Books:

1. P. S. Bimbhra, Power Electronics, Khanna Publications, 2018.
2. D.C.Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 1st Edition, 2009.
3. Jimmie J. Cathey, Syed A. Nasar, Basic Electrical Engineering, Schaum's Outline.
4. Huges, Electrical and Electronic Technology, Person, 2010.

Online Resources:

1. https://nptel.ac.in/courses/108108076

Course Outcomes:

After completion of the course, students should be able to

1. Analyze and solve circuits using Kirchoff's Laws.
2. Apply network theorems to analyze and solve D.C circuits.
3. Comprehend the OCC test on Separately excited DC Generator.
4. Analyze the performance of a 3x Induction motor and Transformer.
5. Analyze and interpret VI characteristics of a Diode & SCR.
6. Identify and compare the characteristics of different types of Batteries.

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I Year B.Tech. EEE II-Semester **L T P C**
Course Code: 122AD **2 0 0 2**

DESIGN THINKING

(Common to EEE, ECE, ETM & CST)

Prerequisites: -Nil-

Course Objectives: The main objectives of this course are

1. To inculcate attitude to solve societal problems using design thinking tools.
2. To come-up with proper design which further leads to successful products or enterprises.
3. To instill a sense of significance towards applying creativity to product and service design.

UNIT 1: (~6 Lecture Hours)

Introduction to Design Thinking: Origin of Design thinking, Importance of Design thinking, Understanding Design thinking: A non- linear process - 5-stage d.school process model, Application of design thinking.

UNIT 2: (~7 Lecture Hours)

Empathy: Difference between Empathy and Sympathy, Role of Empathy in design thinking, Empathy mapping, Understanding empathy tools: Customer Journey map, Persona; Importance of Empathizing before Ideating.

Define: Explore define phase in Design Thinking, Methods of Define phase.

UNIT 3: (~6 Lecture Hours)

Ideation: Introduction, Types of Thinking- convergent, divergent, critical and creative thinking; Ideation Methods- Brainstorming, Storyboarding, Bingo Selection, Six Thinking Hats, Mind mapping.

UNIT 4: (~6 Lecture Hours)

Prototyping and Testing: Prototyping and methods of prototyping. User testing methods, Advantages and disadvantages of user Testing/ Validation. Iteration and Pitching.

UNIT 5: (~7 Lecture Hours)

Innovation: Definition, Innovation and creativity, Innovation Triangle- Desirability, Feasibility and Viability; Types of Innovation – Product Innovation, Process Innovation and Business Model Innovation.

Design thinking in various sectors: Design thinking to meet corporate needs. Case studies in Information Technology, Finance, Education, Management, Health care and Retail sector.

Text Books:

1. Daniel Ling, Complete Design Thinking Guide for Successful Professionals, Create Space Independent Publishing, 2015.
2. Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, Routledge Taylor and Francis group, 2019.

Reference Book:

1. Idris Mootee, Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design school, John Wiley & Sons, 2013.
2. Tim Brown, Change by Design_ How Design Thinking Transforms Organizations and Inspires Innovation, Harper Bollins, 2009.
3. George E Dieter, Engineering Design, 5th Edition, The McGraw-Hill Companies, 2013.

Online Resources:

1. https://www.interaction-design.org/
2. https://designthinking.ideo.com/
3. https://www.innovationtraining.org/design-thinking-mindsets/
4. https://onlinecourses.nptel.ac.in/noc20_mg38/preview
5. https://www.ideou.com/blogs/inspiration/what-is-design-thinking

Course Outcomes:

After completion of the course, students will be able to

1. Understand the origin and importance of various stages of Design Thinking.
2. Empathize with the users and formulate specific problem statement.
3. Develop the ability to generate ideas and portray them through Ideation techniques.
4. Learn and apply various prototyping methods.
5. Know user validation methods, Iteration and Pitching.
6. Comprehend the role of innovation in various sectors

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I Year B.Tech. EEE II –Semester **L T P C**
Course Code: 12206 **2 0 0 -**

ENVIRONMENTAL SCIENCE AND TECHNOLOGY

(Common to EEE, ECE, ETE & CST)

Prerequisites: Knowledge on Environmental Issues, natural resources, biodiversity, sustainable development.

Course Objectives:

1. To imbibe the importance of ecological balance for sustainable development.
2. To acquire the knowledge on the impacts of developmental activities and mitigation measures.
3. To study the international and national environmental policies and regulations.

UNIT 1: (~ 6 Lecture Hours)

Ecosystems: Definition, Scope, and Importance of ecosystem (ecosystem value, services and carrying capacity), Classification, Structure and functions of an ecosystem (Food chains, food webs, and ecological pyramids. Flow of energy, Bio Geo Chemical Cycles), Bioaccumulation, Bio-magnification, Field visits.

UNIT 2: (~ 6 Lecture Hours)

Natural Resources: Classification of Natural Resources and their uses: Living and Non-Living resources, **Water resources:** use and over utilization of surface and ground water, floods and droughts, Dams benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources: Forest resources**, **Energy resources:** growing energy needs, renewable and non- renewable energy sources, use of alternate energy source, case studies.

UNIT 3: (~ 6 Lecture Hours)

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; (consumptive se, productive use, social, ethical, aesthetic and optional values). India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: (habitat loss, poaching of wildlife, man-wildlife conflicts);conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act, Field Trip to nearby lake.

UNIT 4: (~ 7 Lecture Hours)

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Causes, Effects and control methods of **Air Pollution, Water Pollution, Soil Pollution and Noise Pollution: Solid**

Waste and its Management: and characteristics of e-Waste and its management. Swach Bharat Mission – Save Soil Campaign

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives. Environmental control of Epidemics and Pandemics

UNIT 5: (~ 7 Lecture Hours)

Environmental Policy, Legislation & EIA: Salient Features of Environmental Protection act, Air Act-1981, Water Act, Forest Act, Wild life Act National Green Tribunal Act, 2010 Municipal Solid Waste Management and Handling rules, Biomedical Waste Management and Handling Rules, Hazardous Waste Management and Handling Rules, e-Waste Management and Handling Rules. EIA: Concept of EIA and Importance of EIA.

Towards Sustainable Future: Concept of Sustainable Development Goals, Crazy Consumerism, Urban Sprawl, Human health, Concept of Green Building, Ecological Foot Print, Life Cycle Assessment (LCA),Low Carbon Life Style. Environmental Ethics and Economics.

Text Books:

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

Reference Books:

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

Online Resources:

1. https://www.epa.gov/students/lesson-plans-teacher-guides-and-online-environmental-resources-educators.
2. https://onlinecourses.swayam2.ac.in/cec20_hs10/preview
3. https://open.ed.ac.uk/environment-sustainability-resources/
4. https://onlinepublichealth.gwu.edu/resources/sources-for-climate-news/

Course Outcomes:

After completion of the course, students will be able to

1. Based on this course, the Engineering graduate will understand/evaluate/ develop technologies based on ecological principles and environmental regulations, which in turn helps in sustainable development.
2. Acquire the knowledge on ecological principles and functions of eco systems and their importance for survival.
3. Develop the knowledge on role of natural resources for sustenance of life.
4. Analyze the concepts of bio - diversity and its role in the maintenance of ecological balance.
5. Evaluate the various causes, effects, control/mitigation of environmental pollution on man and environment.
6. Follow the environmental legislations in their daily life and professional practice to protect the environment.

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II Year B.Tech. EEE I –Semester **L T P C**
Course Code: 123AX **3 0 0 3**

SPECIAL FUNCTIONS AND COMPLEX VARIABLE THEORY

(Common to ECE, EEE, 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 variable that are used in various techniques dealing in engineering problems.
3. To evaluate the real integrals by representing into Beta and Gamma functions.

UNIT 1 : Beta and Gamma Functions (~08 lectures)

Beta function, properties of Beta function, express the integral in terms of Beta function.

Gamma function, properties of gamma function, relation between Beta and Gamma functions, evaluation of integrals by using Beta - Gamma functions.

UNIT 2 :First Order Partial Differential Equations (~08 lectures)

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

UNIT 3 : Analyticity of complex functions (~12 lectures)

Limit, continuity, differentiability, analyticity of complex functions and its properties, Cauchy-Riemann equations in Cartesian and polar coordinates, Harmonic functions, Milne-Thomson Method.

UNIT 4 :Complex Integration (~10 lectures)

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 (only statement), classification of singular points.

UNIT 5 : Residue Calculus (~10 lectures)

Calculus of residues, Residue theorem (only statement),evaluation of real definite integrals of the types

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

Text Books:

1. J.N.Sharma, Functions of A Complex Variables, 49^{th} Edition, Krishna Prakashan Publishers.
2. B.S. Grewal, Higher Engineering Mathematics, 43^{rd} Edition, Khanna Publishers.

Reference Books:

1. H.S.Kasana, Complex Variables-Theory and Applications, 2^{nd} Edition, Eastern Economy Edition.
2. Ravish R Singh and Mukhul Bhatt, Engineering Mathematics: A Tutorial Approach, 2^{nd} Edition, McGraw Hill Education.
3. James Ward Brown & Ruel, V.Churchill, Complex Variables and Applications, 8^{th} Edition, International Edition.

Online Resources:

1) https://www.youtube.com/watch?v=JoyvDWZ0aMY
2) https://youtu.be/Mwpz1zjPlzI

Course Outcomes (COs):

After completing the course the student will be able to

1. Evaluate the integral using Beta – Gamma functions.
2. Solve first order partial differential equations.
3. Understand about analyticity of complex valued functions and its properties.
4. Integrate a complex function over a given contour.
5. Expand a complex function in a given region of convergence using Taylor's and Laurent's series.
6. Apply knowledge of complex integrals for evaluation of real integrals.

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II Year B. Tech. EEE, I-Semester **L T P C**
Course Code: 123AV **2 0 0 2**

PYTHON PROGRAMMING

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) & CSE (Data Science))

Prerequisites: -Nil-

Course Objectives:

1. Learn syntax and semantics and create functions in Python.
2. Facilitate learning to use lists, tuples, strings and dictionaries in Python programs.
3. Impart knowledge on files and exception handling in Python.
4. Introduce GUI programming and data handling.

UNIT 1: (~5 Lecture Hours)

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input, Processing and Output, 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.

UNIT 2: (~5 Lecture Hours)

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops. **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, Recursion.

UNIT 3: (~6 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.

UNIT 4: (~6 Lecture Hours)

Files and Exception: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.

Modules: Namespaces, Importing Modules, Importing Module attributes, Module built-in functions, Packages, other features of Module.

Regular Expressions: Introduction, Special Symbols and Characters, REs and Python.

UNIT 5: (~ 6 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, box plot, bar plots, Histograms and plotting data contained in files.

Text Books:

1. Tony Gaddis, Starting Out with Python, 3rd Edition, Pearson, 2015.
2. Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson.

Reference Books:

1. Reema Thareja, Python Programming, Oxford Press, 2017.
2. Allen Downe, Think Python: How to Think like Computer Scientist, 2nd Edition, O'Reilly publications.

Online Resources:

1. https://www.python.org/
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm
4. https://www.digimat.in/nptel/courses/video/106106182/L01.html
5. https://www.geeksforgeeks.org/simple-plot-in-python-using-matplotlib/

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental concepts of Python Programming.
2. Apply the concepts of control structures and usage of functions in Python Programming.
3. Design Python programs using data structures like List, Tuple, Strings and Dictionaries.
4. Develop proficiency in handling files, exceptions and modules.
5. Construct regular expressions and design GUI based applications using Python.
6. Interpret various data visualization techniques.

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II Year B.Tech. EEE I –Semester	**L T P C**
Course Code: 123AL	**3 0 0 3**

ANALOG ELECTRONICS

Prerequisites: Applied Physics (121AB)

Course Objectives:

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

UNIT 1: (~ 8 lecture Hours)

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

Applications of P-N Junction Diode: Basic operation of half wave and full wave rectifiers without filters, clippers (Series and Shunt Clippers, clipping at two independent levels), Clampers, Voltage regulators using Zener diode, Varactor Diodes and applications.

UNIT 2: (~10 lecture Hours)

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

Transistor Biasing: Operating point, DC & AC load lines, Biasing - Voltage divider bias, Bias stability. **Small Signal Low Frequency Model of BJT:** BJT modeling, Hybrid model, Determination of h-parameters from transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters, direct coupled multistage amplifiers.

UNIT 3: (~9 lecture Hours)

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

UNIT4: (~8 lecture Hours)

Power Amplifiers: Class A and Class B Power Amplifiers.

Operational-Amplifiers: Internal Structure of an Op-Amp, ideal Op-Amp, non-idealities in an Op- Amp.

UNIT 5: (~10 lecture Hours)

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

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

Text Books:

1. J. Millman and A. Grabel, Microelectronics, 2nd Edition, McGraw Hill, 1988.
2. A.S. Sedra and K.C. Smith, Microelectronic Circuits, 4th Edition, Saunder's College 11 Publishing.
3. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, PHI, 2003.

References:

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

Online Resources:

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

Course Outcomes:

After completion of the course, student will be able to

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

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

Course Code: 123AS **3 1 0 4**

FIELD THEORY & DC MACHINES

Prerequisites: Applied Physics (121AB) & Basic Electrical Engineering (122AC)

Course Objectives:

1. To understand and apply the concepts of electric fields and magnetic fields.
2. To gain Knowledge of Maxwell's equations for both static and time varying fields.
3. To acquire knowledge on working and applications of DC machines and to understand performance and analysis of DC Machines.

UNIT 1: (~10 Lecture Hours)

Electric Fields

Coulomb's Law, Electric Field Intensity (EFI), EFI due to Point, Line Charges Gauss's Law – Divergence - Maxwell's First Equation - Divergence Theorem Electric Potential - Maxwell's Second Equation - Potential Gradient – Properties of Conductors - Continuity Equation - Point Form of Ohm's Law, Dielectrics – Polarization – Dielectric Constant.

UNIT 2: (~10 Lecture Hours)

Magnetic Fields

Biot-Savart's Law - Magnetic Field Intensity (MFI) – MFI due to Straight Current Carrying conductor, Ampere's Circuital Law - CURL –Maxwell's Third Equation - Stoke's Theorem, Magnetic Flux Density - Maxwell's Fourth Equation - Lorentz's Force Equation -Force between Two Straight Long Parallel Current Carrying Conductors, Magnetic Dipole-Magnetization and Relative Permeability.

Time Varying Fields

Faraday's Laws, Displacement Current - Modification of Maxwell's Equations for Time Varying Fields. (Elementary treatment only – Numerical problems are not envisaged in this topic).

UNIT 3: (~10 Lecture Hours)

Electro Mechanical Energy Conversion

Principles of energy conversion, single excited and doubly excited magnetic systems, singly excited electric field systems. Constructional features of rotating electrical machines, generating EMFs, EMF polygon, MMF produced by distribution windings, concepts of torque production.

UNIT 4: (~7 Lecture Hours)

DC Generators – Construction, Classifications, Commutation, EMF equation, Armature Reaction – Cross Magnetizing and De-Magnetizing AT/pole – Compensating Winding – Commutation process, Reactance Voltage Methods of Improving Commutation.

UNIT 5: (~5 Lecture Hours)

DC Motors –Torque Equation, Characteristics and Applications of Shunt, Series and Compound Motors, Starting Methods, Speed Control Methods of DC Motors, Losses and efficiency.

Methods of Testing – Swinburne's Test-Brake test (Direct Load Test) — Series Field Test- Retardation test and Hopkinson's test. Electrical braking – Plugging, Dynamic braking, Regenerative braking (Qualitative Treatment only).

Text Books:

1. William H Hayt, John A Buck, Akhtar, "Engineering Electromagnetics", McGraw Hill, 8th Ed, 2017.
2. Mathew N O. Sadiku, S.V. Kulkarni, "Electromagnetic Fields", Oxford University Press, 6th Ed, 2015.
3. P.S. Bimbhra, Electrical Machinery, 7th Edition, Khanna Publishers, 2011.
4. J.B. Gupta Theory & Performance of Electrical Machines, S.K. Kataria & Sons, 15th Edition, 2015.

Reference Books:

1. Ashutosh Pramanik, "Electromagnetism –Theory and Applications", Prentice Hall of India Pvt. Ltd, 2nd Ed, 2009.
2. William H Hayt & John A Buck, "Electromagnetics – Problems and Solutions", McGraw Hill Education, 2017.
3. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 6th Edition, 2005.
4. H. Cotton, Electrical Technology, CBS Publishers and distributors pvt limited, 2018.
5. D.P. Kothari, I.J. Nagrath, Electrical Machines, McGraw-Hill Education (India) Pvt Limited, Sigma Series, 2006.
6. Syed Nasar, Electric Machines and Electromechanics, Schaum's outline series, 2nd Edition.

Online Resource:

1. https://archive.nptel.ac.in/courses/108/102/108102146/#
2. https://archive.nptel.ac.in/courses/108/102/108102146/
3. https://archive.nptel.ac.in/courses/108/102/108102146/
4. https://archive.nptel.ac.in/courses/108/102/108102146/#
5. https://archive.nptel.ac.in/courses/108/106/108106073/

Course Outcomes:

After completion of the course, student will be able to

1. Formulate and solve typical problems w.r.t. electrostatics and magneto statics in different media.
2. Analyze/interpret various field equations in both point form and integral form.
3. Analyze the problems related to both static and time varying fields by using Maxwell's Equations.
4. Identify different parts of a DC machine & understand its operation and control.
5. Analyze the differences in operation of different dc machine configurations.
6. Identify proper type of motors suitable for a given application.

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II Year B.Tech. EEE I-Semester **L T P C**
Course Code: 123AQ **3 1 0 4**

ELECTRICAL CIRCUIT ANALYSIS

Prerequisites: Basic Electrical Engineering (122AC)

Course Objectives:

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

UNIT 1: Network Analysis (~12 Lecture Hours)

Series and Parallel Magnetic Circuits- Dot Convention- Coupled circuits - Coefficient of coupling- Numerical. Mesh and Nodal analysis of Networks with independent & dependent voltage and current sources –Current locus diagrams of Series and parallel combination of RL, RC, RLC circuits.

Superposition Theorem- Thevenin's Theorem- Norton's Theorem-Maximum Power Transfer Theorem- Reciprocity Theorem-Millman's Theorem with DC and AC Excitation- Numerical.

UNIT 2: Transient Analysis (~10 Lecture Hours)

Transient response of RL, RC and RLC networks with different excitations DC and AC excitations-Initial conditions, Step, ramp and impulse response by using both classical method and Laplace transform methods.

UNIT 3: Network Topology (~8 Lecture Hours)

Impedance parameters-Admittance Parameters-Transmission parameters-Hybrid parameters- Equivalent circuits- Conversion of one parameter to other-Interconnections of two port networks.

Definitions-Graph, Tree, Basic Cut-set and Basic Tie-set matrices for planar networks- Duality & Dual networks.

UNIT 4: Filters (~8 Lecture Hours)

Symmetrical networks, Image Impedance, Characteristic impedance, Attenuation, Propagation constant, Filter characteristics, -Types of filters-Low Pass-High pass and Band pass, Band stop filters. Analysis and design of constant K filter, Chebyshev filter, Butterworth filter.

UNIT 5: Poly Phase Circuits (~8 Lecture Hours)

Phase Sequence-Star and delta connections Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase Circuits-Measurement of active and reactive power.

Text Books:

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

Reference Books:

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

Online Resources:

1. https://nptel.ac.in/courses/108102042
2. https://nptel.ac.in/courses/108105065
3. https://nptel.ac.in/courses/108105159

Course Outcomes:

After completion of the course, student will be able to

1. Analyze Series and parallel magnetic and electric circuits, apply dot convention to determine the coefficient of coupling and also able to draw locus diagrams.
2. Analyze electrical circuits by applying various network theorems.
3. Analyze the transient response of electrical circuits for DC and AC excitations and different standard test signals like, step, ramp, impulse, etc.,
4. Analyze different polyphaser circuit configurations
5. Determine and analyze the two port network parameters and to understand the concept of network topology.
6. Analyze and design various filter circuits.

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

Course Code: 12314 **0 0 3 1.5**

ELECTRICAL CIRCUIT ANALYSIS LAB

Prerequisites: Basic Electrical Engineering (122AC)

Course Objectives:

1. To Construct and verify various electrical circuits applying network theorems (AC).
2. To Learn different transient responses for various electrical circuits like RL, RC and RLC.
3. To understand the concepts of three phase, magnetic circuits and filters.
4. To evaluate various circuits using two–port network parameters.
5. To develop and analyze electrical circuits in the simulation environment.

List of Experiments:

PART-A (All Experiments are compulsory)

1. Determination of Self and Mutual inductance in a Coupled Circuit. Determination of Coefficient of Coupling.
2. Verification of Thevenin's and Norton's Theorems. (with A.C. Excitation)
3. Verification of Superposition and Maximum Power Transfer Theorems. (with A.C. Excitation)
4. Measurement of Active Power for Star and Delta connected balanced loads using two-wattmeter method.
5. Time response of first order RC / RL network for periodic non – Sinusoidal inputs –Time constant and Steady state error determination.
6. Two port network parameters – Z, Y, Transmission Line & Hybrid parameters - Analytical verification.
7. Generation of various signals and sequences (unit Impulse, Step, Square, saw tooth, Triangular, Sinusoidal, Ramp) and operations on signals and sequences (Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power) using software.
8. Simulation of Transient response of RL, RC and RLC Circuits.

PART-B (Any two Experiments)

9. Locus Diagrams of RL and RC Series Circuits.
10. Frequency response of R-L, R-C circuits, Low Pass and High Pass Filters using software simulation.
11. Waveform Synthesis using Laplace Transforms.
12. Simulation of Solar PV System.

Text Books:

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

Reference Books:

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

Online Resources:

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/102/108102042/

Course Outcomes:

After completion of the course, student will be able to

1. Verify and demonstrate various network theorems.
2. Analyze Series and parallel magnetic circuits, determine the coefficient of coupling and also able to demonstrate and draw locus diagrams.
3. Analyze the transient response of electrical circuits for DC and AC excitations and different standard test signals like step, ramp, impulse etc., and synthesize waveforms using suitable software application/ hardware setup.
4. Analyze different three phase circuit configurations.
5. Analyze various two port network parameters and determine the same.
6. Design High pass and Low pass filter circuits

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

Course Code: 12317 **0 0 2 1**

PYTHON PROGRAMMING LAB

(Common to EEE, ECE, CSE, IT, ETE, CST, CSE (AI&ML) &
CSE (Data Science))

Prerequisites: Programming for Problem Solving (121AH)

Course Objectives:

1. Describe the core syntax and semantics of Python programming language.
2. Learn the fundamental sequence types like lists, dictionaries, tuples, sets.
3. Handle files and modules in python.
4. Learn how to write string, Exception Handling programs in python.

List of Experiments:

Week 1:

a. Write a program to demonstrate different number data types in Python.

b. Write a program to illustrate various types of operations in Python.

Week 2:

a. Write a Python program to find largest of three numbers.

b. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula: c/5 = f-32/9]

c. Write a Python program that prints prime numbers less than 20(using for-else).

d. Write a Python program to construct the following pattern, using a nested for loop. 1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
4 4 4 4
3 3 3
2 2
1

e. Write a program to get the binary form of a given number.

Week 3:

a. Write a program to demonstrate various list methods in Python.

b. Write a program to get a list of even numbers from a given list of numbers. (use only list comprehensions).

Week 4:

a. Write a program to add an item in a tuple without converting into a list.

b. Write a program to count the elements in a list until an element is a tuple.

c. Write a Python program to demonstrate set operations.

Week 5:

a. Write a program to access a sub string from a given string (Use slicing)
   - Get the first 5 characters of a string.
   - Get a substring of length 4 from the 3rd character of the string.
   - Get the last 5 characters of a string.
   - Get a substring which contains all characters except the last 4 characters and the 1st character.
   - Get every other character from a string.

b. Get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself

   Eg: restart output: resta$t

c. Write a program to sort a dictionary by a value.

d. Write a program to display the count of individual vowels in the input string-using dictionary. (Ex: Input String: "welcome" Output: {'a':0,'e':2,'i':0,'o':1,'u':0})

Week 6:

a. Write a Python program to find N largest element from given list of integers using functions.

b. Write a Python program to find sum of elements of nested list using recursion. (Input: [9, 1, [3,4], [5,2]], Output:24)

c. Write a Python program to define a module to find Fibonacci Numbers and import the module to another program.

d. Define a module that consist of factorial and sum of individual digits of a number as functions.

e. Write a program to find ncr by importing only factorial function from the above module.

Week 7:

a. Write a program to handle exceptions using try..except..finally…else

b. Write a program to sort words in a file and put them in another file. The output file should have only lower- case words, so any upper-case words from source must be lowered. (Handle exceptions)

c. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.

Week 8: Write a Python application to create basic calculator to demonstrate following GUI components.

i) Button ii) Text box iii) Text area

Week 9: Write a Python application to create basic Registration form to demonstrate following GUI components.

i) Text box ii) Button iii) Submit button iv) Combo box
v) Check button vi) Text widget vii) Radio button viii)Scrolled Text

Week 10: Write a Python program to draw following plots

i) Bar graph. ii) Scatter plot. iii) Box plot.

Text Books

1. Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson.
2. Gowrishankar S, Veena A, Introduction to Python Programming, 1st Edition, CRC Press/Taylor Francis, 2018. ISBN-13: 978-0815394372.

Reference Books:

1. Y Daniel Liang, Introduction to Programming Using Python, 1st Edition, Pearson India, 2017.

Online Resources:

1. www.w3schools.org.in
2. https://www.sgul.ac.uk/about/ourprofessionalservices/information services/library/documents/training- manuals/ExcelFundamentals-Manual.pdf
3. www.lynda.com
4. www.coursera.org

Course Outcomes:

After completion of the course, students will be able to

1. Understand and Apply basic concepts of Python.
2. Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
3. Determine the methods to create Python programs by utilizing lists, dictionaries, tuples, sets and strings.
4. Develop the proficiency in handling of files and modules.
5. Implement the concept of Exception handling using Python.
6. Utilize Python libraries for data visualization.

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II Year B. Tech EEE I-Semester	**L T P C**
Course Code: 12310	**0 0 3 1.5**

ANALOG ELECTRONICS LAB

Prerequisites: Nil

Course Objectives:

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

List of Experiments: (Minimum of 10 Experiments to be conducted)

1. Plot V-I characteristics of PN junction: Diode under Forward and Reverse Bias to obtain cut in voltage, R_f , R_r .
2. Obtain ripple factor, ratio of rectification and efficiency for HWR, FWR with filter.
3. Plot Input and output Characteristics of a BJT in CE configuration and derive h-parameters from Characteristics.
4. Plot Drain and Transfer characteristics of MOSFET.
5. Plot the Frequency response of CE Amplifier.
6. Plot the Frequency response of CC Amplifier.
7. Design an Inverting Amplifier and Non-Inverting Amplifier using Op-amp 741.
8. Design an Integrator using Op-amp 741.
9. Design a Wein Bridge Oscillator using Op-amp 741.
10. Design a Square wave and Triangular wave generator using Op-amp 741.
11. Design a Schmitt Trigger using Op-amp 741.
12. Design an instrumentation amplifier using Op-amp 741.
13. Design a logarithmic amplifier using Op-amp 741.

Text Books:

1. Bell D. A., Electronic Devices and Circuits, Prentice Hall of India, 2007.
2. Malvino A. and D. J. Bates, Electronic Principles7/e, Tata McGraw Hill, 2010.
3. Boylestad R. L. and L. Nashelsky, Electronic Devices and Circuit Theory, 10/e, Pearson Education India, 2009.
4. Choudhury R., Linear Integrated Circuits, New Age International Publishers. 2008.

Reference Books:

1. Floyd T.L., Fundamentals of Analog Circuits,, Pearson Education, 2012.
2. Robert T. Paynter and John Clemons, Paynter's Introductory electronic devices & circuits, Prentice Hall Career & Technology, New Jersey.
3. Millman J. and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill, 2010.
4. Gayakward R. A., Op-Amps and Linear Integrated Circuits, PHI Learning Pvt. Ltd., 2012.

Online Resources:

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

Course Outcomes:

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

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II Year B.Tech. EEE I-Semester **L T P C**
Course Code: 12312 **2 0 0 0**

CONSTITUTION OF INDIA

(Mandatory Course)

(Common to CSE, CSM, CSD, IT, ECE, EEE, ETE& CST)

Prerequisites: -Nil-

Course Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To realise the significance of constitution of India from all walks of life and to understand the basic concepts of Indian constitution.

UNIT 1: (~8 Lecture Hours)

History of Making of The Indian Constitution & Philosophy of The Indian Constitution History of Making of the Indian Constitution

History, Drafting Committee (Composition & Working) **Philosophy of the Indian Constitution**: Preamble, Salient Features.

UNIT 2: (~6 Lecture Hours)

Contours of Constitutional Rights and Duties

Fundamental Rights - Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies; Directive Principles of State Policy, Fundamental Duties.

UNIT 3: (~6 Lecture Hours)

Organs of Governance

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions- Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT 4: (~6 Lecture Hours)

Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati Raj : Introduction, PRI : ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role, Block Level : Organizational Hierarchy (Different departments), Village level : Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT 5: (6 ~Lecture Hours)

Election Commission

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.

Reference Books:

1. Dr.S.N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st edition, 2015.
2. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.

Online Resources:

1. https://nptel.ac.in/courses/129106003 [Constitutional Studies by Prof. Sudhir Krishna Swami, IIT Madras]
2. https://onlinecourses.swayam2.ac.in/cec20_hs38/preview [Indian Government and Politics by Dr.Aijaz Ashraf Wani, University of Kashmir, Srinagar]

Course Outcomes (COs)

After completion of the course, students will be able to

1. Tell about function of Indian constitution with clarity and understanding.
2. Identify the Rights of equality, the Right of freedom and the Right to constitutional remedies
3. Mark the knowledge of union government & their powers and function.
4. Define the state and central policies, fundamental duties.
5. Explain the powers and functions of Municipalities, Panchayats and Co-operative Societies.
6. Discuss the Electoral Process, special provisions.

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II Year B. Tech. EEE II-Semester	**L T P C**
Course Code: 124BQ	**3 0 0 3**

TRANSFORM TECHNIQUES AND APPLICATIONS

Prerequisites: Nil

Course Objectives:

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

UNIT 1: Fourier series and Transforms (~10 Lecture Hours)

Fourier Series – Fourier series representation (0 to 2p and –p to p)

Fourier Transforms - Fourier integral theorem (only statement), Fourier transform, Fourier sine and cosine transforms, Properties, Transforms of simple functions, Convolution theorem.

UNIT 2: Z-Transforms (~8 Lecture Hours)

Definition, Standard Z-transforms, Linearity Property, damping rule, Standard results, Shifting Property, Multiplication by n, Initial value theorem, Final value theorem,

Inverse Z-transform – Power series method, Partial fractions, Inversion Integral method, Convolution theorem (only statement), solution of difference equation using Z-transform.

UNIT 3: Random Variables (~12 Lecture Hours)

Random Variables - Introduction to Random variables, Discrete Random Variable, Continuous Random Variable, Probability distribution function, Probability density function.

Probability Theory Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution, Exponential Distribution– Properties (only statement).

UNIT 4: Signals and Systems (~ 8LectureHours)

Elementary Signals - Unit Step Function, Unit Ramp Function, Unit Parabolic Function, Unit Impulse Function, Sinusoidal Signal, Real Exponential Signal, Rectangular Pulse Function, Triangular Pulse Function. Classification of Signals - Continuous Time and Discrete Time Signals, Periodic and Non-Periodic Signals, Causal and Non- Causal Signals, Even and Odd Signals, Energy and Power signals.

Systems: Classification of Systems- Continuous Time and Discrete Time Systems, Causal and Non-Causal Systems, Linear and Non - Linear Systems, Time Varying Systems, Stable and Unstable Systems, Static and Dynamic systems, Invertible and Non - Invertible systems.

UNIT 5: Applications of Transforms to Signals and Systems (~10Lecture Hours)

Fourier Transform of Complex and Real functions, Fourier transform of Periodic Signal, System analysis with Fourier transform, Transform Analysis of LTI Systems – Relationship between Transfer function and Difference function, Stability analysis, Jury's test for stability criteria.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. Anand Kumar, Text Book of Signals and Systems, 3rd Edition, PHI Learning Publications.

Reference Books:

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

Online Resources:

1. https://www.youtube.com/watch?v=lkAvgVUvYvY
2. https://www.youtube.comwatch?v=c_YLkvk_ZXI&list=PLBlnK6fEyqRhG6s3jYIU48CqsT5cyiDTO&index=14

Course Outcomes:

After completion of the course, student will be able to

1. Express a periodic function as Fourier series.
2. Determine the Fourier Transform of a given function.
3. Evaluate the Z transform of the given function and apply it to solve the difference equation.
4. Understand the theory of probability distributions.
5. Identify & Classify different Types of Elementary Signals and Systems.
6. Apply the concepts of Fourier transforms and Z transforms to Signals and Systems.

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II Year B.Tech. EEE II-Semester **L T P C**
Course Code: 124BM **3 0 0 3**

POWER SYSTEMS-I

Prerequisites: Field Theory & DC Machines (123AS), Electrical Circuit Analysis (123AQ)

Course Objectives:

1. To Understand the Conventional and Non-Conventional power generating stations.
2. To Analyze Economic aspects of power generation.
3. To get familiar with Air insulated Substation and Gas insulated substations.
4. To Analyze D.C and A.C Distribution systems and to Understand underground cables.

UNIT 1: **Power Generating Stations** (~11 Lecture Hours)

Introduction to Power systems and present scenario.

Thermal Power Stations: Schematic diagram of Thermal Power Station (TPS)–Brief description of TPS components.

Hydroelectric Power Stations: Schematic arrangement of hydro-electric power station-types; Components of Hydro- electric power station. Estimation of power developed from a given catchment area; heads and efficiencies.

Nuclear Power Stations: Schematic diagram of nuclear PowerStation (NPS). Principle of operation of nuclear reactor. Brief description of NPS components.

Gas Power Stations: Principle of Operation and Components.

Renewable Energy source: Concept of Solar power generation, wind power generation, Tidal Generation, Geo Thermal Generation and Bio Gas Generation.

UNIT 2: Economic Aspects & Tariff methods (~9 Lecture Hours)

Economic Aspects of Power Generation: Load curve, load duration and integrated load duration curves- load, demand, diversity, capacity, utilization and plant use factors. Power factor - disadvantages of low power factor – causes of low power factor, power factor improvement techniques – Numerical Problems.

Tariff Methods: Cost of Generation and their division into Fixed, semi fixed and Running Costs. Desirable Characteristics of a Tariff, Tariff Methods: Active, Reactive and availability-based tariff methods.

UNIT 3: Substations (~8 Lecture Hours)

Air Insulated Substations (AIS): Classification of substations: Air insulated substations -Indoor & Outdoor substations: layout and equipment. Bus bar arrangements in the Sub-Stations.

Gas Insulated Substations (GIS) –Schematic diagram of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT 4: Distribution Systems (~9 Lecture Hours)

Classification- Comparison of AC & DC distribution systems, Underground & Overhead Distribution Systems- Design of Distribution Systems for AC and DC Systems-Voltage Drop Calculations -Radial Distributor fed at one end and at both ends with equal and unequal Voltages - Ring Main Distributor.

UNIT 5: Underground Cables (~8 Lecture Hours)

Types of Cables, Construction, Types of Insulating materials, Calculation of Insulation resistance and dielectric- stress, Capacitance of Single and 3-Core Belted Cables, Grading of Cables -Capacitance Grading - Inter- Sheath Grading.

Earthing - Types and installation of earthing.

Text Books:

1. C. L. Wadhwa, Generation and utilization of Electrical Energy, 4th Edition, New age International (P) Limited, 2017.
2. J.B. Gupta, A course in Power systems, 11th Edition, S.K. Kataria & Sons Publishers, 2013.
3. C. L. Wadhwa, Electrical Power Systems, 7th Edition, New age International (P) Limited, 2016.

Reference Books:

1. S.N. Singh, Electrical Power Generation, Transmission and Distribution, 2nd Edition, PHI publications, 2008.
2. M.L. Soni, P.V. Gupta, U.S. Bhatnagar, A. Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co. Pvt. Ltd., 2009.
3. Syed Nasar, Electric Power Systems, Schaum's outline series, 2nd Edition.

Online Resources:

1. https://www.digimat.in/nptel/courses/video/108102047/L01.html
2. https://nptel.ac.in/courses/112103243
3. https://powermin.gov.in/en/content/power-sector-glance-all-india

Course Outcomes:

After completion of the course, student will be able to

1. Understand the operation of conventional power generating stations like Thermal, Hydro, Nuclear and Renewable power generation.
2. Interpret Economic aspects and Tariff methods of power system.
3. Categorize Air and Gas Insulated Substations.
4. Model D.C and A.C distribution systems.
5. Understand structure of different underground cables and design.
6. Summarize power generation and Distribution system.

II Year B.Tech. EEE II-Semester **L T P C**

Course Code: 124AY **3 0 0 3**

AC MACHINES

Prerequisites: Basic Electrical Engineering (122AC), Field Theory & DC Machines (123AS)

Course Objectives:

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

UNIT 1: (~9 Lecture Hours)

Single Phase Transformers:

Construction and principle of operation, equivalent circuit, phasor diagrams, voltage regulation, losses and efficiency, Testing – open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Auto transformers – construction, principle of operation, applications, comparison with two winding transformers.

UNIT 2: (~9 Lecture Hours)

Three Phase Transformers:

Construction, types of connection and their comparative features, parallel phase conversion – Scott connection, open delta connection, three phase to single phase conversion, Tap changing techniques and induction regulators, three winding transformers.

UNIT 3: (~10 Lecture Hours)

Poly-Phase Induction Motors:

Constructional details of cage and wound rotor machines-production of a rotating magnetic field - equivalent circuit –phasor diagram, torque equation, relation between Full Load Torque, maximum Torque and starting Torque, Losses and efficiency. Torque slip characteristics- crawling and cogging, Methods of Starting & Speed Control. Principle of induction generator.

UNIT 4: (~10 Lecture Hours)

Synchronous Generators: Constructional Features of round rotor and salient pole machines – Armature windings (single layer and double layer) – winding factors – E.M.F Equation- armature reaction - leakage reactance – synchronous reactance and impedance - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method and Z.P.F. methods– Numerical Problems-salient pole alternators – two reaction analysis –Phasor diagrams- Slip test.

UNIT 5: (~7 Lecture Hours)

Parallel operation of Synchronous Generators:

Synchronizing methods of alternators– synchronizing power& torque – parallel operation -Effect of change of excitation and mechanical power input- Alternators in parallel with infinite bus bar.

Synchronous Motors: Principle of operation –Methods of starting, applications-phasor diagram –Mathematical analysis of power developed -V and inverted V Curves-synchronous condenser – hunting and its suppression.

Single Phase Induction Motors: Constructional features, double revolving field theory, equivalent circuit- starting methods.

Text Books:

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

Reference Books:

1. E. Fitzgerald and C. Kingsley, Electric Machinery, McGraw Hill Education, 6th Edition, 2005.
2. M. G. Say, Performance and design of AC machines, CBS Publishers, 2002.
3. S. Langsdorf, Theory of Alternating current machinery, 2nd Edition, McGraw Hill Education, 1984.
4. P.S. Bimbhra, Generalized Theory of Electrical Machines, 7th Edition, Khanna publishers, 2021.
5. Syed Nasar, Electric Machines and Electromechanics, Schaum's outline series, 2nd Edition.

Online Resource:

1. https://nptel.ac.in/courses/108106072
2. https://archive.nptel.ac.in/noc/courses/noc19/SEM1/noc19-ee01/

Course Outcomes:

After completion of the course, student will be able to

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

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II Year B.Tech. EEE II-Semester **L T P C**
Course Code: 124BF **3 0 0 3**

DIGITAL ELECTRONICS

Prerequisites: Nil

Course Objectives:

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

UNIT 1: (~8 Lecture Hours)

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

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

UNIT 2: (~10 Lecture Hours)

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

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

UNIT 3: (~8 Lecture Hours)

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

UNIT 4: (~8 Lecture Hours)

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

UNIT 5: (~10 Lecture Hours)

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

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

Text Books:

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

Reference Books:

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

Online Resources:

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

Course Outcomes:

After completion of the course, student will be able to

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

II Year B.Tech. EEE II-Semester **L T P C**
Course Code: 124BD **3 0 0 3**

CONTROL SYSTEMS

Prerequisites: Electrical Circuit Analysis (123AQ)

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 understand the different types compensators performance.

UNIT 1: (~9 Lecture Hours)

Introduction: Concepts of Control Systems- Classification of control systems, Open Loop and closed loop control systems - Examples of control systems- Feed Back Characteristics, Effects of feedback.

Modeling of Physical Systems – Differential equations, Impulse Response and transfer functions –Electrical systems, Translational and Rotational mechanical systems, electrical analogy.

UNIT 2: (~9 Lecture Hours)

Transfer Function Representation: Definition, Differential equation, Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems -Block diagram algebra –Signal flow graph - Mason's gain formula.

UNIT 3: (~10 Lecture Hours)

Time Response & Stability Analysis: Standard test signals - Time response of first order systems and second order systems– Characteristic Equation, Time domain specifications – Steady state response - Steady state errors and error constants – Effects of P, PI, PD, PID controllers.

The concept of stability – Routh's stability criterion– limitations of Routh's stability. Root Locus Technique- construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT 4: (~9 Lecture Hours)

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

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

UNIT 5: (~9 Lecture Hours)

State Space Analysis of Continuous Systems: Concepts of state, state variables and state space model, derivation of state space model– Solution of state space equation - State Transition Matrix and its Properties – Concepts of Controllability and Observability.

Text Books:

1. B.C. Kuo, Automatic Control Systems, 9th edition John wiley and son's 2014.
2. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age International(P) Limited, Publishers, 7th edition, 2021.

Reference Books:

1. Nagoor Kani, Control systems, RBA Publishers 2nd Edition, 2014.
2. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
3. Narciso F. Macia George J. Thaler, Modelling & Control of Dynamic Systems, Thomson Publishers. 1st Edition December 16, 2004
4. Joseph J Distefano, Allen R Stubberud, Ivan J Williams, Control Systems, Schaum's outline series, 3rd Edition.

Online Resources:

1. https://www.tutorialspoint.com/control_systems control_systems_useful_resources.htm

Course Outcomes:

After completion of the course, student will be able to

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

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II Year B.Tech. EEE II-Semester **L T P C**

Course Code: 12421 **0 0 3 1.5**

ELECTRICAL MACHINES LAB

Prerequisites: Basic Electrical Engineering (122AC), Field Theory & DC machines (123AS).

Course Objectives:

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

List of Experiments

PART-A (All Experiments are Compulsory)

1. Swinburne's Test & Retardation Test on DC shunt motor.
2. Internal & External Characteristics of a DC Shunt Generator
3. Parallel operation of single-phase transformers.
4. OC and SC Test on Single Phase Transformer – Equivalent circuit-Efficiency and Regulation
5. Brake test on a 3 phase Induction Motor.
6. No load and blocked rotor test on three phase induction motor (Equivalent circuit and circle diagram)
7. Regulation of a three-phase alternator by Synchronous Impedance & MMF methods.
8. V & inverted V curves of a three-phase synchronous motor. Determination of X_d & X_q of a salient pole synchronous machine.

PART-B (Any two Experiments)

1. Speed control of DC shunt motor.
2. Series Fields Test on a Pair of Two Identical Dc Series Machines
3. Hopkinson's Test on a Two DC Shunt machines
4. Scott connection of Transformers.
5. Sumpner's test on a pair of single-phase transformers.

Text Books:

1. D.P.Kothari and B.S.Umre, Laboratory Manual For Electrical Machines, Second Edition, 2017.
2. P.S.Bimbhra, Generalized Theory of Electrical Machines, 7^{th} Edition, Khanna publishers, 2021.
3. Clayton & Hancock , "Performance & Design of DC Machines", B.P.B.Publications, Third Edition, 2001.

Reference Books:

1. A.E.Fritgerald, C.Kingsley & S.Umans "Electric Machinery", Mc Graw-Hill Companies, 5th Edition,2005.
2. M. G. Say, Performance and design of AC machines, CBS Publishers, 2002.
3. J.B. Gupta Theory & Performance of Electrical Machines, S.K. Kataria & Sons, Edition, 2015.

Online Resources

1. https://archive.nptel.ac.in/courses/108/105/108105017/
2. https://archive.nptel.ac.in/courses/108/106/108106071/
3. https://archive.nptel.ac.in/courses/108/106/108106072/

Course Outcomes:

After completion of the course, student will be able to

1. Analyze the characteristics of DC& AC machines.
2. Carry out various tests to assess the performance of DC& AC Machines
3. Understand different starting methods of DC& AC Machines.
4. Know conceptual things to implement in real time applications.
5. Choose suitable DC& AC machine for a specific application.
6. Draw the equivalent circuits of different DC& AC machines by conducting suitable experiments.

II Year B. Tech EEE II-Semester **L T P C**

Course Code: 12420 **0 0 3 1.5**

DIGITAL ELECTRONICS LAB

Prerequisites: Nil

Course Objectives:

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

List of Experiments:

(Any 12 from given the list to be done)

1. Realize and design Logic gates using discrete components and devices. Realize and verify the functionality of the following circuits. (Experiments 2-6)
2. Logic Gates using ICs.
3. 3 to8 Decoder using LS74138 IC.
4. 8 to1 Multiplexer using LS74151 IC.
5. 2 to4 De-Multiplexer using LS74155 IC.
6. 4-bit Comparator using LS7485 IC.
7. Realize and design 4-bit Binary to Grey Code Converter using logic gates.
8. Design a 16-bit Adder/Subtractor using 4-bit Adder/Subtractor.
9. Design a 16 to 4 Priority Encoder using two 8 to 3 Priority Encoders. Realize and verify the functionality of the following circuits. (Experiments 10-13)
10. D and JK-Flip-Flops using LS7474 and LS7476 ICs.
11. Verify all the functions of the Universal Shift Register using LS74194/ 195 IC.
12. Up/Down Counter using LS74192/193 IC.
13. Decade Counter using LS7490 IC.
14. Convert the given Analog signal to Digital signal using ADC0808.
15. Generate ramp waveform, square waveform using DAC0808
16. Verify the Read and Write operations on a 16X4 RAM using LS74189 IC.

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design With an Introduction to the Verilog HDL", 5th edition, Pearson.
2. R.P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill.
3. ZviKohavi & Niraj K.Jha, Switching and Finite Automata Theory, 3rd Edition, Cambridge.

Reference Books:

1. W.H. Gothmann, Digital Electronics- An introduction to theory and practice, 2nd Edition, PHI.
2. Roger Tokheim, Experiments Manual for Use with Digital Electronics Principles & Applications, 8th Edition, McGraw-Hill Science Engineering.
3. Cherry Bhargava, Digital Electronics – A Comprehensive Lab Manual, BS Publications.

Online Resources:

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

Course Outcomes:

After completion of the course, student will be able to

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

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II Year B.Tech. EEE II-Semester **L T P C**
Course Code: 12422 **2 0 0 0**

HUMAN VALUES AND PROFESSIONAL ETHICS

(Mandatory Course)

(Common to CSE, CSM, CSD, IT, ECE, EEE, ETE& CST)

Prerequisites: -Nil-

Course Objectives:

1. To instill among the Engineering professionals, the need to follow ethical principles in life.
2. To stimulate thinking and help internalize the value systems and ethical behavior.
3. To enable the students to understand the need for value based education.
4. To inculcate a sense of moral responsibility and professional ethics as Engineers.
5. To understand the impact of ethical perspectives globally.

UNIT 1: (~7 Lecture Hours)

Understanding Value Education

Basic Concepts: Moral and Morality, Ethics, Values, Principles – Thoughts of Ethics: Indian Thought versus Global Thought – Objectives of Value Education – Importance of Value Education – Personal Ethics – Professional Ethics.

UNIT 2: (~7 Lecture Hours)

Understanding The Harmony At Various Levels

Harmony in the Self – Harmony in the Family – Harmony in the Society – Harmony in the Nature – Harmony in Existence – Understanding the Interconnectedness and Mutual fulfilment – Understanding Existence as Co-existence – CASE STUDIES.

UNIT 3: (~6 Lecture Hours)

Ethical Theories

Utilitarian Ethics – Kant's Deontological Theory – Virtue Ethics – Kohlberg's Levels of Moral Development – Gilligen's Theory - CASE STUDIES.

UNIT 4: (~6 Lecture Hours)

Professional Ethics

Profession and Professionalism – Ethics in Engineering – Role of Engineers – Responsibilities of Engineers – Engineering Code of Ethics – Ethical Dilemmas – CASE STUDIES.

UNIT 5: (~6 Lecture Hours)

Global Issues and Ethical Perspectives

Business Ethics – Environment Ethics – Computer Ethics – Media Ethics – Research Ethics – Intellectual Property Rights – Social Responsibility – CASE STUDIES.

Text Books:

1. A foundation course in Human Values and Professional Ethics by RR Gaur, R.Sangal and G.P.Bargaria,Excel Books (2011).
2. Human Values and Professional Ethics by Tanu Shukla, Anupam Yadav, Gajendra Singh Chauhan, Cengage Publications (2018).

Reference Books:

1. Fundamentals of Ethics for Scientists and Engineers by Edmund G, SeeBauer, Robert L, Barry Oxford University Press (2015).
2. Professional Ethics by R.Subramanian, Oxford University Press (2013).

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_mg54/preview [Ethics in Engineering Practice by Prof.Susmita Mukhopadhyay, IIT Kharagpur]
2. https://nptel.ac.in/courses/109104068 [Exploring Human Values by Prof.A.K.Sharma, IIT Kanpur]

Course Outcomes (COs):

After completion of the course the student should be able to

1. Understand the importance of imbibing and inhering Ethics and values as an individual and professional
2. Relate the need for establishing harmony at various levels.
3. Evaluate the relevance of ethical values in their academic and professional environment.
4. Develop right understanding about oneself and the rest of reality through self-exploration.
5. Identify the basis for universal human values based on right understanding providing the vision for the holistic way of living.
6. Value oneself as professionals with professional ethics and right code of conduct and behaviour in the working environment.

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III Year B.Tech. EEE I -Semester **L T P C**
Course Code: 125DC **3 0 0 3**

POWER SYSTEMS II

Prerequisites: Power Systems-I (124BM), Field theory & DC Machines(123AS).

Course Objectives:

1. To calculate Transmission line parameters.
2. To analyze the performance of short, medium and long transmission lines.
3. To analyze various factors influencing performance of transmission lines and power transients.
4. To determine the string efficiency and sag of transmission lines.
5. To understand voltage control and compensation techniques.

UNIT 1: (~8 Lecture Hours)

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

UNIT 2: (~10 Lecture Hours)

Performance of Transmission lines: Classification of Transmission Lines: Performance of Short and Medium Transmission Lines: - Short, medium model representations-Nominal-T, Nominal-ð, A, B, C, D Constants, regulation and efficiency for symmetrical & Asymmetrical Networks-Numerical Problems. Long Transmission Line model- representation-Rigorous Solution, evaluation of A, B, C, D Constants, Surge Impedance and SIL of Long Lines, Equivalent-T and Equivalent-ð network models – Numerical.

UNIT 3: (~11 Lecture Hours)

Performance of Transmission Line with Various Governing Factors: Skin and Proximity Effects-Description and effect on Resistance of Solid Conductors-Ferranti Effect-Charging Current-Effect on Regulation of the Transmission Line. **Corona:** Description of the phenomenon, factors affecting corona, critical voltages and power loss- Numerical.

Power System Transients: Types of System Transients - Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients-Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T Junction, Lumped Reactive Junctions. - Numerical.

UNIT 4: (~8 Lecture Hours)

Insulators and sag calculations: Types of Insulators, String efficiency and Methods for improvement, Capacitance grading and Static Shielding

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

UNIT 5: (~8 Lecture Hours)

Voltage Control and Compensation: Methods of voltage control, shunt and Series capacitors and inductors, tap changing transformers, Synchronous Phase modifiers. Concepts of Load Compensation Loadability characteristics of overhead lines, uncompensated transmission lines-symmetrical line, radial line with asynchronous load compensation of lines- Numerical.

Text books:

1. C.L. Wadhwa, Electrical Power Systems, 7th Edition, New Age International (P) Ltd, 2016.
2. I.J. Nagarath& D. P Kothari, Power Systems Engineering, 2nd Edition, TMH, 2010.
3. J.B. Gupta, A course in Power systems, S.K. Kataria & Sons Publishers, 2016.

Reference Books:

1. John J. Grainer & W.D. Stevenson, Power System Analysis, 1st Edition, McGraw Hill Education, 2017.
2. M.L. Soni, P.V. Gupta, U.S. Bhatnagar, A. Chakraborti, A Text Book on Power System Engineering, Dhanpat Rai & Co. Pvt. Ltd., 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ee39/preview
2. https://www.coursera.org/learn/electric-power-systems
3. https://www.mooc-list.com/course/electric-power-systems-coursera

Course Outcomes

After completion of the course, student will be able to

1. Compute transmission line parameters
2. Analyze the performance of small, medium and Long Transmission lines.
3. Assess the performance of transmission lines.
4. Evaluate the performance of transmission lines under various conditions.
5. Design of Insulators and compute the sag and tension of Overhead line.
6. Analyze the role of compensators in voltage control and power system.

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

Course Code: 125DB **3 1 0 4**

POWER ELECTRONICS

Prerequisites: 123AQ: Electrical Circuit Analysis, 123AL: Analog Electronics.

Course Objectives:

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

UNIT 1: (~10 Lecture Hours)

Power semiconductor devices: V-I Characteristics: Diode, SCR, TRIAC, Power BJT, Power MOSFET and IGBT, Thyristor ratings and protection, Methods of SCR commutation, Triggering circuits for SCR, Series and parallel operation of a SCR's-Numerical.

UNIT 2: (~10 Lecture Hours)

AC-DC Converters: Single Phase and Three Phase Half wave and Full Wave Rectifiers with R and RL Loads, Effect of Freewheeling Diode, fully controlled rectifier with RLE load, Effect of source inductance, Single phase dual converters - Numerical.

UNIT 3: (~8 Lecture Hours)

AC- AC Converters - Introduction, Analysis of Single-phase voltage controllers for R& R-L loads using SCR and TRIAC and its applications, Integral Cycle control, three phase AC voltage controllers with star & delta connected R load–Principle of operation of Single phase Cyclo converters with R & RL Loads, Numerical.

UNIT 4: (~8 Lecture Hours)

DC-DC Converters: Principle of operation of Buck, Boost and Buck-Boost converters with R & RL loads with continuous current mode and discontinuous currents mode.

Classification of Choppers: Single Quadrant, Two –Quadrant and four Quadrant choppers and their control Techniques, Applications, Numerical.

UNIT 5: (~7 Lecture Hours)

DC-AC Converters: Single phase half & Full bridge inverters with R&RL loads. 3-phase bridge inverter – 120° and 180° mode of operation. Voltage control of single-phase inverters: single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation, 3-phase PWM inverter with SPWM, Applications.

Text Books:

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

Reference Books:

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

Online Resources:

1. https://www.youtube.com/playlist?list=PLA07ACBDE053A8229

Course Outcomes:

After completion of the course, student will be able to

1. Understand the concepts of power semiconductor devices.
2. Analyze the performance of single & three phase converters.
3. Analyze single phase AC voltage controller and Cyclo converters.
4. Analyze the DC-DC Converters.
5. Understand the operation of single & three phase Inverters.
6. Comprehend Triggering, Commutation and Protection circuits.

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III Year B.Tech. EEE I-Semester **L T P C**
Course Code: 125CY **3 0 0 3**

MICROPROCESSORS AND MICROCONTROLLERS

(Common to ECE, ETE & EEE)

Prerequisites: Analog Electronics (123AL), Digital Electronics (124BF).

Course Objectives:

1. Describe the architecture of Microprocessor and Microcontrollers.
2. Understand and apply the fundamentals of assembly language and C programming of Microprocessors and Microcontrollers.
3. Experimenting with memory and I/O interfacing of Microcontroller.
4. Study the basic concepts of ARM Cortex-M3 architecture.

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: (~8 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: (~10 Lecture Hours)

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

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

UNIT 5: (~10 Lecture Hours)

ARM Cortex-M3 processor: Introduction, Applications, The Cortex-M3 Processor System Block Diagram, Programming model – Registers, Special Registers, Operation modes, Instruction set, Exceptions and Interrupts, Vector

Tables, Reset Sequence, Unified Assembler Language, Memory Maps, Pipeline.

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.
3. Joseph Yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 2nd Edition, 2011.

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.
4. Kenneth. J. Ayala, The 8051 Microcontroller, 3rd Edition, Cengage Learning, 2006.
5. Shibu K.V, Introduction to Embedded Systems, Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.
6. Dr. K.V.K.K. Prasad, ¯Embedded / Real-Time Systems: Concepts, Design & Programming, Dreamtech publishers, 1st Edition, 2003.
7. Mazidi M., "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson, 200.

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 Familiarize with the internal architecture and organization of 8086/8051/ ARM Cortex-M3.

2 Write assembly language programs using 8086/8051.

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/ ARM Cortex-M3.

6 Discuss various serial communication interface standards.

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III Year B.Tech. EEE I –Semester **L T P C**
Course Code: 125CG **3 0 0 3**

DIGITAL CONTROL SYSTEMS

(Professional Elective-1)

Prerequisites: Control Systems (124BD)

Course Objectives:

1. To understand the concepts of Digital Control System.
2. To introduce the Mathematical modelling of Digital Control System.
3. To Analyze the Digital Control system -Input-output model, State Space model.
4. To become familiar with the design concepts of Digital Control System.

UNIT 1: (~9 Lecture Hours)

Introduction to Digital Control Systems:

Z-Transforms-Examples of Digital control systems- Types of signals, Sample and Hold Devices, Mathematical Modeling of the Sampling process, Sampling theorem, Data reconstruction, zero order Hold, first order hold.

Z-Transforms and its Properties, Theorems and Limitations of Z-Transform, Inverse Z-Transform, Modified Z-Transform, Z-Transform method for solving difference equations.

UNIT 2: (~9 Lecture Hours)

Pulse Transfer Function: Pulse Transfer function of Discrete time systems, Mapping between s-plane and z-plane – primary strip and complementary strips, Constant Frequency loci, Constant Damping ratio loci.

State Space Analysis: State Space representation of Discrete Time Systems, Pulse Transfer Matrix, Solving Discrete Time State Space Equations, State transition matrix and its properties, Methods of computing the State Transition Matrix, Discretization of Continuous Time State Space Equations.

UNIT 3: (~12 Lecture Hours)

Controllability and Observability: Definitions, Theorems, Tests, Duality and Relationship of Controllability and Observability. Transfer Function, Effect of Pole Zero cancellation on Controllability and Observability.

Stability Analysis: Stability analysis of Closed Loop systems in the z-plane, Transient and Steady State Response analysis, Jury Stability Test- Stability Analysis using Bilinear Transformation and Routh- Hurwitz Criterion, Design of Digital Control Systems.

UNIT 4: (~6 Lecture Hours)

Design of Digital Control System: Design based on Frequency Response Method- Bilinear Transformation, Design Procedure in the w-plane, Lead, Lag and Lead-Lag Compensators and Digital PID Controllers, Dead Beat Controller.

UNIT 5: (8 Lecture Hours)

Design of State Controllers & Observers: Design of State feedback Controller through Pole Placement –Necessary and Sufficient Conditions, Ackerman's Formula. State Observers-Full order and Reduced Order Observers.

Text Books:

1. B.C Kuo, "Digital Control Systems", Oxford University Press, 2nd Edition, 2012.
2. K. Ogata, "Discrete Time control systems", Pearson Education, PHI, 2nd Edition, 2015.
3. M. Gopal, "Digital Control & State Variable Methods", Tata McGraw Hill, 4th Edition, 2012.

Reference Books:

1. C. P Kurian, V. I. George, "Digital Control System", Cengage Learning India, 2012.
2. M. Sami Fadali, Antonio Visioli, "Digital Control Engineering Analysis and Design", Academic Press, 2nd Edition, 2012.
3. M. Gopal, "Digital Control Engineering", New Age International, 2nd Edition, 2014.
4. Norman S. Nise, "Control System Engineering", Wiley India, 7th Edition, 2018.

Online Resources:

1. https://nptel.ac.in/courses/108103008
2. digital_cont_lec_p1.pdf (weebly.com)
3. Digital Control and State Variable Methods M Gopal.pdf (gcebargur.ac.in)

Course Outcomes:

After completion of the course, student will be able to

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

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III Year B. Tech, EEE I-Semester **L T P C**
Course Code: 125BK **3 0 0 3**

JAVA PROGRAMMING
(Professional Elective-1)

Prerequisites: Programming for Problem Solving (121AH)

Course Objectives:

1. Learn the concepts of object-oriented programming.
2. Introduce the implementation of inheritance, packages and interfaces.
3. Introduce the implementation of inheritance, packages and interfaces.
4. Understand the concepts of exception handling and multithreading.
5. Introduce the java collection framework and I/O classes.
6. Gain knowledge in designing Graphical User Interface using applets and swing controls.

UNIT 1: (~9 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, String Handling.

UNIT 2: (~10 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-Ad hoc Polymorphism, Pure Polymorphism, Method Overriding, Abstract Classes, Object Class.

Packages: Defining a Package, Class path, Access Protection, Importing Packages.

Interfaces: Defining an Interface, Implementing Interfaces, Nested Interfaces, Variables in Interfaces and Extending Interfaces.

UNIT 3: (~10 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 Subclasses.

Multithreading: Differences between Thread-Based Multitasking and Process-Based Multitasking, Java Thread Model, Creating Threads, Thread Priorities, Synchronizing Threads, Inter Thread Communication.

UNIT 4: (~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. Lifecycle of an applet, Passing parameters to applets.

UNIT 5: (~ 9 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, The For-Each alternative, Hash Table, Stack, String Tokenizer, Random Scanner.

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 10th 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. H.M. Dietel and Dietel, Java – How to Program, 6th Edition, Pearson Education/PHI.
5. Cay Horstmann, Big Java, 4nd Edition, John Wiley and Sons Publisher, 2009.

Online Resources:

1. https://docs.oracle.com/javase/tutorial/java/TOC.html
2. https://onlinecourses.nptel.ac.in/noc22_cs47/preview
3. www.javatpoint.com/java-tutorial

Course Outcomes:

After completion of the course, student 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.

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III Year B.Tech. EEE I-Semester	**L T P C**
Course Code: 125DE	**3 0 0 3**

PROGRAMMABLE LOGIC CONTROLLERS AND APPLICATIONS

(Professional Elective-1)

Prerequisites: Digital Electronics (124BF), Control Systems (124BD)

Course Objectives:

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

UNIT 1: (~8 Lecture Hours)

Introduction to PLC: PLC Basics, PLC system, I/O modules and interfacing CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT 2: (~10 Lecture Hours)

Programming with PLC: PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-Press Operation. Digital logic gates programming in the Boolean algebra system, conversion examples, Ladder diagrams for process control, Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT 3: (~10 Lecture Hours)

PLC Registers: Characteristics of Registers, module addressing, holding registers, input registers and output registers. PLC Functions: Timer functions and industrial applications, counters, counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT 4: (~8 Lecture Hours)

Data handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT 5: (~8 Lecture Hours)

Analog PLC operation

Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning.

Text Books:

1. John W Webb, Ronald A Reiss, Programmable Logic Controllers: Principle and Applications, 5th Edition, PHI, 2015
2. JR Hackworth, F.D Hackworth, Programmable Logic Controllers: Programming Methods and Applications, 1st Edition, Pearson, 2006.

Reference Books:

1. L.A. Bryan and E.A. Bryan, Programmable Controllers-Theory and applications, 2nd Edition, An Industrial Text Company Publication, 1997
2. Dag H. Hanssen, Programmable Logic Controllers: A Practical Approach to IEC 61131using CODESYS, 1st Edition, John Wiley & Sons, Ltd, 2015.

Online Resources:

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

Course Outcomes:

After completion of the course, student will be able to

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

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III Year B.Tech. EEE I-Semester **L T P C**
Course Code: 125DL **3 0 0 3**

SENSORS AND TRANSDUCERS
(Professional Elective-1)

Prerequisites: Applied Physics (121AB)

Course Objectives:

1. To understand the principle of sensors and transducer technology and measurement systems
2. To provide a knowledge in Theoretical and Practical concepts of Transducers
3. To learn different sensors and their applications.
4. To learn various measurement methods of physical parameters like velocity, acceleration, torque, pressure, flow, temperature etc.

UNIT 1: (~ 6 Lecture Hours)

Introduction to Measurement Systems: General concepts and terminology, measurement systems, sensor classifications: Analog Input and Output, Digital Input and Output, General input-output configuration, methods of correction.

UNIT 2: (~ 12 Lecture Hours)

Passive Sensors:

Resistive Sensors: Potentiometers, Strain Gauges, Resistive temperature Detectors (RTDs): Three wire and four wire, Thermistors, Light-dependent Resistors (LDRs), Resistive Hygrometers.

Capacitive Sensors: Variable capacitor and Differential capacitor, Capacitive touch sensors.

Inductive Sensors: Reluctance variation sensors, Eddy current sensors, Linear Variable Differential Transformers (LVDTs), Magneto elastic sensors, Electromagnetic Sensor based on Faraday 's law of Electromagnetic induction-search coil magnetometers. Introduction to proximity sensors.

UNIT 3: (~ 11 Lecture Hours)

Self-generating Sensors:

Thermoelectric Sensors: Thermocouples-Thermo electric effects, Common thermocouples, Practical thermocouple laws, Cold junction compensation in thermocouple circuits. Thermowell.

Piezoelectric Sensors: Piezoelectric effect, piezoelectric materials, applications. Pyroelectric Sensors: Pyroelectric effect, pyroelectric materials, Radiation laws: Plank, Wein and Stefan-Boltzmann, Applications.

Photovoltaic Sensors: Photovoltaic effect, materials and applications. Hall Effect Sensors.

UNIT 4: (~ 8 Lecture Hours)

Digital Sensors: Position Encoders, Incremental position encoders, absolute position encoders, Variable frequency sensors-Quartz digital thermometers, vibrating cylinder sensors, SAW sensors, Introduction to Smart Sensors: MEMS.

UNIT 5: (~ 8 Lecture Hours)

Signal Conditioning: Voltage dividers, Wheatstone bridge, Instrumentation amplifier, Programmable gain amplifier, linearization of resistive bridge sensor, Electrostatic shield, Noise elimination using filters.

Text Books:

1. Areny, John G. Webster, Ramon Pallas – Sensors and Signal Conditioning, 2^{nd} Ed., Wiley, 2000.
2. D. Patranabis -Sensors and Transducers, TMH, 2003

Reference Books:

1. Jon Wilson -Sensor Technology Hand Book, Newne Herman, 2004
2. K. P. Neubert -Instrument Transducers, An Introduction to their Performance and Design, Oxford University Press, 2^{nd} edition, 1999.
3. E. O. Doblin -Measurement System: Applications and Design, McGraw-Hill Publications, 6^{th} Edition, 2017.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee105/preview

Course Outcomes:

After completion of the course, student will be able to

1. Classify sensors and transducers for real world applications.
2. Demonstrate the operation of resistive, inductive and capacitive sensors.
3. Demonstrate the operation of various self-generating sensors.
4. Design signal conditioning circuit for self-generating sensors.
5. Design a signal conditioning circuits for various passive sensors.
6. Demonstrate the operation of various Digital sensors and MEMS.

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III Year B.Tech. EEE I-Semester	**L T P C**
Course Code: 125PA	**3 0 0 3**

COMPUTER ORGANIZATION

(Professional Elective-2)

Prerequisites: -Analog Electronics (123AL), Digital Electronics (124BF)

Course Objectives:

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

UNIT 1: (~11 Lecture hours)

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

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

UNIT 2: (~8 Lecture hours)

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

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

UNIT 3: (~9 Lecture hours)

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

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

UNIT 4: (~9 Lecture hours)

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

UNIT 5: (~8 Lecture hours)

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

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter processor Arbitration. Inter processor Communication and Synchronization.

Text Books:

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

References:

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

Online Resources:

1. NPTEL Course on Computer Organization and Architecture by Prof. S. Raman-IITM https://www.youtube.com/ watch?v= leWKvuZVUE8& list=P LQObLunIEgaQ7Drxp8yCmsJqidgSsTqlw
2. Web Course for NPTEL on Computer Organization and Architecture - https://nptel.ac.in/courses/106103068/pdf/coa.pdf

Course Outcomes:

After completion of the course, student 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.

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III Year B.Tech. EEE I-Semester	**L T P C**
Course Code: 125DM	**3 0 0 3**

SPECIAL MACHINES
(Professional Elective-2)

Prerequisites: Field Theory and DC Machines (123AS), AC Machines (124AY)

Course Objectives:
1. To understand the principle of operation of special machines.
2. To Analyze the performance of Special Machines.
3. To Evaluate the Characteristics of the Machines and applications of the different Machines.
4. To apply control techniques for Special Machines.

UNIT 1: (~9 Lecture Hours)

Reluctance motors: Constructional features – Types –Axial and Radial flux motors – Operating principles– Variable Reluctance Motors – Voltage and Torque Equations – Phasor diagram – Performance characteristics – Applications.

UNIT 2: (~9 Lecture Hours)

Stepper Motors: Constructional features – Principle of operation –Variable reluctance motor – Hybrid motor – Single and multi-stack configurations – Torque equations – Modes of excitation – Characteristics– Drive circuits – Control of stepper motors – Closed loop Control-Concept of lead angle– Applications.

UNIT 3: (~9 Lecture Hours)

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

UNIT 4: (~9 Lecture Hours)

Brushless DC Motors (BLDC): Permanent Magnet materials– Minor hysteresis loop and recoil line- Magnetic characteristics-Permeance coefficient - Principle of operation – Types – Magnetic circuit analysis-EMF and torque equations-Commutation-Power Converter Circuits and their Controllers-Motor characteristics and control–Applications.

UNIT 5: (~9 Lecture Hours)

Permanent Magnet Synchronous Motors (PMSM): Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings – Phasor diagram–

Torque/speed characteristics – Power controllers – Converter Volt-ampere requirements– Applications.

Text Books:

1. K. Venkataratnam, Special Electrical Machines, Universities Press (India) Private Limited, 2008
2. T.J.E. Miller, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Second edition,1993.

Reference Books:

1. R. Krishnan, Switched Reluctance Motor Drives-Modelling, Simulation, Analysis, Design and Application, CRC Press, New York, 2001.
2. Paul Acamley, "Stepping Motors – A Guide to Motor Theory and Practice", IET Publishers, Fourth Edition,2002.
3. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press.
4. E.G. Janardanan, Special Electrical Machines, PHI learning Private Limited, Delhi, 2014.

Online Resources:

1. https://nptel.ac.in/courses/108/102/108102156/
2. https://new.abb.com/motors-generators/iec-low-voltage-motors/process-performance-motors/synchronous-reluctance-motors
3. http://www.ee.iitb.ac.in/~ccgroup/old/Lab_pages/experiment_files/manual_stepper.motor.study.pdf

Course Outcomes:

After completion of the course, student will be able to

1. Identify the Principle of operation of different Machines.
2. Describe the constructional features and types of different machines.
3. Understand the various speed control methods of different machines.
4. Analyze the control operations of different machines.
5. Justify the suitable power converter circuit configuration in different machines.
6. Build the real time applications of different machines.

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III Year B.Tech. EEE I-Semester **L T P C**
Course Code: 125PA **3 0 0 3**

ELECTRICAL MACHINE MODELLING & ANALYSIS

(Professional Elective-2)

Prerequisites: Field Theory and DC Machines (123AS), AC Machines (124AY)

Course Objectives:

1. To acquire the knowledge of generalized theory of electrical machines.
2. To represent the DC and AC machines as Basic Two Pole machines.
3. To model the electrical machines with voltage, current, torque, and speed equations.
4. To investigate the steady state behavior of the electrical machines.

UNIT 1: (~9 Lecture Hours)

Basic concepts of Modelling: Basic Two-pole Machine representation of DC machines, 3-phase synchronous machine, and 3-phase induction machine, Kron's Primitive 2- axis Machine -voltage, current and Torque equations.

UNIT 2: (~9 Lecture Hours)

DC Machine Modelling: Mathematical model of separately excited D.C machine, D.C Series machine and D.C Shunt machine instate variable form, Transfer function of the motor - Numerical.

UNIT 3: (~9 Lecture Hours)

Linear Transformation: Phase transformations: Park's Transformation (a, b, c to á, â), Inverse Park's transformation ((á, âto a, b, c)– Active transformation (á, â, to d, q), Circuit model of a 3 phase Induction motor– Linear transformation - Phase Transformation –Transformation to a Reference frame – Two axis models for induction motor.

UNIT 4: (~9 Lecture Hours)

Modelling of three phase Induction Machine: Voltage and current Equations in stator reference frame – equation in Rotor reference frame– Equations in arbitrary Reference frame, Equations in state space form, Torque equation.

UNIT 5: (~9 Lecture Hours)

Modelling of Synchronous Machine: Two-axis representation of synchronous Motor, Synchronous machine inductances - voltage equations in the Stator reference frame, Equations in state space form, Torque equation.

Text Books:

1. P.C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Analysis of Electrical Machinery and Drive Systems, 3rd Edition, IEEE Press, 2013.

2. P.S. Bhimbra, Generalized theory of Electrical Machines, 7th Edition, Khanna Publishers, 2021.

Reference Books:

1. R. Krishnan, Electric Motor Drives - Modeling, Analysis & Control, 1st Edition, Pearson Publications, 2015.
2. Vedam Subramanyam, Thyristor Control of Electric Drives, Tata McGraw Hill Education, 2017.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/106/108106023/

Course Outcomes:

After completion of the course, student will be able to

1. Apply knowledge of transformation to model various AC and DC machines.
2. Develop mathematical models for different types of DC motors to apt various applications.
3. Acquire knowledge of reference frame theory for AC machines.
4. Evaluate the steady state and transient behaviour of AC machines to propose the suitability of drives for different industrial applications.
5. Formulate the 2-Phase induction and Synchronous machine using voltage and current equations.
6. Apply knowledge of 2- axis concept to obtain the torque equation of AC and DC motors.

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III Year B.Tech. EEE I-Semester **L T P C**
Course Code: 125CM **3 0 0 3**

FUEL CELL TECHNOLOGIES
(Professional Elective-2)

Prerequisites: Applied Chemistry (121AA), Electrical Circuit Analysis (123AQ).

Course Objectives:
1. Understand the principles, working mechanisms, and design concepts of fuel cell technologies.
2. Analyze the performance and efficiency of fuel cell systems through modeling and simulation.
3. Evaluate the applications, advantages, and disadvantages of fuel cell technologies in different sectors.

UNIT 1: (~ 8 Lecture Hours)

Introduction to Fuel Cell Technologies

Overview of fuel cell technologies, Types of fuel cells and their operating principles, Electro chemical reactions in fuel cells, Fuel cell system components and configurations, Comparison with conventional energy sources.

UNIT 2: (~ 8 Lecture Hours)

Design Concepts of Fuel Cell Systems

Fuel cell stack design and construction, Proton Exchange Membrane (PEM) fuel cell design considerations, Solid Oxide Fuel Cell (SOFC) design considerations, Balance of Plant (BOP) components and their integration, Thermal management and water management in fuel cell systems.

UNIT 3: (~ 8 Lecture Hours)

Performance Analysis of Fuel Cell Systems

Efficiency and power output characteristics of fuel cells, Voltage-current characteristics and polarization phenomena, Fuel cell modeling and simulation, Fuel utilization and fuel efficiency, Durability and degradation analysis.

UNIT 4: (~ 8 Lecture Hours)

Applications of Fuel Cell Technologies

Transportation applications: automotive, buses, and trains, Stationary power generation applications, Portable power and auxiliary power unit (APU) applications, Integration with renewable energy sources, applications and market trends.

UNIT 5: (~ 8 Lecture Hours)

Environmental impacts and challenges of Fuel Cell Technologies

Environmental benefits and reduced emissions, Energy efficiency and fuel flexibility, Safety considerations, hydrogen infrastructure Cost considerations, commercial viability Challenges and limitations of fuel cell technologies.

Text Books:

1. Fuel Cell Systems Explained by Andrew L. Dicks, David A. J. Rand, Third Edition, John Wiley & Sons Ltd. 2018
2. Fuel Cell Science and Engineering, Materials, Processes, Systems and Technology, Volume 2, Wiley-VCH, 2011

Reference Books:

1. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi Modern Electric, Hybrid Electric and Fuel Cell Vehicles-Fundamentals, Theory and Design, CRC Press, 2005.

Online Reference:

1. https://archive.nptel.ac.in/courses/103/102/103102015/#:~:text=Fuel%20cells%20are%20silent%20as,the%20efficiency%20could%20be%20100%25.

Course Outcomes:

After completion of the course, student will be able to

1. Describe the operating principles and characteristics of different types of fuel cells.
2. Design and analyze fuel cell systems, considering performance parameters and system integration.
3. Evaluate the performance and efficiency of fuel cell systems using modeling and simulation techniques.
4. Analyze the applications and potential benefits of fuel cell technologies in various sectors.
5. Assess the advantages and disadvantages of fuel cell technologies, considering economic, environmental, and safety aspects.
6. Apply knowledge of fuel cell technologies to propose sustainable energy solutions for real-world applications.

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III Year B.Tech. EEE I-Semester	**L T P C**
Course Code: 12528	**0 0 2 1**

ADVANCED COMMUNICATION SKILLS LAB

Prerequisites: -Nil-

Course Objectives:

1. To address various challenges of communication as well as personality traits faced by individuals at workplace and organizations through case studies and interactions.
2. To help the students engage with each other's 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.

1. Fundamentals of Interpersonal Communication Skills (ICS) :

Definition of ICS – Types of ICS : Verbal, Written and Non-verbal - Forms of ICS : Face-to-face conversation: Phone calls, E-mails and Video conference – Stages of ICS : Acquaintance, Build-up, continuation, bringing to a close, ending – Principles of ICS – a sender, a receiver, medium, encoding, decoding and feedback – Strategies for effective ICS – Objectives of ICS - Barriers to ICS.

Activities :

- Role plays on Conflict management, Negotiation, Problem solving, Assertiveness
- Conducting a meeting
- E-mail etiquette and netiquette
- Scenario based Role-plays
- Case study based Role-plays

2. Reading Comprehension Skills (RCS) :

Importance of RCS : Understanding grammar, vocabulary and semantics – Benefits of RCS – strategies to improve RCS : Skimming, Scanning, Visualization, Summarizing, Questioning, Predicting – Essential skills for RCS : Decoding, Fluency, Vocabulary, Coherence – Schema in reading through – stories, poetry and dramas.

Activities :

- Paraphrasing the Reading passage.
- Critical Analysis of the Reading passage.
- Vocabulary and Grammar Quizzes/Exercises.

3. Writing Skills (WS) :

Importance of WS : The message with clarity and ease to larger audience – Basic elements of writing : Spelling, Capitalization, Punctuation, Sentence structure, handwriting – Essential steps of writing : Planning, Drafting, Sharing, Evaluating, Revising, Editing and Publishing – Types of writing : Essays-Expository, Descriptive, Persuasive and Narrative; Journal Writing, reflective Writing – Structure of writing : Process writing : Paragraph writing, Essay writing; Product writing: Report writing, Resume writing and SOP writing.

Activities :

- Drafting a Report.
- Building a Resume.
- Writing Statement of Purpose (SOP)

4. Presentation Skills (PS) :

Definition of PS – Types of presentation : Informative, Instructional and persuasive – Stages of oral presentation : Identifying purpose, planning, preparation, presenting, concluding and handling Q & A's – Guidelines for Power Point presentation: Content on each slide, font sizes, visual images, number of slides, tools used for PPT.

Activities :

- Poster Presentation.
- Pecha Kucha Presentation.
- Field Research Project Presentation.
- Project elevator pitch

5. Personal Branding and Self Development (PB&SD):

Definition of Personal Branding – Importance of PB – Self assessment based on purpose, values, authenticity, strengths achievements and credentials – ways to create personal branding – Understanding the importance of soft skills for self-development and professional development : Communication, being engaged, ability to participate fully, to think critically, to demonstrate leadership, to develop team building.

Activities :

- Self-Introduction. (personal elevator pitch)
- Mock Interviews.
- Group Discussions.

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*, PH1 Learning Pvt. Ltd., (2011).

3. Sanjay Kumar and PushpLata, *Communication Skills,* Oxford Higher Education, 2nd Education (2015).

Online Resources:

1. https://onlinecourses.swayam2.ac.in/ntr23_ed43/preview
2. https://onlinecourses.swayam2.ac.in/nou23_cm21/preview
3. https://onlinecourses.nptel.ac.in/noc23_hs146/preview
4. https://onlinecourses.nptel.ac.in/noc23_hs115/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.

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III Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: 12535	**0**	**0**	**3**	**1.5**

MICROPROCESSORS AND MICROCONTROLLERS LAB

(Common to ECE, ETE & EEE)

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 ìicro Vision IDE for 8051.

1. Write a program for 16 bit arithmetic, logical, shift, rotate operations for 8086.
2. Write a program for 16 bit sorting an array for 8086.
3. Write a program for string manipulations (searching a character, insertion, deletion, comparison) using string instructions of 8086.
4. Write a program using arithmetic, logical and bit manipulation instructions of 8051.
5. Write a program to interface LEDs to 8051.
6. Write a program to generate a square wave of 50% duty cycle on the P1.5 bit using Timer 0 for generating the time delay and calculate the delay generated.
7. Write a program to configure external Interrupts INT0 and INT1 as interrupt request resources and turn on LEDs respectively in 8051.
8. Write a program for serial communication from PC to 8051.
9. Write a program to interface stepper motor with 8051.
10. Write a program to interface Seven Segment Display to 8051.
11. Write a program to interface LCD to 8051.
12. Write a program to interface 4X4 Matrix Keyboard to 8051.
13. Write a program to interface 8bit ADC to 8051.
14. Write a program to generate a triangular wave using DAC interface to 8051.

Note: Minimum of 12 experiments to be conducted.

Text Books:

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

Online Resources:

1. https://www.alldatasheet.com/datasheet-pdf/pdf/1154707/INTEL/8086.html
2. https://tasm-editor.soft112.com/
3. https://www.keil.com/https://lecturenotes.in/subject/22/microprocessor-and-microcontroller-mpmc

Course Outcomes (COs):

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 8051microcontroller.
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.

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III Year B.Tech. EEE I-Semester	**L**	**T**	**P**	**C**
Course Code: 12532	**0**	**0**	**3**	**1.5**

CONTROL SYSTEMS LAB

Prerequisites: 122AC: Basic Electrical Engineering, 124BD: Control systems

Course Objectives:

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

List of Experiments

Part -A (All Experiments are compulsory)

The following are compulsory experiments:

1. Time domain analysis of Second order system
2. Characteristics of Synchro transmitter.
3. Programmable logic Controller-Study and verification of truth tables of logic gates, simple Boolean expressions.
4. Effect of Feedback on AC and DC servo motors.
5. Transfer function of DC motor & DC generator
6. Temperature controller using PID.
7. Effect of P, PI, PD, PID Controller on a second order system.
8. Frequency domain analysis of compensating networks.

Part -B (Any Two Experiments)

1. Simulation of P, PI, PID Controller using MATLAB
2. Step response of second order system (Time domain analysis & Error analysis) using MATLAB/SIMULINK.
3. State space model for a classical transfer function using MATLAB.
4. Design of Lead-Lag compensator for the given system and with specification using MATLAB.
5. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant systems using MATLAB.

Text Books:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 4th edition 2016.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 9th edition 2014.

Reference Books:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th edition 2009.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 7th edition 2021.

Course Outcomes:

After completion of the course, student will be able to

1. Obtain & analyze the transfer function of DC Motor and DC Generators.
2. Develop the logic to realize the Boolean expressions for Programmable logic controllers.
3. Analyze the time response of second order RLC system.
4. Analyze the P PI and PID controllers on the second order systems.
5. Design & simulate Lag, Lead and Lag- Lead compensators.
6. Analyze by Simulation State space models, stability by root locus and bode plots for a given classical transfer function using MATLAB.

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III Year B.Tech. EEE II-Semester **L T P C**
Course Code: 126EG **3 0 0 3**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common to CSE, CSD, CSM, CST, ECE, EEE, ETE & IT)

Prerequisites: Nil

Course Objectives:

1. Provide the basic concepts of Managerial economics.
2. Interlink the concepts of Managerial economics for effective business decision making.
3. Provide Fundamental knowledge in accounting and interpretation of the statements.

UNIT 1: (~10 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.

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

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

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

UNIT 2: (~08 Lecture Hours)

Production and Cost Analysis:

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.

Cost Analysis: Cost classification - Cost concepts relevant for Managerial decision making – Cost relationship – Determinants of cost.

UNIT 3: (~10 Lecture Hours)

Break Even Analysis, Market Structures and Pricing

Break Even Analysis: Need - Scope and Significance – Assumptions - Advantages and Limitations -Practical Applications (with simple problems).

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 Concepts and Conventions - Accounting Terminology. Journal - Ledger - Trial Balance - Final Accounts with Adjustments (Simple Problems).

UNIT 5: (~10 Lecture Hours)

Financial Analysis and Interpretation

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

Text Books:

1. P L Mehta (2016) Managerial Economics- Analysis, Problems & Cases, 21st Edition, Sultan Chand & Sons.
2. T.S.Grewal (2006) Double Entry Bookkeeping, Sultan Chand & Sons.

Reference Books:

1. D.N.Dwivedi (2016) Managerial Economics, 8th Edition, Vikas Publishing House Pvt. Ltd.
2. S.N. Maheshwari, Suneel K Maheshwari, Sharad K. Maheshwari (2018) Financial Accounting, 6th Edition, Vikas Publishing House Pvt. Ltd.
3. I.M.Pandey (2021) Financial Management, 12th Edition, Pearson.
4. R.L.Varshney, K.L Maheshwari (2004) Managerial Economics, 22nd Revised Edition, Sultan Chand & Sons.

Online Resources:

1. Managerial Economics https://onlinecourses.nptel.ac.in/noc20_mg67/preview
2. Financial Accounting http://nptel.ac.in/courses/110107073/

Course Outcomes:

After completion of the course, student will be able to

1. Understand the Basic Concepts of Managerial Economics.
2. Demonstrate the significance of Demand, its analysis and forecasting for decision making.
3. Apply the theory of Production function and Cost concepts for problem solving and decision making.
4. Analyze different Market structures & pricing strategies for business decision making.
5. Evaluate the concepts of Accounting for Business decision making.
6. Interpret the Financial Statements for management decision making.

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III Year B.Tech. EEE II-Semester	**L T P C**
Course Code: 126EL	**3 0 0 3**

POWER SYSTEM PROTECTION

Prerequisites: Power Systems –I (124BM), Power Systems- II (125DC), Microprocessors and Microcontrollers (125CY).

Course Objectives:

1. To understand all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars.
2. To describe neutral grounding for overall protection.
3. To understand microprocessor based protective relays.
4. To understand system protection schemes.

UNIT 1: (~9 Lecture hours)

Circuit Breakers: Types of MCB, fuses, fuse characteristics, Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages. - Restriking Phenomenon, Average and Maximum RRRV, Numerical Problems – Current Chopping and Resistance Switching-CB ratings and Specifications, Numerical Problems. Types of circuit breakers: Minimum Oil, Air Blast, Vacuum, and SF_6 circuit breakers.

UNIT 2: (~9 Lecture hours)

Relays: Principle of Electromagnetic Relay, Induction type relays, Types of Over Current Relays**:** Instantaneous, DMT and IDMT types. Applications of relays: Over current relays, Directional relays. Universal torque equation, Distance relays: Impedance, Reactance, Mho and Off-Set Mho relays, Characteristics of Distance Relays.

UNIT 3: (~10 Lecture hours)

Microprocessor Based Protective Relays: Over Current Relay, Impedance Relay, Reactance Relay, Mho Relay, Offset Mho Relay and Directional Relay, earth fault and differential relay. Comparison of digital relays Vs electromagnetic relays.

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

UNIT 4: (~10 Lecture hours)

Protection of Power Equipment: Protection of generators against Stator and Rotor faults. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems. Protection of transformers**:** Percentage Differential Protection, Numerical Problem on Design of CT Ratio, Buchholtz relay. Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay. Protection of Bus bars-Differential protection.

UNIT 5: (~7 Lecture hours)

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

Text Books:

1. BadriRam, D.N. Viswakarma, Power System Protection and Switchgear, 2nd Edition, TMH Publications, 2018.
2. Sunil S Rao, Switchgear and Protection, 10th Edition, Khanna Publishers, 2018.

Reference Books:

1. J. L.Blackburn, Protective Relaying: Principles and Applications, Marcel Dekker, 3rd Edition, New York, 2007.
2. A.G. Phadke, J. S. Thorp, Synchronized Phasor Measurements and their Applications, Springer science & Business Media, LLC, 2008.
3. D. Reimert, Protective Relaying for Power Generation Systems, Taylor and Francis, CRC Press, 2006.
4. J.B. Gupta, Switchgear and Protection, 3rd Edition, S.K. Kataria & Sons, 2019.

Online Resources:

1. https://www.classcentral.com/course/swayam-power-system-protection-19974

Course Outcomes:

After completion of the course, student will be able to

1. Classify the types of fuses and Circuit breakers.
2. Choose Relays for appropriate protection of power system equipment.
3. Analyse various types of Protective devices in Electrical Power Systems.
4. Interpret the importance of Neutral Grounding, Effects of Ungrounded Neutral grounding on system performance, Methods and Practices
5. Illustrate various digital protection relays.
6. Analyze various system protection schemes.

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III Year B.Tech. EEE II-Semesterr **L T P C**

Course Code: 126EK **3 1 0 4**

POWER SYSTEM ANALYSIS

Prerequisites: Power Systems –I (124BM), Power Systems- II (125DC)

Course Objectives:

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

UNIT 1: (~9 Lecture Hours)

Network Matrices: Transmission Network Representations: Bus Admittance frame and Bus Impedance frame. Formation of Y-BUS: Inspection method, Singular Transformation Method, Numerical Problems.

Formation of Z-BUS from Y-BUS, Direct method of Z-Bus, Numerical Problems.

UNIT 2: (~10 Lecture Hours)

Power Flow Studies-I: Necessity of Power Flow Studies – Data for Power Flow Studies –Static Load Flow Equations – Load Flow Solutions Using Gauss Seidel Method, Acceleration Factor, Load Flow Solution, Algorithm and Flowchart, Numerical Load Flow Solution for Simple Power Systems (Max. 3-Buses).

UNIT 3: (~9 Lecture Hours)

Power Flow Studies-II: Newton Raphson Method of Load flow solution, Rectangular and Polar Co-ordinates Form, Jacobian Elements, Algorithm and Flowchart, Decoupled and Fast Decoupled Methods, Comparison of Different Methods – DC Load Flow (Max. 3-Buses).

UNIT 4: (~9 Lecture Hours)

Short Circuit Analysis: Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems.

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems. Symmetrical Components, sequence impedances and networks, Numerical Problems.

Unsymmetrical Fault Analysis: Fault current calculations for LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT 5: (~9 Lecture Hours)

Power System Stability Analysis: Introduction to Power System Stability issues. Rotor dynamics & Swing equation, Power angle equation, Steady State Stability, Classical representation of system and its assumptions, Determination of Transient Stability through Equal Area Criterion for single machine infinite system, Critical clearing angle & time, Methods to improve Stability, Numerical problems.

Text Books:

1. I.J. Nagrath & D. P. Kothari Modern Power System Analysis, 4th Edition, Tata McGraw-Hill Publishing Company, 2011.
2. John J.Grainer & W.D.Stevenson Power System Analysis, 1st Edition, McGraw Hill Education; July 2017.

Reference Books:

1. Dr. K.Uma Rao, Computer Techniques and Models in Power Systems, 2nd Revised Edition, I.K.International, 2014.
2. Glenn W.Stagg, Ahmed H. El-Abiad, Computer Methods in Power System Analysis, McGraw-Hill Publishing Company
3. Olle. I. Elgerd, Electric Energy Systems Theory – An Introduction, 30th Reprint, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2007.
4. Hadi Saadat, Power System Analysis, 3rd Edition TMH, 2011.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105067/

Course Outcomes:

After completion of the course, student will be able to

1. Develop Ybus , Zbus matrices for the power system networks
2. Perform the load flow analysis of power system networks using Gauss-Seidel, Newton-Raphson methods.
3. Perform the load flow analysis of power system networks using decoupled and fast decoupled method.
4. Analyze symmetrical faults in power system networks.
5. Analyze unsymmetrical faults in power system networks.
6. Estimate the Transient and steady state Stability for single machine infinite system.

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III Year B. Tech EEE II-Semester **L T P C**
Course Code: 126ER **3 0 0 3**

UTILIZATION OF ELECTRICAL ENERGY

(Professional Elective-3)

Prerequisites: Field theory and DC Machines (123AS), AC Machines (124AY).

Course Objectives:

1. To study various types of electric drives and their characteristics.
2. To understand applications of electrical energy for heating and welding etc.
3. To understand principles of illumination.
4. To understand various traction systems and types of services.
5. To understand modified train lighting systems adopted by Indian Railway system.

UNIT 1:(~10 Lecture Hours)

Conservation of Energy: Energy **c**onservation and selection of equipment as per BEE (Bureau of Energy Efficiency). Advantages of energy conservation, Energy policy in India, Need and significance of energy stars.

Electric Heating &Welding: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating. Resistance and arc welding, electric welding equipment, comparison between A.C and D.C welding.

UNIT 2: (~10 Lecture Hours)

Illumination: Introduction, terms used in illumination, laws of Illumination, polar curves, photometry, integrating sphere, sources of light. Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps, fluorescent tubes and LED lamps, Basic principles of light control, Types and design of lighting and flood lighting as per BIS.

UNIT 3: (~10 Lecture Hours)

Electric Drives: Temperature rise in drives, types of industrial loads: continuous, intermittent and variable loads, load equalization [Elementary treatment only].

Electric Traction-I: System of electric traction and track electrification, Review of existing electric traction system in India. Special features of traction motor, Mechanism of train movement, Speed-time curves for different services- trapezoidal and quadrilateral speed time curve.

UNIT 4: (~7 Lecture Hours)

Electric Traction-II: Calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

UNIT 5: (~8 Lecture Hours)

Train Lighting: Systems of train lighting, Special requirements of train lighting, Single Battery system, Double Battery parallel block systems, Modified Train Lighting System, construction of DC dynamo, Silicon Blocker Rectifier, End on generation and Head on generation.

Text Books:

1. H. Partab, Art & science of Utilization of Electrical Energy, Dhanpat Rai & Sons-2017.
2. G. C. Garg, Utilization of Electric power and Electric Traction, 3rd Edition, Khanna Publishers, 2004.

Reference Books:

1. R.K.Rajput, Utilization of Electrical Power, 2nd Edition, Laxmi Publications, 2014.
2. C.L.Wadhwa, Generation, Distribution and Utilization of Electrical Energy, 3rd Edition, New Age International (P) Limited, 2010.
3. N.V. Suryanarayana, Utilization of electrical Power including Electric drives and Electric traction, 2nd Edition, New Age International (P) Ltd, 2014.
4. H. Partab, Modern Electric Traction, Dhanpat Rai and Sons, 2018.

Online Resources:

1. https://nptel.ac.in/courses/108/105/108105060/
2. www.irieen.com (Indian Railways Institute of Electrical Engineering, Nasik Road).
3. https://scr.indianrailways.gov.in/uploads/files/1341896144130

E-Text Books:

1. https://www.freebookcentre.net
2. Beeindia.gov.in

Course Outcomes:

After completion of the course, student will be able to

1. Categorize and analyze different aspects & methods of utilization of electrical energy from both and industrial perspective and also acquire knowledge about characteristics of various Electric Drives.
2. Identify the type of device/scheme for utilizing of electrical energy for a given application.

3. Design some of the electrical energy utilization systems namely Heating equipment and Lighting schemes etc.
4. Apply the concepts of utilization of electrical energy to determine the ratings, specifications for different types of services namely traction, heating and illumination.
5. Choose a suitable method for Heating, Welding, Illumination and Traction systems.
6. Acquire knowledge about various train lighting systems.

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III Year B. Tech EEE II-Semester **L T P C**
Course Code: 126EN **3 0 0 3**

SMART ELECTRIC GRID

(Professional Elective 3)

Prerequisites: Power Systems-II (125DC).

Course Objectives:

1. To group various aspects of the smart grid.
2. To defend smart grid design to meet the needs of a utility.
3. To select issues and challenges that remain to be solved.
4. To analyze basics of electricity, electricity generation, economics of supply and demand, and the various aspects of electricity market operations in both regulated and deregulated environment.

UNIT 1: (~8 Lecture Hours)

Introduction: Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation- Attributes of the smart grid- Alternate views of a smart grid.

Smart Grid to Evolve a Perfect Power System: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT 2: (~8 Lecture Hours)

DC Distribution and Smart Grid: AC vs DC sources-Benefits and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

Intelligrid Architecture for the Smart grid: Introduction- Launching intelligrid- Intelligrid today- Smart grid vision based on the intelligrid Architecture-Barriers and enabling technologies. SCADA, synchro phasors, WAMS.

UNIT 3: (~10 Lecture Hours)

Dynamic Energy Systems Concept: Smart energy efficient end use Devices-Smart distributed energy Resources-Advanced whole building control systems- Integrated Communications Architecture-Energy Management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- advanced whole building control systems and dynamic energy management system, Net zero building.

UNIT 4: (~8 Lecture Hours)

Energy Port As Part Of The Smart Grid: Concept of energy -Port, generic features of the energy port. Policies and Programs to Encourage End – Use Energy Efficiency, Policies and programs in action: multinational - national-state-city and corporate levels.

Market Implementation: Framework-factors influencing customer acceptance and response-program planning-monitoring and evaluation. Concepts of power trading, power exchanges - IEX, power exchange of India, Hindustan power exchanger.

UNIT 5: (~10 Lecture Hours)

Efficient Electric End–Use Technology Alternatives: Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency-LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

Text Books:

1. Clark W Gellings, The Smart Grid, Enabling Energy Efficiency and Demand Side Response- CRC Press, 2009.
2. Jean-Claude Sabonnadiere, Nouredine Hadjsaid, Smart Grids, Wiley-ISTE, IEEE Press, May 2012.

Reference Books:

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins, Smart Grid: Technology and Applications, Wiley, 2012.
2. James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley, IEEE Press, 2012.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/107/108107113/
2. https://www.classcentral.com/course/swayam-introduction-to-smart-grid-14165

Course Outcomes:

After completion of the course, student will be able to

1. Recite the structure of an electricity market in either regulated or deregulated market conditions.
2. Understand the advantages of DC distribution and developing technologies in distribution.

3. Discriminate the trade-off between economics and reliability of an electric power system, differentiate various investment options (e.g., generation capacities, transmission, renewable, demand-side resources etc.) in electricity markets.
4. Analyze the development of smart and intelligent domestic systems.
5. Implement the market by framing the factors to influence the customer acceptance and response.
6. Identify the efficient electric end use alternative technologies.

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III Year B. Tech EEE II-Semester **L T P C**
Course Code: 126DZ **3 0 0 3**

HIGH VOLTAGE ENGINEERING

(Professional Elective-3)

Prerequisites: Power Systems-II (125DC).

Course Objectives:

1. To understand Breakdown phenomenon in gaseous, liquids and solids dielectrics.
2. To study Generation and measurements of High voltages and currents.
3. To understand Over Voltages Phenomenon and Protection against over voltages.
4. To know the different methods for testing of electrical apparatus and layout of HV laboratories.

UNIT 1: (~10Lecture Hours)

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

UNIT 2: (~9Lecture Hours)

Generation of High Voltages: Generation of high DC and AC voltages, generation of impulse voltages and impulse currents, tripping and control of impulse generators.

UNIT 3: (~7Lecture Hours)

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

UNIT 4: (~8Lecture Hours)

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

UNIT 5:(~9Lecture Hours)

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

Text Books:

1. M.S.Naidu,V.Kamaraju, High Voltage Engineering, McGraw Hill Education, 2020.
2. C.L.Wadhwa, High Voltage Engineering, 3rdEdition, NewAgeScience, 2012.

Reference Books:

1. E.Kuffel,W.S.Zaengl, J.Kuffel, HighVoltage Engineering Fundamentals, Newnes Publication, 2000.
2. SubirRay, An Introduction to High Voltage Engineering, PHI Learning Pvt. Ltd, 2nd Edition , 2013.
3. IS standard booklets for HV Laboratory Techniques and Testing.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104048/

Course Outcomes:

After completion of the course, student will be able to

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

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

Course Code: 126DP **3 0 0 3**

COMPUTER AIDED MACHINE DESIGN

(Professional Elective-3)

Prerequisites: 123AS: Field Theory and DC Machines, 124AY:AC Machines

Course Objectives:

1. To impart the knowledge on selection of suitable materials based on their electrical and thermal properties.
2. To design aspects of field and armature windings and formulation of objective functions for different types of machines.
3. To understand the optimal design aspect of algorithms for electrical machines.

UNIT 1: (~10 Lecture Hours)

Basic Concepts of Electric Machine Design:

Introduction- Specification- Output Coefficient- Importance of Specific Loadings- Electrical Materials- Magnetic Circuit Calculations- General Procedure for Calculation of Amp-Turns- Heating & Cooling- Modes of Heat Dissipation- Standard Rating of Electrical Machines- Ventilation Schemes- Quantity of Cooling Medium - Types of Enclosures- General Design Procedure- Steps to Get Optimal Design.

UNIT 2: (~8 Lecture Hours)

Design of DC machine:

Design of armature- Windings and field systems- Selection of variables for optimal design- Formulation of design equations- Objective function- Constraint functions- Algorithms for optimal design.

UNIT 3: (~9 Lecture Hours)

Design of power transformer:

Design of magnetic circuit- Design of windings- Selection of variables for optimal design- Formulation of design Equations-Objective function, Constraint functions- Algorithms for optimal design.

UNIT 4: (~9 Lecture Hours)

Design of 3-phase Induction motor:

Design of stator- Windings, Design of squirrel cage rotor - Design of slip ring rotor- Selection of variables for optimal design- Formulation of design equations- Objective Functions, Constraint functions- Algorithms for optimal design.

UNIT 5: (~9 Lecture Hours)

Optimal design for 3-phase Alternator:

Design of stator- windings- Design of Field systems for salient pole and non-salient pole machines- Selection of variables for optimal design- Formulation of design equations- Objective function - Constraint functions - Algorithms for optimal design.

Text Books:

1. S.K. Sen-"Principles of Electrical Machine Design with Computer Programmes" Oxford & IBH Publishing Co, Second edition, 2006.
2. MV Deshpandey– "Design and Testing of Electrical Machines" PHI Learning, Third Edition, 2010.

Reference Books:

1. A.K.Sawhney – "A Course in Electrical Machine Design" Dhanpat Rai And sons,10th Edition, - New Delhi.
2. K.M.Vishnu, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
3. R. K. Agarwal, "Principles of Electrical Machine Design", S.K.Kataria & Sons, Fifth Edition 2016, New Delhi.

Online Resources:

1. https://nptel.ac.in/courses/108106023
2. https://mitpress.mit.edu/9780262220163/computer-aided-design-of-electric-machinery/

Course Outcomes:

After completion of the course, student will be able to

1. Understand the basic concepts involved in electric machine design.
2. Analyze the significance of selection of variable for optimal design for optimal design in DC machines.
3. Apply the formulation of design aspects in magnetic circuits and selection of variables for optimal design.
4. Design the rotor windings of induction motor and develop the equations for constraint functions in the optimal design of algorithms.
5. Discriminate the design of field system for salient and non-salient pole machine and emphasis on the formulation of design aspects for objective and constraint functions.
6. Generalize the computer aided optimization techniques for design of electrical machines.

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III Year B.Tech. EEE II-Semester **L T P C**
Course Code: 12646 **0 0 2 1**

POWER ELECTRONICS LAB

Prerequisites: Power Electronics (125DB).

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

List of Experiments

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

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

Text Books:

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

Reference Books:

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

Online Resources:

1. https://www.youtube.com/playlist?list=PLA07ACBDE053A8229

Course Outcomes:

After completion of the course, student will be able to

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

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

Course Code: 12636 **0 0 2 1**

JAVA PROGRAMMING LAB

Prerequisites: Programming for Problem Solving (121AH), JAVA Programming (125BK).

Course Objectives:

1. Develop skills to apply object oriented programming in problem solving.
2. Demonstrate the use of inheritance and interfaces.
3. Implement the concepts of exception handling and multithreading.
4. Solve problems using java collection framework and I/O classes.
5. Write GUI programs using applets and swing controls.

Note: Use Linux/Windows for Lab Experiments. Though not mandatory, encourage the use of the Eclipse platform.

List of Experiments:

Week 1:

Write a Java program that prints all real solutions to the quadratic equation $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula. If the discriminant b2-4ac is negative, display a message stating that there are no real solutions.

Week 2:

a. Write a Java program that checks whether the given string is a palindrome or not.
b. Write a Java program to multiply given 3X3 matrices.

Week 3:

a. Write a Java program that accepts a number from the end-user and then prints all prime numbers up to a given number.
b. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

   If the type of the EB connection is domestic, calculate the amount to be paid as follows:

   First 100 units - Rs. 2 per unit

   101-200 units - Rs. 3.50 per unit

   201 -500 units - Rs. 5 per unit

   Above 501 units - Rs. 6 per unit

If the type of the EB connection is commercial, calculate the amount to be paid as follows:

First 100 units - Rs. 4 per unit

101-200 units - Rs. 6 per unit

201 -500 units - Rs.7 per unit

& > 501 units - Rs. 10 per unit

Week 4:

a. Write a Java program that demonstrates constructor overloading.

b. Write a Java program to implement the use of inner classes.

Week 5:

a. Write a Java program that demonstrates the following:

   i. Method overloading

   ii. Method overriding.

b. Write a Java program to create an abstract class named 'Shape' that contains two integers and an empty method named printArea( ). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.

Week 6:

Develop a java Program for Payslip generation using the Concept of inheritance with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

Week 7:

a. Write a Java program that implements a multi-threaded application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

b. Write a Java program that implements producer – consumer problem using the concept of Inter thread communication.

Week 8:

Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use Adapter classes).

Week 9:

Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 are not integers, the program would throw a Number Format Exception. If Num2 is Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

Week 10:

Write a Java program that works as a simple calculator. Use a Grid Layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

Week 11:

a. Write a Java program to list all the files in a directory including the files present in all its subdirectories.
b. Write a Java program for the following:
   i) Create a doubly linked list of elements.
   ii) Delete a given element from the above list.
   iii) Display the contents of the list after deletion.

Week 12:

Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record is separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).

Text Books:

1. Herbert Schildt, Java: The Complete Reference, 10th Edition, McGraw Hill Education (India) Pvt. Ltd.
2. Jim Keogh, J2EE: The Complete Reference, McGraw Hill Education (India) Pvt. Ltd., 2017.

Reference Books:

1. Timothy Budd, Understanding Object-Oriented Programming with Java, updated Edition, Pearson Education.
2. Y. Daniel Liang, Introduction to Java Programming, Comprehensive Version, 7th Edition, Pearson Education.
3. H.M. Dietel and Dietel, Java – How to Program, 6th Edition, Pearson Education/PHI.

Online Resources:

1. https://docs.oracle.com/javase/tutorial/java/TOC.html
2. https://onlinecourses.nptel.ac.in/noc22_cs47/preview
3. www.javatpoint.com/java-tutorial

Course Outcomes

After completion of the course, student will be able to

1. Implement the concepts of object oriented programming to solve problems.
2. Develop programs using inheritance and interfaces.
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. Develop GUI based applications using applets and swing controls.

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

Course Code: 127FN **3 0 0 3**

FUNDAMENTALS OF MANAGEMENT

(Common to CSE, CSD, CSM, CST, ECE, EEE, ETE & IT)

Prerequisites: Managerial Economics and Financial Analysis.

Course Objectives:

1. Educate the importance of Management in Business Decision Making.
2. Inculcate the conceptual aspects required for Managerial Decision Making.
3. Outline the practical application of Management in Engineering Decision Making.

UNIT 1 : (~09 Lecture Hours)

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 Behavioral approach - The Quantitative approach - The Systems Approach - Contingency Approach – Corporate Social Responsibility of Business.

UNIT 2 : (~10 Lecture Hours)

Planning and Decision Making

Planning : Plans - Types of Plans - Planning – Features – Principles of Planning, Types of Planning – Concept of MBO - Development of Business Strategy – Steps of Strategic Planning Process.

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

UNIT 3 : (~10 Lecture Hours)

Organization and HRM

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

Human Resource Management: Talent Management – Importance – HRM - Features – Principles – Job Analysis - Functions of HRM – Recruitment and Selection - Training and Development - Performance Appraisal.

UNIT 4 : (~09 Lecture Hours)

Leading and Motivation

Leading: Leadership - Characteristics of a Leader - Power and Authority - Leadership Styles - Leadership Theories – Trait Theory - Behavioral Leadership Theories - Situational Leadership Theories (Fielders Contingency Theory – House path Goal Theory – Life Cycle Situational Theory – Leader as Mentor and Coach – Team Leadership.

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

UNIT 5 : (~09 Lecture Hours)

Communication and Controlling

Communication : Importance - Types - Process - Barriers.

Controlling - Principles of Controlling - Types and Strategies for Control – - Steps in Control Process - Methods of Budgetary and Non- Budgetary Controls - Characteristics of Effective Control System – Methods of Controlling (Traditional and Modern Techniques.)

Text Books:

1. Stephen P. Robbins (2016) Fundamentals of Management, 9th Edition, Pearson Education.
2. K. Aswathappa (2023) Organisational Behavior, 14th Edition, Himalaya Publishing House.

Reference Books:

1. Y K Bhushan (2016) Fundamentals of Business organization and Management, 20th Edition, Sultan Chand and Sons.
2. Andrew DuBrin (2012) Management Essentials, 9th Edition, Cengage Learning.
3. VSP Rao (2012) Management (Text & cases), 2nd Edition, Excel Books.
4. James A.F. Stoner, R. Edward Freeman, Danial R.Gilbert (2018) Management, 6th Edition, Prentice - Hall of India Pvt. Ltd.
5. L.M.Prasad (2019) Organisational Behavior, 6th Edition, Sultan Chand and Sons.

Online Resources:

1. Concept of Management and Evolution of Management Thought https://archive.nptel.ac.in/courses/122/108/122108038
2. Principles of Management : https://nptel.ac.in/courses/110107150

Course Outcomes (COs)

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

1. Understand the concept of Management in practical scenario for effective decision making.
2. Summarize the preparation of effective plans in strategizing the decision making process.
3. Identify the Organizational Structure and confine authority responsibility conduct in an organization.
4. Apprehend the human resource management in an organization for its effectiveness.
5. Assess the role of leader and build motivation to attain the objectives of an organization.
6. Communicate and Design techniques of controlling in the process of an organization.

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IV Year B.Tech. EEE I-Semester **L T P C**
Course Code: 127FE **3 0 0 3**

ELECTRIC AND HYBRID VEHICLES

Prerequisites: Field Theory and DC Machines (123AS), AC Machines (124AY), Power Electronics (125DB), Control Systems (124BD).

Course Objectives:

1. Understand the Concepts and Principles of Electric Vehicle (EV).
2. Analysis of Propulsion Systems in EV.
3. Able to identify the suitable energy storage devices and hybridization.
4. Able to understand the charging topologies in EV.

UNIT 1: (~9 Lecture Hours)

Electric vehicle introduction: EVs and Hybrid EVs: Types of Electric vehicle, Electric Vehicle Market, History. Costs and Emissions: Electricity Costs, CO_2 emissions in HVE. Introduction to Autonomous vehicles.

General Architectures of Hybrid Electric Vehicle: Series Hybrid, Parallel Hybrid, Series-Parallel Hybrid. Typical Drive cycles, Vehicle drivability, Controls of Hybrid vehicle. Hybridisation factor of Electric vehicles, AIS – 158-1.

UNIT 2: (7~ Lecture Hours)

Electric Vehicle Modelling: EV modelling, Tractive Effort- Rolling Resistance Force, Aerodynamic drag, Hill climbing force, Acceleration force, Acceleration performance parameters, Electric braking and Regenerative braking.

UNIT 3: (~10 Lecture Hours)

Electric vehicle Drivetrain: EV Transmission configurations, Gears, Automobile differential, Clutch, Brakes, Ideal gear box: Gear ratio, Torque speed characteristics, EV motor sizing: Initial acceleration, Rated vehicle velocity, Maximum velocity, Maximum gradability.

Electric Propulsion and its control: Electric vehicle Motors and its Torque Speed Characteristics. Control and configuration of Brushless DC Motor, Switched Reluctance Motor, Induction Motor (Elementary treatment only).

UNIT 4: (~10 Lecture Hours)

Energy storage System: Overview of batteries, Battery parameters, Lead acid batteries, Nickel based Batteries, Lithium batteries, Sodium based batteries, Metal Air batteries, sizing of batteries. Battery chargers, Charge equalization, Use of Batteries in Hybrid vehicles, Battery equivalent circuit, Introduction to alternative energy sources used in EHV: Fuel Cell, Super-capacitor.

UNIT 5: (~9 Lecture Hours)

Electric Vehicles Charging Technology: Battery modelling, Methods of

Cell equalization, Introduction to Battery Management System. Types of Charging in EV: On-board charger, Off-board charger, Fast Charging stations. Charging Methods: Constant Current – Constant Voltage (CC-CV), Five Step charging pattern, Pulse Charging Method, Charging Strategies.

Text Books:

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

Reference Books:

1. C. Mi, M. A. Masrur, D. W. Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao, G. Rizzoni, Hybrid Electric Vehicles: Energy Management Strategies, Springer, 2015.
3. T. Denton, Electric and Hybrid Vehicles, Routledge, 2016
4. Automotive Industry Standards-158 ; Code of Practice for Type Approval of Modular Hydraulic Trailers towed by Puller Tractor of Category N3

Online Resources:

1. https://www.udemy.com/course/electric-and-hybrid-vehicle-engineering/
2. https://nptel.ac.in/courses/108/106/108106170/
3. https://e-amrit.niti.gov.in/home
4. https://powermin.gov.in/en/content/electric-vehicle
5. Brenna, M., Foiadelli, F., Leone, C. *et al.* Electric Vehicles Charging Technology Review and Optimal Size Estimation. J. Electr. Eng. Technol. 15, 2539–2552 (2020). doi.org/10.1007/s42835-020-00547

Course Outcomes:

After completion of the course, student will be able to

1. Identify the difference between conventional vehicles, Hybrid Electric vehicles and Electric Vehicles.
2. Understand the models to describe Electric vehicles and their performance, various battery sources and additional energy storage systems like Fuel cells, Ultra capacitors.
3. Apply the concepts of electrical machines, Power Electronics for the design of Electrical Vehicles.
4. Analyse the various vehicle topologies, Drive trains, Energy storage devices and energy management strategies.
5. Estimate the suitable combination motor, battery and energy management strategy.
6. Choose the appropriate charging methods for an EV.

IV Year B.Tech. EEE I –Semester **L T P C**
Course Code: 127DV **3 0 0 3**

DIGITAL SIGNAL PROCESSING

(Professional Elective-4)

Prerequisites: Transform Techniques and Applications (124BQ), Digital Electronics (124BF).

Course Objectives:

1. Underline the fundamental concepts of Discrete time signals, classification and systems.
2. Analyze the discrete signals and systems using different transforms like Fourier Series, Fourier Transform and ZT.
3. Apply the concepts of different Transforms to find the response of Discrete time systems using convolution.
4. Evaluate computational efficiency of DFT using FFT algorithms.
5. Design and realize structures of different filters.

UNIT 1: (~9 Lecture Hours)

Introduction: Introduction to Digital Signal Processing, Advantages and application of DSP, classification of sequences based on duration, shape, periodicity, power, and energy. Operation on signals like shifting, folding, decimation, interpolation, fractional delay, Concept of frequency in continuous time and discrete time, Properties of LTI system, Classification of systems like linearity, time variance, causality, Discrete convolution, Frequency domain representation of discrete time signals and systems.

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

Z-Transform: Z- Transform of a discrete sequence, Region of convergence in Z-Transform, constraints on ROC for various classes of signals, properties of Z-transforms, one sided Z-transform, application-solution to difference equation, Inverse Z-transform using contour integration, power series expansion and partial fraction method.

Discrete Time Fourier Series and Transform: Representation of Periodic Sequences (DFS), Properties of Discrete Fourier Series, Discrete Time Fourier Transform (DTFT) of aperiodic sequence, properties of DTFT with proof.

UNIT 3: (~9 Lecture Hours**)**

Discrete Fourier Transform: Frequency domain Sampling, Discrete Fourier Transforms, Problems on DFT and IDFT, DFT as a Linear Transformation, Properties of DFTs like linearity, periodicity, time shifting, DFT of real valued and complex valued sequence, central coordinates, Parseval's theorem, Time reversal of a sequence, circular time shift of a sequence, circular frequency shift, duality. linear convolution of sequences using DFT, Over-lap Add method, Over-lap Save method, Relation between DTFT, DFS, DFT and Z-Transform.

Fast Fourier Transform:

Fast Fourier transforms (FFT) - Radix-2 decimation-in-time and decimation-in-frequency FFT Algorithms, Advantages, Inverse DFT using FFT.

UNIT 4: (~9 Lecture Hours)

IIR Digital Filters: Analog filter approximations – Design of analog LPF using Butterworth and Chebyshev, Design of IIR Digital filters from analog filters using Impulse invariant techniques and Bilinear transformation method, Spectral transformations to covert LPF to other filters in S domain

Realization of IIR Filters:

Direct form, signal flow graphs and transposed structure, Cascade and Parallel forms.

UNIT 5: (~9 Lecture Hours)

FIR Digital Filters: Advantages of FIR filters, condition for filters to have linear phase response, Frequency response of Type 1,2,3 and 4, location of zeros of FIR transfer function, Design of FIR Filters using Fourier Series Method, Window Techniques like Rectangular, Triangular, Hanning, Hamming, Blackman windows and Frequency Sampling technique, Comparison of IIR & FIR filters.

Realization of FIR Filters: Direct form I and II, Cascaded form.

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

Reference Books:

1. Digital Signal Processing - Ramesh Babu.
2. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Tarun Kumar Rawat, "Digital Signal Processing", 1st edition, Oxford university press, 2015.
4. Ashok Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 2001.
5. DSP by A Anand kumar, PHI.

Online Resources:

1. https://onlinecourses.nptel.ac.in
2. https://www.classcentral.com/course/swayam-digital-signal-processing-14007

Course Outcomes

After completion of the course, student will be able to

1. Underline the fundamental concepts of Discrete time signals, classification, and systems.
2. Analyze the discrete signals and systems using different transforms like Fourier Series, Fourier Transform and ZT.
3. Apply the concepts of different Transforms to find the response of Discrete time systems using convolution.
4. Evaluate computational efficiency of DFT using FFT algorithms.
5. Design and realize structures of IIR filter.
6. Design and realize structures of FIR filter.

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IV Year B.Tech. EEE I-Semester **L T P C**
Course Code: 127FF **3 0 0 3**

ELECTRICAL & ELECTRONICS MEASUREMENTS AND INSTRUMENTATION

(Professional Elective-4)

Prerequisites: Basic Electrical Engineering (122AC), Field Theory and DC Machines (123AS).

Course Objectives:

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

UNIT 1: (~9 Lecture Hours)

Analog Instruments:

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

UNIT 2: (~9 Lecture Hours)

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

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

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

UNIT 3: (~9 Lecture Hours)

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

Measurement of Energy: Single phase induction type energy meter-driving and braking torques-errors and compensations-testing by phantom loading using R.S.S. meter and Three phase energy meter. Power Factor Measurement (single phase electrodynamometer), Frequency Meter (Weston frequency meter) and Synchroscope (Elementary treatment only), Digital Energy meter.

UNIT 4: (~9 Lecture Hours)

Electronic Instrumentation:

Cathode Ray Oscilloscope: Dual trace and dual beam oscilloscope, digital storage oscilloscope, measurement of phase of amplitude, phase and frequency using CRO. Qualitative analysis of DSO, MDO, Power and spectrum analyzer.

UNIT 5: (~9 Lecture Hours)

Transducers: Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo-electric transducers, photovoltaic, photo conductive cells, and photo diodes. Measurement of strain, Gauge sensitivity, Displacement, Velocity, Angular Velocity, Torque measurement by Strain Gauge only.

Text Books:

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

Reference Books:

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

Online Resources:

1. NPTEL : Electrical Engineering - NOC: Electrical Measurement and Electronic Instruments.

Course Outcomes:

After completion of the course, student will be able to

1. Acquire the knowledge about the measuring instruments for measurement of voltage, current, power, energy, CRO
2. Analyze the extension of range of measuring instruments and Different types of errors and their reduction techniques, CT and PT, Potentiometers.
3. Evaluate power factor and frequency, phase sequence using power factor meter, frequency meter and synchroscope.

4. Measure the resistance, inductance and capacitance by using various bridges and phase and frequency using CRO.
5. Acquire the knowledge about Transducers and measurement of displacement, velocity, angular velocity using strain gauge
6. Apply the conceptual thing to real world electrical and electronics problems and applications.

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

Course Code: 127FV **3 0 0 3**

POWER SEMICONDUCTOR DRIVES

(Professional Elective-4)

Prerequisites: Field Theory and DC Machines (123AS), AC Machines (124AY) Control Systems (124BD), Power Electronics (125DB).

Course Objectives:

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

UNIT 1: (~10 Lecture Hours)

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

Dynamics of Electrical drives: Fundamental torque equations – Speed torque conventions and Multi-quadrant operation- Components of load Torque-Nature and classification of load torques.

Control of drives: Modes of Operation-Speed control and drive Classification-Closed loop control of drives.

UNIT 2: (~12 Lecture Hours)

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

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

Four Quadrant operation of DC drives: Motoring operation, Electric Braking-Plugging, Dynamic, regenerative braking operation, Four quadrant Operation of DC motors by dual Converters-Closed loop operation of DC motor (Block diagram only).

Control of DC motors by Choppers: Single, double and four quadrant Chopper fed DC Separately excited motors- Numericals.

UNIT 3: (~10 Lecture Hours)

Control of Induction Motor Through Stator Voltage and Stator Frequency: Variable voltage Characteristics-Control of Induction Motor-Waveforms-speed torque characteristics. Variable frequency characteristics-Variable frequency control and V/f control, vector control of induction motor by voltage source and current source inverter. PWM control-Comparison of VSI and CSI operations-Speed Torque characteristics- Numericals- Closed loop operation.(Block Diagram Only)

Rotor Side Control of Induction Motor: Static rotor resistance control -Slip power recovery- Static Scherbius drive-Static Kramer Drive-their performance and speed torque characteristics-advantages, applications, Numericals.

UNIT 4: (~8 Lecture Hours)

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

UNIT 5: (~6 Lecture Hours)

Stepper motor, Switched reluctance motor (SRM) and Brushless DC (BLDC) motor, PMSM drives (Elementary treatment): Permanent magnet-Features of stepper motor-Torque vs stepping rate characteristics-Driver circuits for stepper motors, SRM, BLDC, PMSM. SRM operation and Control-Converter Circuits-Modes of operation- Driving principle of BLDC motor.

Text Books:

1. S. B. Dewan, G.R. Slemon, A. Straughen, Power Semiconductor Drives, Wiley Blackwell, 1985.
2. Gopal K Dubey, Fundamentals of Electric Drives, Narosa Publications, 2019.
3. S.K. Pillai, Basics of Electric Drives, 4th Edition, New Academic Science, 2015.

Reference Books:

1. SK Pillai, Analysis of Thyristor Power-conditioned motors, University Press, 2005.
2. B.K. Bose, Modern Power Electronics and AC Drives, Pearson 2015.
3. R. Krishnan, Electric motor drives-modeling, Analysis and control, Pearson, 2015.
4. Sang-Hoon Kim ,Electric motor control- Elseiver Publications. 2017.

Online References:

1. https://books.google.co.in/books?id=HD1o_BN0rCAC&printsec=copyright&redir_esc=y#v=onepage&q&f=false
2. https://archive.nptel.ac.in/courses/108/104/108104140/
3. https://www.digimat.in/nptel/courses/video/108104140/L01.html
4. https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee65/

Course Outcomes:

After completion of the course, student will be able to

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

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IV Year B.Tech. EEE I -Semester **L T P C**
Course Code: 127FW **3 0 0 3**

POWER SYSTEMS OPERATION AND CONTROL

(Professional Elective - 5)

Prerequisites: Power Systems-I (124BM), Power Systems –II (125DC), Power System Analysis (126EK), Field Theory and DC Machines (123AS), AC Machines (124AY).

Course Objectives:

1. To understand importance of economic load dispatch.
2. To understand real power control and operation.
3. To know the importance of frequency control.
4. To analyze different methods to control reactive power.
5. To understand real time control of power systems.

UNIT 1: (~10 Lecture Hours)

Economic Operation of Power Systems:

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

UNIT 2: (~8 Lecture Hours)

Hydrothermal Scheduling:

Input- Output characteristics, Incremental cost characteristics of hydro systems. Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling Problems-Short term and long term hydrothermal scheduling problem.

UNIT 3: (~10 Lecture Hours)

Modeling of Power systems and Load frequency control (LFC):

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

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

UNIT 4: (~8 Lecture Hours)

Two Area LFC system and Voltage control:

Modeling of Two area systems, Tie line Model, Block diagram representation of two area power system. Uncontrolled case-Steady state analysis.

Excitation systems: Mathematical modeling. Block diagram of Excitation system. (IEEE Type-1 Model). Static and dynamic analysis.

UNIT 5: (~10 Lecture Hours)

Computer Control of Power Systems:

Need of computer control of power systems. Concept of energy control center (or) load dispatch center and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – Importance of Load Forecasting and simple techniques of forecasting.

Text Books:

1. D. P. Kothari and I. J. Nagrath, ‘Modern Power System Analysis’, Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. Dr.K. Uma Rao ,’Power System operation and control’, Wiley India Pvt. Ltd., 2019.

Reference Books:

1. Olle. I. Elgerd, ‘Electric Energy Systems Theory – An Introduction’, Tata McGraw Hill Publishing Company Ltd, New Delhi, 30th reprint, 2007.
2. C. L. Wadhwa, “Electrical power systems”, New Age International (P) Limited Publishers, 1998.
3. Abhijit Chakrabarthi and Sunita Haldar, “Power System Analysis Operation and control”, Eastern Economy Edition, 2006.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104052/

Course Outcomes:

After completion of the course, student will be able to

1. Apply mathematical techniques/methods to solve economic load dispatch problems.
2. Apply mathematical techniques/methods to solve hydro thermal scheduling.
3. Model the components, subsystems and interconnected power systems for control of frequency.
4. Analyze load frequency control in single and two area systems.
5. Model the excitation systems for the control of voltage
6. Apply the concepts of computer control in power system operation.

IV Year B.Tech. EEE I -Semester	**L T P C**
Course Code: 127FU	**3 0 0 3**

POWER QUALITY AND FACTS

(Professional Elective-5)

Prerequisites: Power Electronics (125DB).

Course Objectives:

1. To understand the characteristics of ac transmission and the effect of shunt and Series reactive compensation.
2. To understand the working principles of FACTS devices and their operating characteristics.
3. To understand the basic concepts of power quality.
4. To understand the working principles of devices to improve power quality.

UNIT 1: (~8 Lecture hours)

Reactive Power Compensation:

Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission, Reactive Power Compensation: Shunt and series compensation at the mid-point of an AC line, Comparison of Series and Shunt Compensation.

UNIT 2: (~9 Lecture hours)

FACTS Devices:

Thyristor based Flexible AC Transmission Controllers (FACTS): Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Configurations/Modes of Operation, Harmonics and control of SVC and TCSC, Fault Current Limiter.

UNIT 3: (~10 Lecture hours)

FACTS Controllers:

Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Principle of Operation OF STATCOM, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC), Interline Power Flow Controller(IPFC).

UNIT 4: (~8 Lecture hours)

Power Quality Issues:

Power Quality Problems in Distribution Systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, and Wave-form Distortions: harmonics, noise, notching, dcoffsets, fluctuations and flicker, Tolerance of Equipment: Computer Business Equipment Manufacturers Association(CBEMA) curve.

UNIT 5: (~10 Lecture hours)

Custom Power Devices:

Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM, Synchronous Reference Frame Extraction of Reference Currents, Principle of DVR and Unified Power Quality Conditioner (UPQC)-Working Principle.

Text Books:

1. N. G. Hingorani, L.Gyugyi, Understanding FACTS: Concepts and Technology of FACTS Systems, Wiley-IEEE Press, 2011.
2. Math H J Bollen, Understanding Power Quality Problems, IEEE Press, New Delhi, 2001.

Reference Books:

1. K.R. Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International (P) Ltd., 2016.
2. T. J. E. Miller, Reactive Power Control in Electric Systems, John Wiley and Sons, New York, 2010.
3. Bhimsingh, Ambrish Chandra, kamal AI-Haddad Power quality problems and mitigation techniques Wiley Publications, 2015.
4. G. T. Heydt, Electric Power Quality, Stars in a Circle Publications, 1991.

Online Resources:

1. https://archive.nptel.ac.in/courses/108/107/108107114/

Course Outcomes:

After completion of the course, student will be able to

1. Have the knowledge of Reactive Power Compensation(series/shunt/hybrid) techniques.
2. Understand different types of existing FACTS devices.
3. Select and implement appropriate FACTS device for the transmission line based on the operating conditions.
4. Understand different types of Power quality issues, classification and the reasons for PQ problems.
5. Understand different types of existing Custom Power Devices.
6. Select and implement various Custom Power Devices for the mitigation of PQ problems based on customer(load) requirement.

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IV Year B.Tech EEE I -Semester **L T P C**
Course Code: 127FG **3 0 0 3**

ELECTRICAL DISTRIBUTION SYSTEMS
(Professional Elective-5)

Prerequisites: Power Systems-I (124BM), Power Systems-II (125DC), Power System Protection (126EL).

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

UNIT 1: (~8 Lecture Hours)

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

UNIT 2: (~10 Lecture Hours)

Distribution Feeders: Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Introduction to low voltage distribution systems (LVDS) and High voltage distribution systems(HVDS), voltage levels, Factors effecting the feeder voltage level, feeder loading, Application of general circuit constants (A, B, C, D) to radial feeders, basic design practice of the secondary distribution system, secondary banking, secondary network types, secondary mains.

Substations: Location of Substations: Rating of distribution substation, service area with 'n' primary feeders. Benefits derived through optimal location of substations. Optimal location of Substations (Perpendicular bisector rule and X, Y co-ordinate method).

UNIT 3: (~10 Lecture Hours)

Distributed Generation and System Analysis: Introduction of distributed generation sources like Solar PV, small wind & Hydro, Biomass/Bio-Diesel generators into distribution systems, their basic models and interfacing arrangements with low and medium voltage grids. Voltage drop and power loss calculations on distribution systems with and without distributed generators.

UNIT 4: (~9 Lecture Hours)

Co-ordination of Protective Devices: Objectives of distribution system protection, types of common faults and procedure for fault calculations, Principle of operation of Auto-line Sectionalizers. Objectives of protection coordination, general coordination procedure. Types of protection coordination: Fuse to Fuse, Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser. Co-ordination procedure of protective devices with distributed generators.

UNIT 5: (~9 Lecture Hours)

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

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

Text Books:

1. Turan Gonen, Electric Power Distribution System Engineering, 3rd Edition, CRC Press, 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, 2nd Edition, Tata McGraw Hill Publishing Company, 2010.

Reference Books:

1. G. Ram Murthy, Electrical Power Distribution hand book, 2nd Edition, University press, 2004.
2. A.S. Pabla, Electric Power Distribution, 6th Edition, Tata McGraw Hill Publishing Company, 2011.
3. J B Gupta, A Course in Power Systems, 11th Edition, S K KATARIA & Sons, 2013.

Online Resources:

1. https://nptel.ac.in/courses/108/106/108106182

Course Outcomes:

After completion of the course, student will be able to

1. Acquire the knowledge on Coincidence factor, contribution factor, Loss factor and Characteristics of load.
2. Design and analyze the substations based on the load, geographical data, ratings of the equipment, number of incoming and outgoing feeders and determine the optimal location of substation.
3. Design the basic models of distributed generators and their interfacing arrangements with grid for different sources like solar PV, wind, small hydro and biomass power.

4. Acquire the knowledge on over current protective devices like Fuse, Circuit breaker, Auto-Re-closer and Line sectionalize.
5. Apply the co-ordination procedure on over current protective devices with and without distributed generators included in the distribution system.
6. Apply reactive power compensation techniques in various scenario of the distribution system to limit the voltage drops at the remote ends to the suitable levels.

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IV Year B.Tech. EEE I -Semester	**L T P C**
Course Code: 127FP	**3 0 0 3**

HVDC TRANSMISSION

(Professional Elective - 5)

Prerequisites: Power Systems-I (124BM), Power Systems-II (125DC), Power Electronics (125DB).

Course Objectives:

1. To compare EHVAC and HVDC systems and to describe various types of DC links.
2. To Analyze Graetz circuit for rectifier and inverter mode of operation.
3. To Analyze various converter control methods.
4. To Describe various faults and protection methods for HVDC systems.
5. To classify Harmonics and design different types of filters.

UNIT 1: (~8 Lecture Hours)

HVDC Transmission: Basic Concepts: Historical development–Equipment required for HVDC systems- Comparison of AC and DC Transmission— Limitations of HVDC Transmission Lines- Reliability of HVDC Systems- Types of HVDC Links - **Applications of DC Transmission**-Planning & Modern trends in DC Transmission- Standard rated voltages of HVDC and EHVAC systems.

UNIT 2: (~10 Lecture Hours)

HVDC Converters: Analysis of HVDC Converters: Choice of Converter configuration using Pulse Number – Detailed Analysis of Graetz circuit – Analysis of Voltage waveforms with Overlap Angle(μ) – Voltage drop in Per Unit Quantities- Complete Characteristics of converter as Rectifier/Inverter- Characteristics of 12 Pulse converters.

Control of Converters: Principle of DC Link Control - Converters Control Characteristics – Hierarchy and basic philosophy - Firing angle control – Extinction angle control - Current control - Starting and stopping of DC link - Power Control.

UNIT 3: (~10 Lecture Hours)

Converter Faults & Protection: Types of faults- Faults on AC side of Converter Stations-Converter faults – Faults on DC side of the System - Protection against over current and over voltage in converter station - Surge arresters - Smoothing reactors – Transient over voltages in DC line- DC breakers - Corona effects on DC lines - Radio interference.

UNIT 4: (~10 Lecture Hours)

Harmonics and HVDC Filters: Harmonics in HVDC: Generation of Harmonics - Characteristics harmonics - Calculation of AC Harmonics - Non-

Characteristics harmonics - Adverse effects of harmonics - Calculation of voltage & Current harmonics - Effect of Pulse number on harmonics. Filter configuration- Types of AC filters- Design of Single tuned filters, Double tuned filters – Minimum Cost of Tuned AC Filters- Design of high pass Filters. Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters - shunt capacitors-synchronous condensers.

UNIT 5: (~8 Lecture Hours)

Multi-terminal DC Systems: Types of Multi terminal Systems – Control and Protection of MTDC Systems, – Study of MTDC Systems - Potential applications of MTDC systems, MTDC link modelling.

Text Books:

1. K.R.Padiyar , "HVDC Power Transmission Systems: Technology and system Interactions", Second Edition, New Age International (P) Ltd , Publishers, 2012.
2. S.Rao, "EHVAC and HVDC Transmission Engineering and Practice", Khanna Publishers,1990.

Reference Books:

1. J.Arrillaga," HVDC Transmission, Second Edition", IET, 1998.
2. E.W.Kimbark ,"Direct Current Transmission",Volume 1 John Wiley & Sons, 1971.
3. E.Uhlmann,"Power Transmission by Direct Current", B.S. Publications, 2009.
4. S.Kamakshaiah and V.Kamaraju ,"HVDC Transmission", First Edition, Tata McGraw-Hill Education , 2011.

Online Resources:

1. https://nptel.ac.in/courses/108/104/108104013/
2. https://onlinecourses.nptel.ac.in/noc20_ee67/preview

Course Outcomes:

After completion of the course, student will be able to

1. Classify HVDC and MTDC systems, categorize major components employed, Compare EHVAC and HVDC system and applications of HVDC Transmission system.
2. Analyze Graetz circuit for rectifier and inverter mode of operation
3. Identify a device and its control scheme for a given application in the HVDC system. viz power control, converter control etc.
4. Analyze various faults in Converter stations.
5. Describe various protection methods for HVDC systems and classify Harmonics.
6. Design different types of filters and know about Reactive Power Requirements.

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

Course Code: 12762 **0 0 2 1**

POWER SYSTEMS LAB

Prerequisites: Power System Analysis (126EK), Power Systems Protection (126EL).

Course Objectives:

1. To understand the performance characteristics of various relays like IDMT Over current relay, over voltage/ under voltage relays and differential relays.
2. To determine sequence impedances of 3-ö synchronous machine and Transformer and fault analysis of generator.
3. To simulate the formation of Y and Z bus using MATLAB simulation.
4. To perform Load flow analysis using GS and FD methods.

List of Experiments

Part-A (All Experiments are compulsory)

1. Testing of CT, PT, calculation of String efficiency of Insulators.
2. ABCD constants, Regulation and Efficiency of a 3-ö transmission line model
3. Characteristics of IDMT over current relay.
4. Sequence impedances of 3-ö synchronous machine.
5. Characteristics of over voltage and under voltage relay.
6. Differential protection of 1-ö transformer.
7. Sequence impedances of 3-ö transformer.
8. LG, LL, LLG and 3-Õ fault analysis of 3-ö synchronous machine.

Part - B (Any Two Experiments)

9. Formation of Y-bus and Z-bus .
10. Load flow analysis using Gauss Seidel (GS) method.
11. Load flow analysis using Fast Decoupled (FD) method.
12. Transient stability analysis for single machine connected to infinity.

Text Books:

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.
3. U. A. Bakshi, M. V. Bakshi: Switchgear and Protection, Technical Publications, 2009.

Reference Books:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 5^{th} edition 2022.
2. C. Russel Mason – "The art and science of protective relaying, Wiley Eastern, 1995.

Course Outcomes:

After completion of the course, student will be able to

1. Demonstrate the operation of CT, PT and Insulator string.
2. Demonstrate the operation of Different protection relays.
3. Determine the sequence impedance of generator and transformer.
4. Apply and Analyze various faults on 3-phase alternator.
5. Model and determine the Y-bus and Z-bus of the power system with MATLAB simulation.
6. Model and analyze the load flow using Gauss-Seidel(GS) and Fast Decoupled(FD) methods.

IV Year B.Tech. EEE I -Semester **L T P C**
Course Code: 12740 **0 0 2 1**

DIGITAL SIGNAL PROCESSING LAB

Prerequisites: Transform Techniques and Applications (124BQ), Digital Electronics (124BF)

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. (a) Generation of various discrete signals (Periodic and Aperiodic), such as unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.

   (b) Operations on discrete signals such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.
2. Verification of linearity and time invariance properties of a given discrete time system.
3. 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
4. To find DFT / IDFT of given discrete time signal.
5. To find response of LTI system using graphical approach of Linear Convolution.
6. Determination of Power Spectrum of a given Signal using Wiener-Kintchine relation.
7. To Verify Parseval's theorem of Discrete Fourier Transform.
8. To find Frequency Response of a discrete system given in Transfer Function/ Difference equation form.
9. Implementation of FFT of given Sequence.
10. Implementation of Low Pass and High Pass FIR Filters using Windowing technique.
11. Implementation of Band Pass and Band Reject FIR Filters using Windowing technique.
12. Implementation of Low Pass Analog and Digital Butterworth IIR Filters.
13. Implementation of Low Pass Analog and Digital Chebyshev-Type 1 IIR Filters.

14. Practical implementation of Up-Sampling of a given sinusoidal signal.
15. Practical implementation of Down-Sampling of a given sinusoidal signal.
16. Implementation of I/D Sampling Rate Converters.
17. Generation of DTMF Signals.
18. Filtering of long data sequences using DFT/IDFT.

Note:

- Minimum 12 experiments should be conducted. All these experiments are to be implemented using software (MATLAB) / Hardware (DSP processor).
- At least two experiments are to be simulated using Simulink.

Online Resources:

1. https://www.youtube.com/watch?v=0ENnxVXEv_U&list=PLOzRYVm0a65cU4xstihnbnrCPHenmJJ7f
2. https://www.classcentral.com/course/swayam-digital-signal-processing-14007

Course Outcomes:

After completion of the course, student will be able to

1. Understand fundamental concepts & usage of simulation software in the field of DigitalSignal Processing.
2. Identify the specifications, requirements & built in functions to perform mathematicaloperations involving discrete sequences.
3. Develop code for designing various filters.
4. Develop code for analyzing Fourier and Z-transforms and their utility.
5. Develop code for sampling rate conversion.
6. Generate relevant simulation codes, with and without usage of built in functions & estimation of the numerical results with supporting plots.

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IV Year B.Tech. EEE I-Semester **L T P C**
Course Code: 12755 **0 0 2 1**

ELECTRICAL & ELECTRONICS MEASUREMENTS AND INSTRUMENTATION LAB

Prerequisites: Basic Electrical Engineering (122AC), Field Theory and DC Machines (123AS).

Course Objectives:

1. To calibrate LPF Wattmeter, Energy meter, Power factor using Electrodynamometer type instrument as the standard instrument.
2. To determine unknown Inductance, Resistance, Capacitance by performing experiments on D.C Bridges & A.C Bridges.
3. To determine three phase active & reactive powers using single wattmeter method practically.
4. To determine the ratio and phase angle errors of current transformer and potential transformer.

List of Experiments

Part -A (All experiments are compulsory)

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

Part-B (Any Two Experiments)

9. Dielectric oil testing using H.T. testing Kit.
10. Measurement of % ratio error and phase angle of given CT by Null method.
11. Measurement of % ratio error and phase angle of given CT by Silsbee's method.
12. Measurement of % ratio error and phase angle of the given PT.
13. Resistance Strain gauge–strain measurements and Calibration.
14. Transformer turns ratio measurement using AC bridges.

Text Books:

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

Reference Books:

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

Online Resources:

1. NPTEL : Electrical Engineering - NOC: Electrical Measurement and Electronic Instruments

Course Outcomes:

After completion of the course, student will be able to

1. Calibrate the PMMC type Voltmeters, Ammeters, LPF wattmeter, energy meter and dynamometer type power factor meter.
2. Determine the Low Resistance, Inductance, Capacitance
3. Test the Instrument transformers and methods of indicating dielectric strength and turns ratio of a transformer.
4. Measure the three phase active and reactive power using wattmeter.
5. Identifying the use of transducers and measurement of Non-Electrical Quantities.
6. Apply the conceptual thing to real world electrical and electronics problems and applications.

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IV Year B.Tech. EEE I-Semester **L T P C**
Course Code: 12761 **0 0 2 1**

POWER SEMICONDUCTOR DRIVES LAB

Prerequisites: Field Theory and DC Machines (123AS), AC Machines (124AY), Control Systems (124BD), Power Electronics (125DB).

Course Objectives:

1. To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines using power electronic converters.
2. To familiarize the student with various power electronic converter topologies and their speed Control application.
3. To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation.
4. Have a better understanding of the close relationship between hardware and simulation models of actual systems.

List of Experiments

Part-A (All experiments are compulsory)

1. Speed control of DC motor using 1-Ø half controlled rectifier.
2. Speed control of DC motor using 1- Ø Fully controlled rectifier.
3. Speed control of separately excited DC motor using 3-Ø dual converter.
4. Speed control of BLDC motor.
5. Study and analyze the performance of Four quadrant operation of chopper fed DC motor drive.
6. Modelling and simulation of separately excited Induction machine and to study the dynamic behavior of the machine for change in load torque.
7. Thyristorised drive for PMDC Motor with speed measurement and closed Loop control.
8. V/f control of three phase induction motor drive.

Part-B (Any Two Experiments)

9. Speed control of dc motor drive using Three phase converter.
10. Modelling and simulation of three phase synchronous machine and to study the dynamic behavior of the machine for change in load torque.
11. IGBT based four quadrant Chopper Controlled DC Motor drive using MATLAB.

Text Books:

1. Gopal K Dubey, Fundamentals of Electric Drives, Narosa Publications, 2019.
2. Vedam Subramanyam, Electric Drives, Concepts and Applications, McGraw Hill Publications, 2011.

3. S.K. Pillai, Basics of Electric Drives, 4th Edition, New Academic Science, 2014.
4. Electric motor control- Sang-Hoon Kim, Elseiver Publications. 2017.

Reference Books:

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

Online Resources:

1. https://archive.nptel.ac.in/courses/108/104/108104140/

Course Outcomes:

After completion of the course, student will be able to

1. Identify relevant information to supplement to the course on Power semiconductor drives.
2. Analyze the performance of special machine drives.
3. Conduct experiments on drives for different modes of operation using different converter topologies.
4. Set up control strategies to synthesize the voltages in dc and ac motor drives.
5. Select the suitable converter for getting the desired speed performance of drive.
6. Combine the use of computer based simulation tools relevant to electrical Drives with practical laboratory experimentation.

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IV Year B.Tech. EEE II-Semester	**L**	**T**	**P**	**C**
Course Code: 128GW	**2**	**0**	**0**	**2**

ENTREPRENEURSHIP AND PROJECT MANAGEMENT

(Common to CSE, CSD, CSM, CST, ECE, EEE, ETE & IT)

Prerequisites: Fundamentals of Management.

Course Objectives:

1. Inculcate the entrepreneurial knowledge required to start and/or to run a business.
2. Hone entrepreneurial skills and create sensibility in entrepreneurial establishment.
3. Develop strategic skills in the project planning and implementation.

UNIT 1 : (~ 05 lectures)

Introduction to Entrepreneurship

Entrepreneurship: Introduction to Entrepreneur - Characteristic and skills of an Entrepreneur – Functions and Types of Entrepreneurs – Theories of Entrepreneurship - Process of Entrepreneurship - Factors affecting Entrepreneurship development - Women Entrepreneurs - Growth and Problems – Importance of Entrepreneurial Marketing.

UNIT 2 : (~ 06 lectures)

Entrepreneurial business selection

Entrepreneurial business selection: Criteria for selection of Business Structure - Types of Business Structures - Sole Proprietorship – Partnership - Limited Liability Partnership(LLP) - One-person company - Joint stock company – Features - Merits & Demerits – Suitability.

UNIT 3 : (~ 07 lectures)

Project Finance for Entrepreneur: Introduction to Capital-Types of Capital-Factors affecting Fixed Capital and Working Capital requirements -Sources of raising Finance – Entrepreneurial Finance (Seed Funding, Business Angels, Venture Capital, Family Offices, Financial bootstrapping, Buyouts, Accelerators and Incubators, Crowdfunding, IP based Investment funds).

UNIT 4 : (~ 07 lectures)

Project Appraisal/Evaluation 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).

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 – Project audit.

UNIT 5 : (~ 07 lectures)

Entrepreneurial Business Plan:

Entrepreneurial Business Plan - Preparation – Aspects to be considered in preparing Business Plan – Objectives – Elements of Business Plan (Production plan and Operational Plan)- Understanding Risk assessment of Enterprise towards Entrepreneurial Success. India- Case Study.

Text Books:

1. Dr. S.S. Khanka (2021) Entrepreneurial Development, 4th Edition, S.Chand & Company.
2. L. S. Srinath (2012) PERT & CPM – Principles & Applications, 3rd Edition, EWP.

Reference Books:

1. Khan & Jain (2018) Financial Management, 8th Edition, TMH.
2. Robert.D.Hisrich, Mathew. J. Manimala, Michael. P. Peter, Dean A.Shepherd (2017) Entrepreneurship, 9th Edition, Mc. Graw Hill.
3. S. D. Sharma (2008) Operations Research, 15th Edition, Macmillan.
4. Tulsian (2002) Business organization & Management, 1st Edition, Pearson.

Online Resources:

1. Entrepreneurship Essentials https://onlinecourses.nptel.ac.in/noc21_ge06/preview
2. Project Management https://onlinecourses.nptel.ac.in/noc21_mg71/preview
3. Financial Management for Managers https://nptel.ac.in/courses/110107144

Course Outcomes (COs)

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

1. Summarize the entrepreneurial ingenuity and skills required for business functioning.
2. Relate the probable business structures for entrepreneurial decisions.
3. Identify the probable finance alternatives available for investment in the project.
4. Deduct the investment opportunities and resource allocation decisions.
5. Evaluate the time feasibility of entrepreneurial project implementation.
6. Integrate and formulate an entrepreneurial business plan.

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IV Year B.Tech. EEE II-Semester	**L T P C**
Course Code: 128GN	**3 0 0 3**

AI TECHNIQUES IN ELECTRICAL ENGINEERING

(Professional Elective-6)

Prerequisites: Nil

Course Objectives:

1. To understand soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms.
2. To understand the concepts of feed forward neural networks and about feedback neural networks.
3. To practice the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy controller
4. To analyze genetic algorithm, genetic operations and genetic mutations.

UNIT 1:(~ 10 Lecture Hours)

Artificial Neural Networks: Introduction, Artificial Intelligence and Neural networks, Models of Neuron Network-Architectures-McCullochPitts Model-Knowledge representation–Learning process-Error correction learning, Hebbian learning-Competitive learning-Boltzman learning, supervised learning-Unsupervised learning–Reinforcement learning.

UNIT 2:(~ 9 Lecture Hours)

ANN Paradigms: Perceptron, Multi-layer perceptron - Back Propagation Algorithm (BPA), Self-Organizing Map (SOM), Radial Basis Function Network- Functional Link Network (FLN), Hopfield Network.

UNIT 3: (~ 10 Lecture Hours)

Fuzzy Logic: Introduction-Fuzzy versus crisp, Fuzzy Sets-Membership, function-Basic Fuzzy set operations, Properties of Fuzzy sets-Fuzzy Cartesian Product, Operations on Fuzzy relations-Fuzzy logic–Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods.

UNIT 4: (~ 9 Lecture Hours)

Genetic Algorithms: Introduction-Encoding-Fitness Function-Reproduction operators, Genetic Modeling-Genetic Operators-Cross Over- Mutation operator –Mutation – Mutation Rate-Bit-wise operators, Generational cycle-Introduction to Machine learning and AI.

UNIT 5: (~ 8 Lecture Hours)

Applications of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

Text Books:

1. S. Rajasekaran , G. A. Vijayalakshmi Pai , Neural networks, fuzzy logic, and genetic algorithms : synthesis and applications by , PHI Publications, 2nd Edition, 2017.
2. B.Yegnanarayana, Artificial Neural Networks,PHI Publications,12th Edition, 2006.

Reference Books:

1. Saifullah Khalid,Applications of Artificial Intelligence in Electrical Engineering, Business Science Reference publication, 3rd Edition, 2020.
2. ,Simon haykin, Neural Networks and Learning Machines, Pearson Publication, 3rd Edition, 2009.

Online Resources:

1. https://www.iitg.ac.in/rkbc/CE602/CE602/Genetic%20Algorithms.pdf
2. https://archive.nptel.ac.in/courses/127/105/127105006/
3. https://nptel.ac.in/courses/108104049

Course Outcomes:

After completion of the course, student will be able to

1. Understand soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms.
2. Develop feed forward neural networks, feedback neural networks and learning techniques.
3. Apply fuzzy logic principles in various systems and fuzzy set theory.
4. Analyze genetic algorithm, genetic operations and genetic mutations.
5. Apply fuzzy logic control in electrical engineering.
6. Apply genetic algorithms in electrical engineering.

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IV Year B.Tech. II-Semester	**L**	**T**	**P**	**C**
Course Code: 128HB	**3**	**0**	**0**	**3**

GRID INTEGRATION OF RENEWABLE ENERGY SOURCES

(Professional Elective-6)

Prerequisites: Power Systems-I (124BM), Power Systems-II (125DC), Power Electronics 125DB).

Course Objectives:

1. To describe the concepts of different renewable energy sources.
2. To understand the concepts of solar and wind energy.
3. To describe the utilization of different storage technologies.
4. To analyze the issues involved in the integration of renewable energy sources to the grid.

UNIT 1: (~7 Lecture hours)

Introduction: Renewable Sources of Energy-Grid–Supplied Electricity-Distributed Generation Renewable Energy Economics-Calculation of Electricity Generation Costs-Demand Side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems.

UNIT 2: (~9 Lecture hours)

Solar Energy Systems: Solar Thermal Power Generation. Solar Photovoltaic cells-energy conversion principle-classifications-equivalent circuit-Solar Cell-PV, IV Characteristics, efficiency-Limitations-PV modules-MPPT algorithms-P&O, Incremental Conductance Methods. Single and Two –stage grid integration solar Photovoltaic system with active and reactive power compensation.

UNIT 3: (~9 Lecture hours)

Wind Energy System: Vertical and horizontal axis Wind Turbines. Power and energy from wind turbines, Pitch control and Yaw control-types of wind power generation: singly fed and doubly fed Induction generator, PMSM generator, Characteristics. Dynamics matching- performance of wind generators –economic considerations. Grid Integration of Wind energy systems with active and reactive power control. Grid Codes IEC, IEEE.

UNIT 4: (~9 Lecture hours)

Energy Storage Devices: Super capacitor – SMES – Battery storage – fly wheel storage –compressed air storage- Fuel cells–types and applications; MHD generators-backup–System design- industrial and domestic applications of storage devices.

UNIT 5: (~9Lecturehours)

Converters for Grid Integration: Boost Converter, Bidirectional DC-DC converters, Two level inverters, Three level inverters, Z- source inverters (Qualitative Analysis only).

Text Books:

1. Felix A.Farret, M.GodoySimoes, Integration of Alternative Sources of Energy, JohnWiley & Sons, INC, 2006.
2. M.H.Rashid Power Electronics: Devices, Circuits and Applications, Pearson Publications, 4th edition, 2017.

Reference Books:

1. RaiGD, Solar Energy Utilization, 5th Edition, Khanna Publishers, 2004.
2. BH Khan, Non-Conventional Energy Resources, 2nd Edition, Tata McGraw-Hill, 2009.
3. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic and Wind Power Systems, John Wiley&Sons, 2011.

Online Resources:

1. https://nptel.ac.in/courses/108107143

Course Outcomes:

After completion of the course, student will be able to

1. Describe concepts of different renewable energy sources
2. Explain the concepts of solar energy conversion systems
3. To analyze the working of buck-boost and Multilevel converters.
4. Describe the utilization of different storage technologies
5. To understand the concept of wind energy systems.
6. Analyze the performance of converters used for grid integration.

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IV Year B.Tech. II-Semester **L T P C**
Course Code: 128HJ **3 0 0 3**

VLSI DESIGN

(Professional Elective-6)

Prerequisites:- Analog Electronics (123AL), Digital Electronics (124BF)

Course Objectives:

1. To know electrical properties of MOS and BiCMOS devices and to analyze the behaviour 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.

UNIT 1: (~10 Lecture Hours)

Introduction to MOS Technology: Introduction to Integrated Circuit Technology, The Integrated Circuit Era, MOS and Related Technology, Basic MOS Transistors, Operation of Enhancement and Depletion Mode Transistors. **Fabrication Process** : Silicon Wafer Preparation, Epitaxial Growth, Oxidation, Photolithography, Diffusion, Ion implantation, Metallization, Assembly Processing and Packaging, Encapsulation, nMOS and pMOS fabrication, CMOS fabrication using p-Well, n-Well and Twin Tub processes, BiCMOS technology and its fabrication.

UNIT 2: (~10 Lecture Hours)

Basic Electrical Properties: Basic Electrical Properties of MOS ,CMOS and BiCMOS Circuits: IDS-VDS relationships, MOS transistor threshold Voltage, gm, gds, 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 3: (~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. **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.

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: Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs), Altera MAX 7000 CPLD Architecture, Function Blocks, I/O Blocks, Clock Drivers, Interconnect, Xiling XC4000 Series FPGA Architecture.

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.
3. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI Learning Private Limited, 2013.

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:

After completion of the course, student will be able to

1. Acquire qualitative knowledge on the fabrication process of integrated circuits using MOS transistors.
2. Analyze the modes of operation of MOS transistor and its basic electrical properties.
3. Explain the physical properties of MOS devices.
4. Design different VLSI Datapath Subsystems
5. Illustrate Semiconductor memory design using MOS transistors.
6. Implement different kind of Programmable Logic Devices.

IV Year B.Tech. EEE II-Semester	**L T P C**
Course Code: 128GV	**3 0 0 3**

EHVAC TRANSMISSION

(Professional Elective-6)

Prerequisites: Power Systems-II (125DC), Field Theory and DC Machines (123AS).

Course Objectives:

1. To understand in-depth, inter related concepts of Extra High Voltage AC transmission.
2. It emphasis on the behavior of the line parameters for extra high voltages, voltage gradients of the transmission line conductors gradients.
3. To understand the effect of corona, electro static field calculations,
4. To gain understanding of Lightning, Switching and Dynamic Overvoltage Studies.
5. To introduce the concept of Insulation Coordination in EHV Systems.

UNIT 1: (~8 Lecture Hours)

Introduction to EHVAC: Necessity of EHV AC transmission - advantages and numericals. Power handling capacity and line losses- Mechanical considerations - Resistance of Conductors-Bundled conductors –Bundle Spacing and Bundle Radius.

Review of Line Inductance and Capacitance Calculations-Sequence Inductances and Capacitances. Modes of propagation–Inclusion of Ground Return and Frequency Dependence in Line Parameters Calculations.

UNIT 2: (~10 Lecture Hours)

Voltage Gradients of Conductors: Electrostatics - Field of sphere gap - Field of line charges and properties -Charge - Potential relations for Multi-Conductors -Surface voltage gradient on conductors - Distribution of Voltage Gradient on Sub-conductors of a Bundle.

Corona Effects: Power loss and Audible Noise (AN) -Corona loss formulae-Charge voltage diagram -Generation, Characteristics- limits and Measurements of AN -Relation between 1-phase and 3-phase AN levels.

UNIT 3: (~10 Lecture Hours)

Radio Interference: Corona pulses generation, properties, limits -frequency spectrum - modes of propagation - Excitation function - Measurement of RI, RIV and excitation Functions.

Electrostatic Field: Calculation of electrostatic field of EHV/AC lines - effect on humans, animals and plants - Electrostatic induction in DE energized circuit of double-circuit line - Electromagnetic Interference.

UNIT 4: (~8 Lecture Hours)

Lightning and Switching Over-Voltages: Lightning Stroke Mechanism, Probability Occurrence of Lightning Stroke Currents, General principles of lightning protection problem, Lightning arrestors and protective characteristics, dynamic voltage rise and arrestor rating, operating characteristics of lightning arrestors.

Calculation of switching surges- single phase equivalents, distributed parameter line energized by source, generalized equations for single phase representations, generalized equations for three phase systems.

UNIT 5: (~8 Lecture Hours)

Insulation co-ordination in EHV Systems: Line and EHV Transformers Insulation design based on Transient Over-voltages, Flash-over and Withstand Voltages of EHV Line and Equipment Insulation, Lightning and Surge Arresters and their Protective Levels, Insulation co-ordination based on Lightning, Principle of insulation coordination on EHV power systems.

Text Books:

1. R.D.Begamudre, "EHV AC Transmission Engineering", New Academic Science Ltd, 4th Edition 2011.
2. M.S.Naidu, V.Kamaraju, "High Voltage Engineering", Tata McGraw Hill Publication, 6th Edition 2020.
3. S.Rao, "EHV-AC, HVDC Transmission & Distribution Engineering", Khanna Publishers, 2008.

Reference Books:

1. Allan Greenwood, "Electrical Transients in Power Systems", 2nd Edition,Wiley Inter science, 1991.
2. Edison Electric Institute, "EHV Transmission Line Reference Book", University of Minnesota, 2015.

Course Outcomes:

After completion of the course, student will be able to

1. Analyze the relative application aspects of Bulk Power Transmission through EHV AC Transmission Lines.
2. Acquire the knowledge about the properties of bundled conductors.
3. Model EHV AC Lines, to reduce the effects of Corona Formation, Audio, Radio and Television Interference.
4. Ability to analyze the electrostatic field of AC lines.
5. Analyze the various Measuring Techniques & Testing Procedures applicable to EHV AC Transmission Lines.
6. Analyze and Design EHV Systems, using the Travelling Wave Theory & Line Compensation Techniques.

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III Year B.Tech. II Semester	**L T P C**
Course Code: 126KF	**3 0 0 3**

FUNDAMENTALS OF DATA STRUCTURES
(Open Elective-1)

Prerequisites: - Nil-

Course Objectives:

1. Understand the notations used to analyze the performance of algorithms.
2. Understand the basic concepts such as Linear and Non Linear Data structures.
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, Applications of stacks: Infix to Postfix 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: Introduction, Basic Terminology, Binary trees, Sequential and Linked representation, Operations – Insertion, Deletion and Traversal.

Hashing: Introduction, Hash functions, Collision Resolution Techniques.

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, Properties, Graph representations – Adjacency matrix, Adjacency list. Graph traversals: Depth First Search & Breadth First Search.

Search trees: Binary search trees, Definition, Operations – Insertion and Deletion, m-way search trees (Definition only).

Text Books:

1. R. Thareja, Data Structures using C, Oxford University Press, October 2015.
2. Horowitz, Sahni, and Anderson-Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.

Reference Books:

1. R.F. Gilberg and B.A. Forouzan, Data structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning.
2. A.M. Tanenbaum, Y. Langsam and M.J. Augensrein, Data Structures using C, 2004, Pearson Education Asia.

Online Resources:

1. https://www.cise.ufl.edu/~sahni/fdsc2ed/instruct/index.html
2. www.geeksforgeeks.org/data-structures
3. https://nptel.ac.in/courses/106102064
4. https://www.coursera.org/learn/data-structures
5. https://ict.iitk.ac.in/wp-content/uploads/CS210-Data-Structures-Module-1-Motivation.pdf

Course Outcomes:

After completion of the course, students will be able to

1. Understand 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 non linear data structures like binary trees, search trees and graphs.
5. Choose appropriate data structures as applied to specified problem definition.
6. Analyze various kinds of searching and sorting techniques.

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III Year B. Tech. II Semester **L T P C**
Course Code: 126KG **3 0 0 3**

FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. Understand the basic concepts and the applications of database systems.
2. Understand the relational database design principles.
3. Master the basics of SQL and construct queries using SQL.
4. Understand the design databases using data modelling and data normalization techniques.

UNIT 1: (~ 10 Lecture Hours)

Introduction: History of database system**,** Database-system applications, Purpose of database systems, View of data, Database languages, Relational databases, Data storage and querying, Transaction management, Database architecture, Database users and administrators.

UNIT 2: (~ 8 Lecture Hours)

Database Design and E-R Model: The Entity-Relationship model, Constrains, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity- Relationship Design issues, Extended E-R Features.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Schema Diagrams, Relational Query Languages, Relational Operations.

UNIT 3: (~ 9 Lecture Hours)

Relational Query Languages: 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 Sub Queries, Modification of the Database.

UNIT 4: (~ 9 Lecture Hours)

Advanced SQL: Join Expressions, Views, Integrity Constraints, Accessing SQL from a Programming Language, Functions and procedures, Triggers.

UNIT 5: (~ 9 Lecture Hours)

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional Dependency Theory, Algorithms for

Decompositions, Decomposition using Multi Valued Dependencies, More Normal Forms.

Text Books:

1. A. Silberschatz, Henry.F. Korth and S. Sudharshan, Database System Concepts, 6th Edition, McGraw Hill Education (India) Private Limited.

Reference Books:

1. C.J. Date, A.Kannan, and S.SwamiNadhan, An Introduction to Database systems, 8th Edition, Pearson Education.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, McGraw Hill Education (India) Private Limited.
3. R Elmasri and Shamkant B. Navathe, Database Systems, 6th Edition, Pearson Education.

Online Resources:

1. www.w3schools.in
2. https://beginnersbook.com/2015/04/dbms-tutorial/
3. https://www.coursera.org/courses?query=database
4. https://onlinecourses.nptel.ac.in/noc18_cs15

Course Outcomes:

After completion of the course, students will be able to

1. Understand concepts and the applications of database systems and implement in real time applications.
2. Design an Entity-Relationship (E-R) model from specifications and transform to relational model.
3. Demonstrate the basic concepts of relational database management system
4. Construct unary/binary/set/aggregate queries in Relational Algebra and in SQL.
5. Articulate the SQL commands for retrieval and management of data.
6. Apply normalization on database schema.

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III Year B. Tech. II Semester	**L T P C**
Course Code: 126KK	**3 0 0 3**

OPERATING SYSTEMS

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. Interpret the role of an Operating System in the overall computer system and study the operations performed by it as a resource manager.
2. Understand the scheduling policies and different memory management techniques for different Operating Systems.
3. Examine process concurrency, synchronization and deadlock situation.
4. Assess the concepts of I/O, storage and file management and introduce system call interface for file and process management.
5. Outline the goals and principles of protection.

UNIT 1: (~10 Lecture Hours)

Introduction: Overview-Introduction-Operating System objectives and functions, User view, System view, Operating System definition, Evolution of Operating System- Simple Batch systems, Multiprogrammed, Time-Sharing Systems, 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 of threads, 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's 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 and 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. https://www.docdroid.net/vp5Cfdg/abraham-silberschatz-operating-system-concepts-9th201212-pdf
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

Course Outcomes:

After completion of the course, student will be able to

1. Understand fundamentals of Operating System.
2. Demonstrate the concepts of process, thread and scheduling algorithms.
3. Apply process synchronization methods to solve critical section problem.
4. Solve deadlock problems using various deadlock management techniques.
5. Compare the different memory management techniques.
6. Summarize file & disk management, protection & security concepts and evaluate the performance of disk scheduling algorithms.

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III Year B. Tech. II Semester **L T P C**
Course Code: 126KQ **3 0 0 3**

SOFTWARE ENGINEERING
(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:
1. Understand the software life cycle models.
2. Understand the importance of the software development process.
3. Understand the importance of modeling and modeling languages.
4. Design and develop correct and robust software products.

UNIT 1: (~10 Lecture Hours)

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.

A Generic view of process: Software engineering- a layered technology, A process framework, The capability maturity model integration (CMMI), Process patterns, Process assessment, Personal and team process models.

Process models: The Waterfall model, Incremental process models, Evolutionary process models, The unified process.

UNIT 2: (~9 Lecture Hours)

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, The software requirements document.

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models: Context models, Behavioural models, Data models, Object models, Structured methods.

UNIT 3: (~9 Lecture Hours)

Design Engineering: Design process and design quality, Design concepts, The design model.

Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural design, Conceptual model of UML, Basic structural modelling, Class diagrams, Sequence diagrams, Collaboration diagrams, Use case diagrams, Component diagrams.

Performing user interface design: Golden rules, User interface analysis, and design, Interface analysis, Interface design steps, Design evaluation.

UNIT 4: (~9 Lecture Hours)

Testing Strategies: A strategic approach to software testing, Test strategies for conventional software, Black-box and white-box testing, Validation testing, System testing, The art of debugging.

Product metrics: Software quality, Metrics for analysis model, Metrics for design model, Metrics for source code, Metrics for testing, Metrics for maintenance.

UNIT 5: (~8 Lecture Hours)

Metrics for Process and Products: Software measurement, Metrics for software quality.

Risk management: Reactive Vs proactive risk strategies, Software risks, Risk identification, Risk Projection, Risk refinement, RMMM, RMMM plan.

Quality Management: Quality concepts, Software quality assurance, Software reviews, Formal technical reviews, Statistical software quality assurance, Software reliability, The ISO 9000 quality standards.

Text Books:

1. Roger S. Pressman, Software Engineering - A Practitioner's Approach, 6th Edition, McGraw Hill Companies, Inc.
2. Sommerville, Software Engineering, 7th Edition, Pearson Education.

Reference Books:

1. Grady Booch, James Rambaugh and Ivar Jacobson, The Unified Modeling Language User Guide, 2nd Edition, Pearson Education.
2. Waman S Jawadekar, Software Engineering Principles and Practice, The McGraw-Hill Companies, 2004.

Online Resources:

1. https://alison.com/courses/software-engineering.
2. https://study.com/articles/List_of_Free_Online_Software_Engineering_Courses.html

Course Outcomes:

After completion of the course, students will be able to

1. Understand basic software engineering methods along with practices, process framework and process models.
2. Analyze software requirements, SRS documents and Project Management.
3. Develop different system models that describe the functionality of the system.
4. Design and maintain efficient, reliable and cost effective software solutions and suitable software metrics.
5. Understand various software testing approaches and techniques used for software assessment.
6. Interpret the significance of Software measurement, software risks and quality control.

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

Course Code: 126KD **3 0 0 3**

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

(Open Elective-1)

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, exhaustive search, heuristic search.
3. To learn logic programming and different knowledge representation techniques.
4. To understand the applications of AI like Game Playing and Expert Systems.
5. To introduce the concept of Intelligent agents.

UNIT 1: (~10 Lecture Hours)

Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI & Applications.

Problem Solving - State-Space Search and Control Strategies, General Problem

Solving Techniques, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction. Game Playing, Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning.

UNIT 2: (~10 Lecture Hours)

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Algorithm, Predicate Logic, Logic Programming.

UNIT 3: (~10 Lecture Hours)

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR.

Uncertainty Measure - Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT 4: (~8 Lecture Hours)

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Rule based Expert Systems, Truth Maintenance Systems, Applications of Expert Systems, List of Shells and Tools.

UNIT 5: (~10 Lecture Hours)

Introduction to Intelligent Agents: Introduction, Agents vs software programs, Classification of agents, Working of an agent, Single-agent and Multi-agent systems, Performance Evaluation of agents, Applications, Multi-Agent Application.

Text Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2011.

Reference Books:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition, 2009.
2. Eugene Charniak, Introduction to Artificial Intelligence, Pearson, 2007.
3. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 1990.
4. George Fluger, Artificial Intelligence, 5th Edition, Pearson.

Online Resources:

1. http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf
2. http://nptel.ac.in/courses/106105077/
3. https://onlinecourses.nptel.ac.in/noc18_cs18/preview
4. 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 to formulate efficient problem space and select a search algorithm for a problem.
2. Apply AI techniques to solve problems related to Game playing.
3. Understand and apply Logic programming in problem solving.
4. Represent knowledge and uncertainty measures using appropriate techniques.
5. Knowledge required for developing expert systems.
6. Understand the concepts of Intelligent systems.

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

Course Code: 126KE **3 0 0 3**

FUNDAMENTALS OF DATA SCIENCE

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. To be exposed with basics of data science.
2. To understand data pre-processing and data visualization methods on real world data.
3. To understand machine learning methods to develop predictive model from pre-processed data.
4. To be exposed with the working methodology of various machine learning models.
5. To know the statistical performance metrics of machine learning methods.
6. To understand the ethical way of dealing with the data and its security.

UNIT 1: (~10 Lecture Hours)

Fundamentals of Data Science - Introduction to data science, Data analytics life cycle, Type of data analysis, Types of jobs in data analytics, Data science tools, Fundamental areas of study in data science, Role of SQL in data science, Pros and cons of data science.

UNIT 2: (~10 Lecture Hours)

Data Preprocessing, Plotting and Visualization- Data types and forms, Possible data error types, Various data preprocessing operations, Introduction to data visualization, Visual encoding, Data visualization libraries, Basic data visualization tools.

UNIT 3: (9 Lecture Hours)

Statistical Data Analysis and Machine Learning-Role of statistics in data science, Descriptive statistics, Inferential statistics, Overview of machine learning, Supervised machine learning, Regression methods, Classification methods, Unsupervised machine learning, Clustering methods, Association analysis.

UNIT 4: (~ 8 Lecture Hours)

Time-series Analysis- Overview of time-series analysis, Components of time-series, Time-series forecasting models.

UNIT 5: (~ 8 Lecture Hours)

Ethics and Data Science- The Five Cs: Consent, Clarity, Consistency and Trust, Control and Transparency, Consequences, Implementing Five Cs, Data's Day of Reckoning, Ethics and Security Training, Developing Guiding

Principles, Building Ethics into Data-drive Culture, Regulation. Recent Trends in the Domain of Data Science.

Text Books:

1. Gypsi Nandi and Rupam Kumar Sharma, Data Science Fundamentals and Practical Approaches by 1st Edition, BPB Publications India.
2. Hilary Mason and D J Patil, Ethics and Data Science by Mike Loukides, 1st Edition, O'Reilly.

Reference Books:

1. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, Introducing Data Science, Latest Edition, Manning.
2. Jesus Rogel-Salazar, Data Science and Analytics with Python Latest Edition, CRC Press Taylor & Francis Group.

Online Resources:

1. http://www.biomedicahelp.altervista.org/Magistrale/Clinics/BIC_PrimoAnno/IdentificazioneModelliD ataMining/Business/Intelligence/Carlo/Vercellis.pdf
2. https://learning.oreilly.com/library/view/business-intelligence- 2nd/9780123858894/xhtml/Title_page.html
3. https://learning.oreilly.com/library/view/successful-business-intelligence/9780071498517/title.html
4. https://www.youtube.com/watch?v=Hg8zBJ1DhLQ
5. https://nptel.ac.in/courses/110107092
6. https://www.udemy.com/course/introduction-to-intelligence/

Course Outcomes:

After completion of the course, students will be able to

1. Design and do analysis of an enterprise datasets.
2. Apply data pre-processing and data visualization methods on real world data.
3. Apply machine learning methods to develop predictive model from pre-processed data.
4. Analyze the working methodology of various machine learning models.
5. Evaluate the statistical metrics of machine learning methods using suitable performance metrics.
6. Inculcate the ethical way of dealing with the data in a secured manner.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KP **3 0 0 3**

R PROGRAMMING

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. Understand the fundamental knowledge of' 'R' programming.
2. Learn how to carry out a range of commonly used statistical methods including analysis of variance and linear regression.
3. Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
4. Analyze and evaluate different types of plots, graphs and scripts.

UNIT 1: (~9 Lecture Hours)

Introducing R: Getting the Hand of R, Running the R Program, Finding Your Way with R, Command Packages.

Becoming Familiar with R: Reading and Getting Data into R, Viewing Named Objects, Types of Data Items, The Structure of Data Items, Examining Data Structure Working with History Commands, Saving your Work in R.

Working with Objects: Manipulating Objects, Viewing Objects within Objects, Constructing Data Objects, Forms of Data Objects: Testing and Converting.

UNIT 2: (~9 Lecture Hours)

Data: Descriptive statistics and tabulation.

Distribution: Looking at the Distribution of Data.

Simple Hypothesis Testing: Using the Student's t-test, The Wilcoxon U-Test (Mann-Whitney), Paired t- and U-Tests, Correlation and Covariance, Tests for Association.

UNIT 3: (~9 Lecture Hours)

Introduction to Graphical Analysis: Box-whisker Plots, Scatter Plots, Pairs Plots (Multiple Correlation Plots) Line Charts, Pie Charts, Cleveland Dot Charts, Bar Charts, Copy Graphics to Other Applications.

Formula Notation and Complex Statistics: Examples of Using Formula Syntax for Basic tests, Formula Notation in Graphics, Analysis of Variance (ANOVA).

UNIT 4: (~9 Lecture Hours)

Manipulating Data and Extracting Components: Creating Data for Complex Analysis, Summarizing Data.

Regression (Linear Modeling): Simple Linear Regression, Multiple Regression, Curvilinear Regression, Plotting Linear Models and Curve Fitting, Summarizing Regression Models.

UNIT 5: (~9 Lecture Hours)

More about Graphs: Adding elements to existing plots, Matrix plots, multiple plots in one window, exporting graphs

Writing your own scripts: Beginning to Program: Copy and Paste Scripts, Creating Simple Functions, Making Source Code.

Text Books:

1. "Beginning R the statistical programming language" Dr. Mark Gardener, Wiley Publications, 2015.

References Books:

1. **Hands-On** Programming with R Paperback by Grolemund, Garrett, SPD, 2014.
2. The R Book, Michael J. Crawley, WILEY, 2012.

Online Resources:

1. https://www.udemy.com/r/online-course
2. https://www.courseera.org/learn/r-pragramming
3. https://www.codecademy.com/learn/ learn-r

Course Outcomes:

After completion of the course, students will be able to

1. Develop and implement R analytics to create business insights of real time projects.
2. Understand the relevant data descriptions and process in R language.
3. Learn a wide range of analytical methods and produce the quality graphics.
4. Solve various real time problems using formula notation and statistics in R.
5. Evaluate different data models and perform regression analysis.
6. Explore on various ways to display results through plots and scripts.

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III Year B.Tech II Semester **L T P C**
Course Code: 126KA **3 0 0 3**

BIOMEDICAL ELECTRONICS AND APPLICATIONS

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. To acquire knowledge on basics of human physiology.
2. To study different bio electrodes, 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: (~10 Lecture Hours)

Recording Instruments

Electro Physiology and Bio potential Recording The Origin of Bio potentials Bio potential Electrodes Biological Amplifiers ECG, EEG, EMG, PCG, EOG Lead Systems and Recording Methods Typical Waveforms and Signal Characteristics.

UNIT 2: (~10 Lecture Hours)

Measurement and Analysis Technique

Measurement of Blood Flow Radiographic Indicator Dye Dilution Thermal Convection Magnetic Blood Flow Rate Ultrasonic Blood Flow meter, Sphygmomanometer, Blood Gas Analyzer, Oximeter, Auto Analyzers, Electrophoresis, Colorimeter, Spectrophotometer, Flame Photometer.

UNIT 3: (~10 Lecture Hours)

Therapeutic Equipment's and Patient Safety

Stimulators- Defibrillators, Pacemakers, Diathermy, Respirators, Blood Pumps, Ventilator, Haemodialysis Machine Role of Laser in Health Care, Patient Safety, Macro, Micro Shock Preventive Measures, Earth Free Patient Monitoring.

UNIT 4: (~10 Lecture Hours)

Medical Imaging

X Ray Imaging and CT scan Application and X Ray Therapy CAT Scan, MRI, PET, Physics of Ultrasound, Ultrasound Imaging A Scan and B Scan, Displays Multi Array Scanning, M Mode Scanning, Advantages and Disadvantages of Ultrasound Scanning, Thermal Imaging Systems.

UNIT 5: (~8 Lecture Hours)

Computer Applications in Medical Field

Computer Applications in Medicine, Patient Monitoring System, Endoscopy Unit, Radio pill, Telemedicine and Medical Informatics.

Text Books:

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

Online Resources:

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

Course Outcomes:

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

1. Describe the functioning and recording of human physiological parameters using ECG, EEG, EMG systems.
2. Understanding the measurement of Blood pressure and Blood Flow meters.
3. Explore the applications of the electronic systems as prosthetic devices in biological and medical applications pacemakers defibrillators, Heart lung machine etc.
4. Examine the various medical imaging techniques and discuss therapeutic and assist devices.
5. Evaluate the practical limitations on electronic components while handling bio substances.
6. Illustrate the various computer aided applications in the field of medical applications.

III Year B.Tech II-Semester	**L T P C**
Course Code: 126KN	**3 0 0 3**

PRINCIPLES OF COMMUNICATION TECHNOLOGIES

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. Develop knowledge and understanding of the Communication Technology components.
2. Build up capacity on wireless technologies.
3. Discuss the fundamental problems in wireless networking.
4. Provide an analytical perspective on the design and analysis of the traditional and emerging wireless networks.

UNIT 1: (~9 Lecture Hours)

Basic Concepts of Communication Technology: Data communications system components, Data Representation, Data flow: simplex, half-duplex, or full–duplex, type of Connections: Point-to-Point, Multipoint, types of physical topology, Communication models: OSI model and the TCP/IP model.

UNIT 2: (~10 Lecture Hours)

Overview of Wireless n/w. and Technologies: Introduction, Different generations. Introduction to 1G, 2G, 3G, 4G and 5G, Bluetooth, Radio frequency identification (Rfid), Wireless Broadband, Wireless network topologies, Cell fundamentals and topologies, Global system for mobile communication, GSM architecture, network aspects in GSM, GPRS network architecture, GPRS network operation.

UNIT 3: (~9 Lecture Hours)

Mobile Computing: Architecture for mobile computing, Three tier architecture, design considerations for mobile computing, mobile computing through internet, Wireless network architecture, Applications, Security, Concerns and Standards, Benefits, Future evolution of mobile computing.

UNIT 4: (~9 Lecture Hours)

Wireless Networks: Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a, b, g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

UNIT 5: (~9 Lecture Hours)

Telecommunication Systems: Telephone system, difference between wireless and fixed telephone nwtworks, Paging systems, Internet Telephony. Wireless Application Protocol(WAP), 3G Spread-spectrum Technology, FHSS, DSSS, CDMA versus GSM, applications in 3G Wireless LAN, WiFi v/s 3G Voice over Internet protocol.

Text Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Mobile Computing, Asoke K Telukder, Roopa R Yavagal, TMH
3. Wireless Communication and Networking – William Stallings, 2003, PHI

Reference Books:

1. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, 2002, PE
2. Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH.
3. Vijay Garg, Wireless Communications and Networking, Elsevier Publications, 2007.

Online References:

1. https://onlinecourses.nptel.ac.in/noc22_ee61/preview Communication Networks by Prof. Goutam Das, IIT Kharagpur
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. Interpret the basic concepts of Communication Technology.
2. Comprehend wireless technology systems.
3. Devise mobile computing architecture and its standards.
4. Summarise mobile computing security concerns and applications.
5. Classify wireless Local and Wide area networks and their specifications.
6. Differentiate 2G and 3G wireless standards.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KR **3 0 0 3**

VERILOG HDL
(Open Elective-1)

Prerequisites: Nil

Course Objectives:

1. Understand the need of Hardware Descriptive Languages.
2. Expose students to Language constructs and Conventions of Verilog HDL.
3. Design Digital Circuits using Verilog HDL.
4. Verify the Digital System Designs using Test benches.

UNIT 1: (~8 Lecture Hours)

Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, Module, Testbench.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks.

UNIT 2: (~8 Lecture Hours)

Gate Level Modelling: Introduction, AND Gate Primitive, Module Structure, Other gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delays, Strengths and Construction Resolution, Net Types, Design of Basic Circuits.

UNIT 3: (~10 Lecture Hours)

Modelling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignments to Vectors, Operators.

Switch Level Modelling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with 'Strengths' and 'Delays', Strength Contention with Trireg Nets.

UNIT 4: (~10 Lecture Hours)

Behavioral Modelling : Introduction, Operations and Assignments, Functional Bifurcation, 'Initial' Construct, 'Always' construct, Assignments with delays, 'Wait' construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' statement, Simulation Flow, 'If' and 'If – Else' Constructs, 'Assign and De-Assign' Constructs, 'Repeat' Construct, For loop, The 'Disable' Construct, While Loop, Forever loop, Parallel Blocks, 'Force-Release' Construct, Event

UNIT 5: (~10 Lecture Hours)

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, File Based Tasks and Functions, Compiler Directives, Hierarchical Access, User Defined Primitives.

Text Books:

1. T.R. Padmanabhan, B. Bala Tripura Sundari, Design Through Verilog HDL, Wiley, 2009.
2. Verilog HDL-Samir Palnitkar, II Edition, Pearson Education, 2009.

Reference Books:

1. Michel D. Ciletti, "Advanced Digital Design with the Verilog HDL", PHI, 2009.
2. ZainalabdienNavabi, "Verilog Digital System Design", TMH, II Edition, 2006.

Online Resources:

1. Hardware Modelling using Verilog by Prof.Indranil Sengupta, IIT Kharagpur - https://nptel.ac.in/courses/106105165
2. System Design through Verilog by Prof.Shaik Rafi Ahamed, IIT Guwahati - https://archive.nptel.ac.in/courses/108/103/108103179/
3. Free online book: Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition by Amir Palnitkar, https://d1.amobbs.com/bbs_upload782111/files_33/ ourdev_585395BQ8J9A.pdf .

Course Outcomes:

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

1. Identify the need for hardware descriptive languages, various language Constructs and conventions of Verilog HDL.
2. Design basic digital systems using gate level and switch level HDL modelling.
3. Build digital systems at dataflow level using Verilog HDL.
4. Demonstrate the use of behavioural level modelling constructs to design digital systems.
5. Write test benches to analyze and verify the digital systems.
6. Implement digital circuits using advanced Verilog HDL constructs.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KM **3 0 0 3**

PRINCIPLES OF COMMUNICATIONS

(Open Elective-1)

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. Analyze 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)

Modulation Techniques: Analog Modulation- Amplitude Modulation Fundamentals, Amplitude Modulator and Demodulator Circuits, Fundamentals of Frequency Modulation, PAM, PWM, PPM, Pulse Code Modulation techniques. 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.
2. K.Sam Shanmugam, Digital and Analog Communication Systems, JohnWiley and Sons, 2004.

Reference Books:

1. Theodore S. Rappaport, Wireless Communications-Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2nd Edition, Wiley Publications.

Online Resources:

1. https://nptel.ac.in/courses/108104098/

Course Outcomes:

After completion of the course, students will be able to

1. Analyze the basic concepts of modulation and understand the different kinds of analog modulation techniques.
2. Understand and analyze the different types of pulse analog and digital modulation systems.
3. Describe the Telephone systems and network fundamentals.
4. Statetheoperativephysicalprincipleoflaunchingsatellitesandexplain 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 cellphone operational concepts.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KC **3 0 0 3**

ENGINEERING MATERIALS

(Open Elective-1)

Prerequisites: -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 concepts of semiconductor materials.

UNIT 1: (~8 Lecture Hours)

Electrical Materials Introduction: Types of Materials, Properties

Dielectric materials: Types-Solid, Liquid and Gaseous dielectrics - Electric conductivity in Solid, Liquid and Gaseous dielectrics.

UNIT 2: (~8 Lecture Hours)

Semiconductor Materials

Types of semiconductors, properties, Doping Techniques, - Current carriers in Semiconductor- Photoconductors, Characteristics.

UNIT 3: (~8 Lecture Hours)

Magnetic Materials

Classification of Magnetic Materials, Properties, Curie point, Magnetically soft and hard Materials- Feebly Magnetic Materials, Cermet Permanent Magnets, Ageing of Magnets - Factors effecting Permeability and Hysteresis.

UNIT 4: (~8 Lecture Hours)

Special Purpose Materials

Refractory Materials, Radioactive Materials, Insulating varnishes and coolants, Properties and Applications of mineral oils, Testing of Transformer Oil as per BIS, IEC.

UNIT 5: (~8 Lecture Hours)

Materials for Specific Applications

Materials for solar cells and battery, Materials for coatings for enhanced solar thermal energy collection, Cold Mirror Coatings, Heat Mirror Coatings, Antireflection Coatings.

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 different types of materials by virtue of their properties.
2. Categorize & analyze Dielectric and semiconductor materials.
3. Classify the magnetic materials using their properties.
4. Differentiate & identify special-purpose materials for electrical applications.
5. Identify special-purpose materials for non-electrical applications.
6. Analyze the working of materials from the point of view of specific applications in electrical & other fields.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KL **3 0 0 3**

OPERATIONS RESEARCH

(Open Elective-1)

Prerequisites: -Nil-

Course objectives:

1. Define and formulate linear programming problems and appreciate their limitations.
2. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action.
3. Develop mathematical skills to analyze and solve dynamic programming models arising from a wide range of applications
4. Help students develop the ability to make informed decisions based on quantitative analysis.

UNIT 1: (~10 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: (~9 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: (~9 Lecture Hours)

a) **Assignment model:** Formulation. Hungarian method for optimal solution. Solving unbalanced Assignment problem.

b) **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: (~10 Lecture Hours)

a) **Dynamic programming:** Characteristics of dynamic programming. Dynamic programming approach for Coach/Shortest Path and cargo loading problems.

b) **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: (~10 Lecture Hours)

a) **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.

b) **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. S.D.Sharna, operations research theory methods and applications, 2020th edition, Kedar Nath Ram Nath, 2014.
2. J K Sharma.,Operations Research, theory and applications, 6th edition, Macmillan India Ltd, 2017.

Reference Books

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. F.H. Hillier and G.J. Lieberman, Introduction to Operations Research, Tata-McGraw-Hill, 2010.

Online Resources:

1. Website/ Materials: IOR Tutorials (Interactive Operations Research Tutorial)
2. Onlinecourses.nptel.ac.in

Course Outcomes:

At the end of the course students are expected to

1. Apply linear programming models to several Engineering Applications.
2. To use several other techniques like Transportation, Assignment, and Sequencing Models in the real world applications.
3. In Dynamic Programming selected models were taught.
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.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KJ **3 0 0 3**

INTRODUCTION TO DATA ANALYTICS

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. To learn the importance of data and its types.
2. To understand Regression Analysis and Multi Variate Data.
3. To gain a basic knowledge on Machine learning.
4. To study Non-Linear Optimization Techniques.

UNIT 1: (~9 Lecture Hours)

Fundamentals of Data Analytics: Role of data analytics in science and engineering, types of data and data summarization methods, levels of measurement, data storytelling, data journalism, data warehousing.

UNIT 2: (~6 Lecture Hours)

Simple Linear Regression: Simple Linear regression model, estimate regression coefficients, properties of least square estimators, estimation of σ^2, confidence intervals and test for $5\lambda_0$ & $5\lambda_1$, ANOVA, Coefficient of determination.

UNIT 3: (~9 Lecture Hours)

Multiple Linear Regression: Multiple Linear Regression using Matrix Method-Test for significance for Regression coefficients-ANOVA, Regularization methods- LASSO, RIDGE, and Elastic nets.

UNIT 4: (~12 Lecture Hours)

Foundation for Machine learning:

Machine learning Techniques- Overview, Introduction to Multivariate data, Principal Component Analysis, Dimensionality reduction -Linear Discriminant Analysis - -Naive -Baye's classification, Hierarchical (Agglomerative) clustering, Non-Hierarchical clustering (K-means algorithm).

UNIT 5: (~9 Lecture Hours)

Non-Linear Optimization Techniques:

Problem Formulation for Nonlinear Programming, Unconstrained optimization (Hessian Matrix Method), Constrained Multivariate optimization with equality constraints (Lagrangian Multipliers Technique), Constrained Multivariate optimization with inequality constraints (Kuhn Tucker conditions).

Text Books:

1. S.P.Gupta, Statistical Methods , Sultan Chand & Sons, 46th Edition
2. Galit Shmueli Peter C. Bruce Inbal Yahav Nitin R. Patel Kenneth C. Lichtendahl Jr. Data Mining for Business Analytics Concepts, Techniques, and Applications in R, Wiley Publications
3. Operations Research by Er. Prem Kumar Gupta, Dr. D. S. Hira, S. Chand Publications.

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, Iowa Jay L. Devore ,Introduction to Statistics and Data Analysis, Cengage Learning, 5th Edition.
4. Cole Nussbaumer Knaflic, Story Telling with Data, wiley Publications.
5. Hiller and Lieberman, Introduction to Operation Research, McGraw Hill Higher Education, 7th edition.

Online Resources:

1. E-book on Multivariate Data Analysis. https://www.drnishikantjha.com/papers Collection/Multivariate %20 Data%20Analysis.pdf
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119296294
3. 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 Data Analysis.
2. Determine the Simple Linear regression coefficient and test the significance.
3. Estimate the Multiple Linear regression coefficient and test the significance.
4. Implement the knowledge of Multivariate data and regularization methods.
5. Acquire basic concepts in Machine learning.
6. Learn about Optimization techniques.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KH **3 0 0 3**

INTELLECTUAL PROPERTY RIGHTS

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. Educate the importance of IPR in Engineering
2. Enlighten the various types of IP's and their protection.
3. Maintain IPR's for Business sustainability.

UNIT 1: (~09 Lecture Hours)

Introduction to Intellectual property

Intellectual property: Introduction – Features - Types of Intellectual property - Importance of Intellectual property rights - International organizations - Agencies and treaties, Conventions.

UNIT 2: (~08 Lecture Hours)

Patents

Patents: Concept of Patent – Duration – Patent Process – Patent searching – Procedure for filing 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 Copyright 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: (~08 Lecture Hours)

Industrial Designs

Industrial Designs – Importance of Industrial 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 Secrets – Trade secret law – Determinants of Trade secret status - Liability for misappropriation of Trade Secrets – Protection for submission -

Trade secret litigation – Unfair competition – Interface between Intellectual Property Rights and Competition – Safeguards against Unfair competition.

Intellectual property audits – Types of IP Audit – Procedure of Preparing Audit – Auditing IP Assets.

Text Books:

1. Deborah. E. Bouchoux (2015) Intellectual property right, 4^{th} Edition, Cengage learning.
2. Prabuddha Ganguli (2017) Intellectual property right – Unleashing the knowledge economy, 4^{th} Edition,Tata McGraw Hill Publishing company ltd.

Reference Books:

1. S.P Satarkar (2003) Intellectual Property Rights and Copyrights, Ess Ess Publications.
2. Kompal Bansal, Parikshit Bansal (2020) Fundamentals of Intellectual property for Engineers, BS Publications.

Online Resources:

1. Introduction on Intellectual Property to Engineers and Technologists https://nptel.ac.in/courses/109105112/

Course Outcomes :

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

1. Understand the dynamics and legalistic framework of IPR
2. Acquaint the procedure of securing patents and its procedure.
3. Acquire information and make use of Copy right protection.
4. Examine the eminence of trade marks in growth of Business.
5. Identify the importance of safeguarding Industrial designs.
6. Sustain Trade Secrets and aspects of IP audit.

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III Year B.Tech. II-Semester **L T P C**
Course Code: 126KB **3 0 0 3**

DISASTER MANAGEMENT

(Open Elective-1)

Prerequisites: -Nil-

Course Objectives:

1. To introduce the basic concepts in Disaster Management.
2. To explain the different types of natural and manmade disasters.
3. To provide the information on Disaster Management Mechanism.
4. To introduce the concept of capacity building, safety in industries.
5. To provide an overview on the roles of national and international cooperation in disaster management.
6. To explain the application of spatial technologies in disaster management.

UNIT 1: (~9 Lectures)

Introduction to Disaster Management: Introduction – Hazard, Disaster, Vulnerability, Risk, Capacity Building, Environmental Hazard, Disaster and Stress, Disaster Phenomena and Events (Global, National and Regional).

Classification - Natural and Man-made Hazards (Planetary, Extra Planetary, Endogenous and Exogenous Hazards). Climate Change Impact – (Global Warming, Ozone Layer Depletion, Deforestation, Forest Fires).

UNIT 2: (~9 Lectures)

Planetary and Extra Planetary Hazards: Endogenous Hazards and Exogenous Hazards. **Earthquakes, Landslides, Volcanic Eruptions –** Causes, Effects, distribution, human adjustment, perception and mitigation measures

Cyclones, Floods, Droughts, Cold Waves and Heat Waves - Causes, Effects, distribution, human adjustment, perception and mitigation measures.

Extra Planetary Hazards and Disasters – Asteroids, Meteoroids, Meteors, Meteorites.

Man Induced Hazards and Disasters – Nuclear Hazards (Chernobyl), Industrial/ Chemical – (Bhopal Gas Tragedy), Biological – (Covid-19), Road and Rail Accidents, Plane Crash.

UNIT 3: (~8 Lectures)

Disaster Management Mechanism: Disaster Management Cycle – Prevention, Mitigation, Preparedness, Response, Recovery and Rehabilitation. Planning for Relief. Concepts of Risk Management and Crisis Management – (Risk Reduction and Survival Strategies).

UNIT 4: (~9 Lectures)

Disaster Risk Reduction (DRR) - Structural and Non-Structural Measures; Risk Analysis, Vulnerability and Capacity Assessment; Early Warning Systems, Post Disaster Environmental Response (Water, Sanitation, Food Safety, Waste Management, Disease Control, Security, Communications); Roles and Responsibilities of Government, Community, Local Institutions, NGOs and other Stakeholders; Policies and Legislation for Disaster Risk Reduction, Industrial Safety Plan.

UNIT 5: (~9 Lectures)

National & International Co-Operation in Disaster Management:

DRR Programmes in India and the activities of National Disaster Management Authority, Role of NDMA, NDRF, NIDM in Disaster Management, NDMA Guidelines, Disaster Management Act, 2005 and National Policy on Disaster Management, 2009, The National Disaster Management Plan, 2016, Organizational Structure for Disaster Management. Global Framework for Disaster Risk Reduction (Sendai Framework, Paris Agreement, Sustainable Development Goals, Hyogo Framework, Yokohoma Strategy on Disaster Risk Reduction). Bilateral Agreements, 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. Disaster Management by Mrinalini Pandey, Wiley, 1st Edition, 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Private Limited, 2015.
4. Disaster Mitigation: Experiences and Reflections by Pradeep Sahni, PHI Learning Private Limited, 2010.
5. Natural Hazards and Disasters by Donald Hyndman and David Hyndman - Cengage Learning, 2006.
6. UNEP – Disaster Risk Reduction - https://www.unep.org/explore-topics/disasters-conflicts/what- we-do/risk-reduction

Reference Books:

1. Earth and Atmospheric Disasters Management by N. Pandharinath, CK Rajan, BS Publications, 2009.
2. Environmental Geography by R. B. Singh, Heritage Publishers, New Delhi, 1990.
3. Environmental Geography by Savinder Singh, Prayag Pustak Bhawann, 1997.
4. The Environment as Hazards by B. I. Kates and G. F. White. Oxford Press, New York, 1978.

5. Disaster Management by R. B. Singh, Rawat Publication, New Delhi, 2000.
6. Disaster Management by H. K. Gupta, Universities Press, India, 2003.
7. Space Technology for Disaster Mitigation in India (INCED) by R. B. Singh, University of Tokyo, 1994.
8. Disaster Management in Hills by Satender, Concept Publishing Co., New Delhi, 2003.
9. An Overview on Natural and Manmade Disaster and their Reduction by R. K. Bhandani, CSIR, New Delhi.
10. Manuals on Natural Disaster Management in India by M. C. Gupta, National Centre for Disaster Management, IIPA, New Delhi, 2001.

Web Resources:

- National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf).
- National Institute of Disaster Management (NIDM) (https://nidm.gov.in)
- WHO–Disaster Management Resources- https://www.who.int/surgery/publications/immesc_disaster_management/en/

Online Courses:

- https://swayam.gov.in/courses/4983-disaster-management
- https://reliefweb.int/training/2455444/free-online-course-disaster-risk-reduction-and-management
- https://www.unisdr.org/we/inform/events/47107
- https://www.futurelearn.com/courses/disaster-management/2
- https://www.ifrc.org/en/get-involved/learning-education-training/certified-professional- development-courses/online-certificate-programme-in-disaster-management/

Course Outcomes:

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

1. Explain and differentiate disasters and their vulnerabilities - causes, impacts and mitigation measures.
2. Articulate the disaster management mechanism in natural and man induced disasters.
3. Design Industrial Safety Plan for Industrial Hazards.
4. Plan and implement for the Disaster Risk Reduction.
5. Prepare disaster management plan for specific disasters with the help of national and international agencies.

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

Course Code: 127KY **3 0 0 3**

INTERNET OF THINGS

(Open Elective-2)

Prerequisites: -Nil-

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, Date/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, I2C) 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 Web server – Web server for IoT, Cloud for IoT, Python web application framework, Designing a REST ful 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 RaspberryPi, 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.onlinecourses.nptel.ac.in

Course Outcomes:

After completion of the course, students will be able to

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

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KT **3 0 0 3**

CYBER SECURITY

(Open Elective-2)

Prerequisites: -Nil-

Course Objectives:

1. To familiarize various types of cyber-attacks and cyber-crimes, Laws and IT Acts.
2. To study the defensive techniques against Cyber attacks.
3. To explore various security challenges faced by mobile workforce and their implications under Cybercrime.
4. To determine various web threats faced by organizations and understand about Social Media Networking.
5. To understand various data privacy issues and role of Cyber Forensics.

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: (~9 Lecture Hours)

Cyber Offenses: How Criminals Plan Them: Introduction – Categories of Cybercrime, How Criminals plan the Attacks – Reconnaissance, Passive Attacks, Active Attacks, Scanning and Scrutinizing Gathered Information, Attack, Social Engineering, Cyber stalking – Types, Cases reported on Cyberstalking, Working of Stalking, Real-Life incident of Cyberstalking, Cybercafé 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: (~9 Lecture Hours)

Privacy Issues

Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

UNIT 5: (~9 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.

Cyber Forensics: Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Text Books:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley.
2. B.B.Gupta,D.P.Agrawal,HaoxiangWang,ComputerandCyberSecurity: Principle s, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

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://cloudian.com/guides/data-protection/data-protection-and-privacy-7-ways-to-protect- user-data/
3. https://www.cybersecurityeducation.org/resources/
4. https://onlinecourses-swayam2-ac- in.translate.goog/nou19_cs08/preview?_x_tr_sl=en&_x_tr_tl=ta&_x_tr_hl=ta&_x_tr_pto=sc
5. https://www.mygreatlearning.com/academy/learn-for-free/courses/cyber-forensics

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 the forms of Cybercriminal activities and Social Engineering methods used to undertake crimes.
3. Understand the Security challenges posed by mobile and wireless devices.
4. Define privacy policies and their specifications.
5. Apply risk management policies to protect organization's critical information and forensically investigate security incidents.
6. Understand real time cybercrimes to assess the scenarios in India, Global and Legal Perspectives.

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IV Year B.Tech II Semester **L T P C**
Course Code: 127KZ **3 0 0 3**

MACHINE LEARNING BASICS

(Open Elective-2)

Prerequisites: -Nil-

Course Objectives:

1. To be able to identify machine learning problems corresponding to different applications.
2. To understand a various machine learning algorithms along with their strengths and weaknesses.
3. To understand the basic theory underlying machine learning.
4. To Introduce Decision Tree learning, Instance Based Learning techniques.

UNIT 1: (~10 Lecture Hours)

Introduction: Well posed learning problems, designing a learning system Perspectives and issues in machine learning.

Concept Learning: Concept learning task, Concept Learning as search through a hypothesis space, Finding maximally specific hypothesis, Version spaces and the Candidate-Elimination algorithm, Inductive Bias.

UNIT 2: (~10 Lecture Hours)

Decision Tree Learning: Decision Tree representation, appropriate problems for Decision Tree Learning, Hypothesis space search in Decision Tree Learning,Issues in Decision Tree Learning.

Neural Network Learning: Introduction, The Neuron Model, Activation Functions, Neural Network Architecture: Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks.

UNIT 3: (~9 Lecture Hours)

Support Vector Machines: Introduction, Linear Classifier, Non-linear Classifier, Training SVM, Support Vector Regression.

Bayesian Learning: Bayes theorem and concept learning, Minimum Description Length Principle, Bayes optimal classifier, Gibbs Algorithm, Naïve Bayes Classifier, The EM algorithm.

UNIT 4: (~ 8 Lecture Hours)

Computational Learning Theory: Sample complexity for finite and infinite hypothesis spaces, Mistake bound model.

Instance – Based Techniques: K-nearest neighbor Learning, Locally Weighted Regression, Radial Basis Function, Case Based reasoning, Remarks on Lazy vs Eager learning.

UNIT 5: (~ 8 Lecture Hours)

Genetic Algorithm: Biological motivation, Representing Hypothesis, Genetic Operators, Fitness function and selection, Models of Evolution and Learning, Parallelizing Genetic Algorithms.

Text Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill Education, Edition 2013

Reference Books:

1. Saroj Kaushik, Artificial Intelligence, CENGAGE Learning, 2011.
2. Trevor Hasti, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, 2nd Edition, Springer Series in Statistics, 2001.
3. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009.

Online Resources:

1. http://www.cs.cmu.edu/~tom/
2. http://www.holehouse.org/mlclass/

Course Outcomes:

After completion of the course, students will be able to

1. Gain Knowledge on the basic theory in machine learning
2. Understand machine learning problems corresponding to different applications.
3. Identify machine learning techniques appropriate to respective problems.
4. Compare various machine learning algorithms along with their strengths and weaknesses.
5. Analyze the machine learning algorithms under supervised and unsupervised paradigms.
6. Apply different learning algorithms to solve problems of moderate complexity.

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IV Year B.Tech. I-Semester	**L**	**T**	**P**	**C**
Course Code: 127KU	**3**	**0**	**0**	**3**

DATA VISUALIZATION USING PYTHON

(Open Elective-2)

Prerequisites: -Nil-

Course Objectives:

1. To understand the basics and data pre-processing techniques of data visualization.
2. Learn various techniques for visualization of data.
3. To draw the plots and learn how to customize them.
4. To Plot charts with images and maps.
5. To design the right plot to understand the data.

UNIT 1: (~ 8 Lecture Hours)

Introduction to Data & Visualization: Data foundations – Types of Data – Nominal, Ordinal, Interval, Ratio Scaled.

Data Pre-processing: Why Pre-process the data? Descriptive Data Summarization – Measuring the Central Tendency, Measuring the Dispersion of Data – Ratio scaled.

UNIT 2: (~ 8 Lecture Hours)

Visualizing Data: Mapping Data on to Aesthetics and Types of Data, Scales Map Data values on to Aesthetics,

Drawing your first plot and customizing them: Defining plot types – Bar, Line, and stacked charts. Defining plot line styles, properties, and format strings. Adding a legend and annotations. Making histograms, making pie charts count, Plotting with filled areas.

UNIT 3: (~10 Lecture Hours)

More plots and Customization: Adding a data table to the figure, using subplots, filling an under-plot area.

Plotting charts with images: Processing images with PIL, plotting with images, displaying an image with other plots in the figure.

UNIT 4: (~ 9 Lecture Hours)

Plotting charts with Maps: Plotting data on a map using base map, plotting data on a map using google API, Generating CAPTCHA images.

Using Right plots to understand the Data: Using scatter plots and histograms, plotting the cross correlations between two variables, importance of auto correlation.

UNIT 5: (~ 9 Lecture Hours)

Making 3D visualizations: Creating 3D bars and Creating 3D Histograms.

Case Studies on Data Visualization using Python: Visualizations in python on sales data, any other case study on real time dataset.

Text Books:

1. Igor Milovanovic, Python Data Visualization Cookbook, PACKT publishing, 2013.
2. Claus O. Wilke, Fundamentals of Data Visualization, First Release Edition, O'Reilly Publication.

Reference Books:

1. Daniel Keim, Georges Grinstein and Matthew O. Ward, Interactive Data Visualization Foundations, Techniques, and Applications, Natick, Massachusetts: A K Peters, Ltd.
2. Kieran Healy, Data Visualization: A Practical Introduction, 1st Edition, Princeton University Press.
3. Edward R. Tufte, The Visual Display of Quantitative Information, 2nd Edition, Graphics Press.

Online Resources:

1. https://clauswilke.com/dataviz/
2. https://www.coursera.org/learn/python-for-data-visualization

Course Outcomes:

After completion of the course, students will be able to

1. Understand fundamental computer knowledge in the visualization process and pre-processing of the data.
2. Analyze the tools for creating, importing & exporting data, and generate reports using different chart types.
3. Able to design plots and how customize them.
4. Knowledge on visualizing images, maps and generating CAPTCHAs.
5. Understand the data and choose correct visualization to that.
6. Able to apply data visualization techniques on real-time datasets.

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IV Year B.Tech. I-Semester **L T P C**
Course Code: 127KV **3 0 0 3**

SENSORS AND ACTUATORS

(Open Elective-2)

Prerequisites: -Nil-

Course Objectives:

1. To create a conceptual understanding of the basic principles of sensors, actuators, and their operations.
2. To promote awareness regarding recent developments in the fields of sensors and actuators
3. To provide an idea of strengths and weaknesses of the various types of sensors and actuators.
4. To analyze different types of Sensors, Pneumatic, Hydraulic, and Micro actuators.

UNIT 1: (~ 10 Lecture Hours)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges, Inductive Sensors- Sensitivity and Linearity of the Sensor.

Types: Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors using Quartz Resonators, Ultrasonic Sensors.

UNIT 2: (~ 9 Lecture Hours)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Resistance Change Type Thermometric Sensors.

Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto-resistive Sensing, Semiconductor Magneto-resistors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers.

UNIT 3: (~ 9 Lecture Hours)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, Automation.

UNIT 4: (~ 9 Lecture Hours)

Actuators: Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator;

cylinder, rotary actuators. Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.

UNIT 5: (~ 9 Lecture Hours)

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic-Linear, Rotary, Resonant, Electro Hydrodynamic Magnetic- Thermo magnetic, Magnetostatic micro actuators.

Text Books:

1. D. Patranabis, Sensors and Transducers, Prentice Hall India Pvt., 2nd Ed, 2021.
2. Massood Tabib and Azar, Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures, First edition, Kluwer academic publishers, Springer, 1997.
3. Manfred Kohl, Shape Memory Actuators, first edition, Springer.

Reference Books:

1. Robert H Bishop, The Mechatronics Hand Book, CRC Press, 2002.
2. Clarence W. De Silva, "Sensors and Actuators Engineering System Instrumentation", Taylor & Francis Ltd, 2nd Ed,2015.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ee32/preview
2. https://nptel.ac.in/courses/108108147

Course Outcomes:

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

1. List the different types of sensors and actuators based on their working principle.
2. Classify different Sensors & Actuators based on various physical phenomena and differentiate their performance characteristics
3. Interpret the functional principles of sensors and actuators.
4. Demonstrate the working operations, strengths, and weaknesses of the various types of sensors and actuators.
5. Distinguish different types of sensors and actuators based on their mathematical model.
6. Select the relevant Sensors, Pneumatic, Hydraulic and Micro actuators for real-time advanced applications.

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IV Year B.Tech. I-Semester	**L T P C**
Course Code: 127LR	**3 0 0 3**

ELEMENTS OF SATELLITE COMMUNICATIONS
(Open Elective 2)

Prerequisites: Nil

Course Objectives:

1. Acquire foundation in orbital mechanics for the satellites with Applications of satellite Communication.
2. Provide basic knowledge of Satellite Sub Systems.
3. Familiarize basic knowledge of Link Design of Satellite.
4. Understand Earth Station Technology.
5. Understand the concepts of LEO , GEO stationary Satellite systems.

UNIT 1: (~10 Lecture Hours)

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics: Orbital Mechanics, Look Angle determination, Orbital Perturbations, Orbit determination, Orbital Effects in Communication Systems Performance.

UNIT 2: (~10 Lecture Hours)

Satellite Subsystems: Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification

UNIT 3: (~8 Lecture Hours)

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Up Link Design, Design Of Satellite Links For Specified C/N, System Design Examples.

UNIT 4: (~8 Lecture Hours)

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

UNIT 5: (~12 Lecture Hours)

Low Earth Orbit and Non Geo-Stationary Satellite Systems: Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.

Text Books:

1 Satellite Communications – Timothy Pratt, Jeremy Allnutt, WSE, Wiley Publications, 3rd Edition, 2019.

2 Satellite Communication by Robert M. Gagliardi, CBS Publisher, 1st Edition 2019.

3. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

Reference Books:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication – D.C Agarwal, Khanna Publications, 5th Edition 2008.
3. Satellite Communications: Concepts and Applications – K.N. Raja Rao, PHI, 2nd Edition 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 4th Edition, 2009.

Online Resources:

1. UCLA University EC ENGR X 422.19 https://www.uclaextension.edu/engineering/electrical-computer-engineering/course/satellite-communication-system-design-ec-engr-x
2. MIT Open courseware https://ocw.mit.edu/courses/16-851-satellite-engineering-fall-2003/resources/l2_orbital_mech/

Course Outcomes:

After completion of the course, student will be able to

1. Understand basic concepts and frequency allocations for satellite communication, orbital mechanics.
2. Envision the satellite sub systems with the Knowledge of Multiple beam focusing.
3. Familiarize the concept of G/T ratio
4. Analyze in design of satellite links for specified C/N.
5. Understand Earth station technologies.
6. Know the concepts of LEO, NGSO Satellite Systems with High Throughput.

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IV Year B.Tech I Semester **L T P C**
Course Code: 127LC **3 0 0 3**

TELECOMMUNICATION SWITCHING SYSTEMS

(Open Elective-2)

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 analysis of electronic space division switching systems.
3. To provide knowledge to the students regarding design and analysis of time division switching systems.
4. To inculcate students on various traffic engineering concepts.
5. To inculcate students on various switching techniques used in Telecommunications.

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.

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)

Circuit Switching and Packet Switching: Switching Networks, Circuit Switching Networks, Circuit Switching Concepts, Packet Switching Principles.

Virtual Circuit Switching: Global Addressing, Virtual Circuit Identifier, Three Phases, Data Transfer Phase, Setup Phase, Teardown Phase.

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.
3. William Stallings, Data and Computer Communications, Seventh Edition, TMH, 2003.

Reference Books:

1. Behrouz A.Forouzan, Data Communications and Networking, Third Edition, TMH.
2. Achyut. S.Godbole, Data Communications & Networks, TMH, 2004.
3. H. Taub & D. Schilling, Principles of Communication Systems, 2^{nd} Edition, TMH, 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. Understand the evolution of telecommunication systems, advancements in telecommunications, classification of switching systems as well as the basics of switching systems.
2. Analyse the principles and various configurations of Crossbar Switching considering factors like switching capacity and switching elements.
3. Analyze electronic space division switching, Two-Stage Networks, and Three-Stage Networks, considering factors like switching capacity, switching elements and blocking probability.
4. Understand various configurations of time division switching and combination of both Space Switching and Time Switching to achieve improved efficiency and flexibility.
5. Apply mathematical models to measure telecommunication traffic, predict congestion, and assess network performance, considering factors like call loss and queuing systems.
6. Develop an understanding of various switching techniques like Circuit switching, Packet switching and Virtual Circuit Switching.

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

Course Code: 127LA **3 0 0 3**

RENEWABLE ENERGY SOURCES

(Open Elective-2)

Prerequisites: -Nil-

Course Objectives:

1. To understand various renewable energy resources available at a location and assessments of its potential, using tools and techniques.
2. To create awareness on Solar energy radiation, its interactions, measurement and estimation.
3. To study site selection for wind turbines, wind systems, measurements and instrument.
4. To acquire knowledge on Geothermal, wave, tidal and OTEC resources, site selection.

UNIT 1: (~7 Lecture Hours)

Introduction: Definitions, Concepts and limitations of RES Criteria for assessing the potential of NCES, Classification of RES- Solar-Wind-Geothermal- Biomass- Ocean energy sources, Comparison. **Solar energy**: Solar radiation spectrum - Extra-terrestrial and terrestrial solar radiation, solar constant, Measurement of solar Radiation -Pyranometer, Pyrheliometer, sunshine recorder.

UNIT 2:(~9 Lecture Hours)

Solar Energy Collection, **Storage and Applications**: Energy Collection: Flat plate and Concentrating collectors, Classification of Concentrating collectors.

Energy Storage: Definition of Sensible heat, Latent heat, Stratified storage - Solar ponds - Applications.

Solar Photovoltaic Generation (elementary treatment only): PV Generation, Photovoltaic energy conversion – Operating principle, Photovoltaic cell concepts, Cell, module, array, Series and parallel combinations, Potential in India.

UNIT 3: (~9 Lecture Hours)

Wind energy (elementary treatment only): Power in Wind, Betz criteria, Types of wind mills, Aerodynamics of wind energy -basic components of wind energy systems, Potential in India.

Bio-energy: Biomass resources ,Bio-Conversion Technologies -Densification-Combustion and Incineration -thermo-chemical -Bio chemical – Aerobic &Anaerobic digestion -ethanol fermentation Types of Bio-gas plants-floating drum and fixed dome type.

UNIT 4: (~9 Lecture Hours)

Geothermal energy: Structure of Earth's Interior-Geothermal Resources - Hydro thermal resources - Geopressured -Hot dry rocks- magma resources. Geothermal Power generation from various geothermal resources.

Ocean energy: OTEC - Principle of utilization, types up of OTEC plants- open loop and closed loop OTEC systems **Tidal and wave energy**: potential and conversion Techniques.

UNIT 5: (~6 Lecture Hours)

Direct Energy Conversion: Need for DEC, types of DEC-fuel cell, Magento hydro dynamic energy conversion (MHD) Thermoelectric conversion working principle (elementary treatment only) Combined cycle and Co-generation.

Text Books:

1. D.P.Kothari, K.C.Singhal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, 2nd Edition, P.H.I., 2014.
2. B.H.Khan, Non-Conventional Energy Resources, 3rd Edition, McGraw Hill Education, 2017
3. Twidell&Wier, Renewable Energy Resources, 3rd Edition, CRC Press (Taylor & Francis), 2006.

Reference Books:

1. G.D. Rai, Non-Conventional Energy Sources, 5th Edition, Khanna Publishers, 2009
2. Sukhatme.S.P, Solar Energy: Principles of Thermal Collection and Storage, 3rd Edition, Tata McGraw Hill, 2008.

Online Resources:

1. https://nptel.ac.in/courses/103103206

Course Outcomes:

After completion of this course, the students should able to

1. Define and comprehend the relevance of RES.
2. Identify different forms of Wind and Solar energy systems.
3. Assess working of OTEC, Ocean energy, Biomass energy and Geothermal energy systems.
4. Explain the need for usage of renewable energy resources and energy conservation.
5. Differentiate between power generation concepts of Renewable & Non-Renewable sources.
6. Describe the conversion technologies using biomass, Tidal, Wave and Geothermal energy resources.

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

Course Code: 127LB **3 0 0 3**

RESEARCH METHODOLOGY

(Open Elective-2)

Prerequisites: -Nil-

Course objectives: This course will enable the students:

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: (~ 9 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: (~ 9 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: (~ 10 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: (~ 10 Lecture Hours)

Interpretation and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Precautions of interpretation. Significance of Report Writing, Steps in Writing the Report, Format of the Research Report. Technical paper writing/Journal paper writing, Making Presentation, Use of Visual Aids, Elementary Treatment of Plagiarism Tools.

Text Books:

1. C.R Kothari & Gaurav Garg, Research Methodology, Methods & Technique, New Age International Publishers, 2019.
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2016.

Reference Books:

1. R.Pannerselvam, Research Methodology, Prentice hall of India, 2014.
2. Ratan Khananabis and Suvasis Saha, Research Methodology, Universities Press, Hyderabad, 2015.
3. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.

Online Resources:

1. Onlinecourses.nptel.ac.in

Course Outcomes:

At the end of the course students are expected 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.

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IV Year B.Tech I Semester **L T P C**
CourseCode: 127KX **3 0 0 3**

INDUSTRIAL MANAGEMENT

(Open Elective-2)

Prerequisites: -Nil-

Course Objectives:

1. Educate the importance of productivity in production process.
2. Managing various production activities and quality aspects
3. Inculcate the importance of industrial safety & legislation.

UNIT 1: (~ 10 Lecture Hours)

Introduction to Industrial Management

Industrial Management – Introduction – Need and Scope of Industrial Management.

Production Management – Plant location – Factors affecting Plant location - Plant Layout – Types of Plant Layout – Product, Process, Fixed Position and Combination Layout - Production **–** Introduction – Types of Production.

Productivity – Production vs Productivity – Objectives – Factors affecting Productivity – (Theory only) – Measures to improve Productivity and its benefits.

UNIT 2: (~ 09 Lecture Hours)

Operations and Materials Management

Operations Management – Work study – Definition – Objectives – Principles of Work study – Method study - Definition - Objectives – Steps of Method study. Work measurement – Definition - objectives – Time study – Steps in Time study – Uses of Time study.

Materials Management – Definition – Objectives – Functions – Purchase procedure – ABC analysis – VED Analysis.

UNIT 3: (~ 09 Lecture Hours)

Inventory and Stores Management

Inventory Management – Introduction - Functions of Inventory Control – Advantages of Inventory Control – Economic Order Quantity - Methods of Inventory issues – FIFO, LIFO, Simple average and Weighted Average methods (simple problems).

Stores Management – Stores Keeping – Classification of Stores – Stores Records.

Modern techniques in Inventory and Stores Management – Introduction to Material Resource Planning (MRP) - Enterprise Resource Planning (ERP) – Just in Time (JIT) - Supply Chain Management (SCM).

UNIT 4: (~ 10 Lecture Hours)

Quality Management and Control

Quality Management – Introduction, Contributions of Juran, Deming, Crosby, Total Quality Management - Quality Policy.

Statistical Quality Control – Need for Quality control- Sampling techniques - Advantages of Quality control – Shewart Control Charts - Test of variables - Mean chart and Range chart – Test of Attributes
– c Chart and p Chart (simple problems) - Six Sigma.

UNIT 5: (~ 10 Lecture Hours)

Industrial Safety and Security

Industrial Safety– Objectives of Industrial safety – Planning of Industrial safety – Industrial accidents and their types – Causes of Accidents – Risk Management in Industrial safety.

Industrial Security- Introduction- Need - Principles of security – Essential ingredients of security.

Text Books:

1. O.P. Khanna (2018) Industrial Engineering and Management, Dhanpat Rai Publications Pvt. Ltd.
2. T.R. Banga, N K Agarwal, S.C. Sharma (2008) Industrial Engineering and Management Science, 12th Edition, Khanna Publishers.

Reference Books:

1. Joseph, G. Monks (2012) Operations Management -Theory and Problems, 3rd Edition, McGraw- Hill Series.
2. NVS Raju (2013) Industrial Engineering & Management, Cengage Learning.
3. Besterfield (2013) Total Quality Management, 3rd Edition, Pearson.
4. S.Subramanian (2006) Industrial Security Management, Gyan Publishing House.

Online Resources:

1. Operations Management : https://onlinecourses.nptel.ac.in/noc18_me26/preview

Course Outcomes:

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

1. Organize the activities of Business efficiently.
2. Adapt to appropriate methods of production yielding productivity.
3. Identify efficient methods of production.
4. Handle inventory efficiently for improving Productivity.
5. Implement and maintain Quality standards in Production.
6. Understand industrial safety and security.

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

Course Code: 127KS **3 0 0 3**

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 students to handle and overcome the professional challenges and conflicts in a working environment.
3. To facilitate the students to understand and develop their managerial skills in a professional environment.
4. To help the students understand professional and cross cultural communication through digital technologies.
5. To develop critical thinking skills for speech and writing.

UNIT 1: (~09 lecture hours)

Life Skills

Essential Social Skills and Presentation Skills– Confidence Building – Self-esteem– Positive Attitude – Assertiveness – 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 – Professional Etiquettes and Netiquettes.

UNIT 5: (~09 lecture hours)

Fundamental Values Through Diversity And Inclusivity:

Meaning and concept of diversity and inclusivity – learner diversity— Diversity for sustainability— strength of diversity for inclusivity –Inclusivity in workplace— strategies for inclusivity Importance of Resilience – Concepts of resilience – qualities of a resilient person – strategies for building resilience.

Reference Books:

1. Meenakshi Raman and Shalini, *Softskills: Key to success in workplace and life,*Cengage Publications (2018).
2. Barun, K. Mitra, *Personality Development and Soft Skills*, Oxford University Press, 2nd Edition (2016).
3. Sailesh Sen Gupta, *Business and Managerial Communication*, PH1 Learning Pvt. Ltd., (2011).

Online Resourses:

1. Softskills : https://onlinecourses.nptel.ac.in/noc21_hs76/preview
2. Emotional Intelligence: https://onlinecourses.nptel.ac.in/noc20_hs13/previe

Course Outcomes:

After 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.

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IV Year B.Tech II Semester
Course Code: 128LE

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CLOUD COMPUTING

(Open Elective - 3)

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: (~8 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: (~10 Lecture Hours)

Cloud Platforms in Industry: Amazon web services, Google App Engine, Microsoft Azure, Aneka- Integration of private and public cloud.

Cloud Programming and Software Environments: Programming Support for Google App Engine: Programming the Google App Engine, Google File System(GFS), BigTable, Google's NOSQL System, Chubby, Google's Distributed Lock Service, Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service(S3), Amazon Elastic Block Store(EBS) and SimpleDB, Microsoft Azure Programming Support.

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.

Advanced Topics in Cloud Computing – Energy Efficiency in Clouds: Energy-Efficient and Green Cloud Computing Architecture, Market Based Management of Clouds: Market-Oriented Cloud Computing, A Reference Model for MOCC, Technologies and initiatives Supporting MOCC, Federated Clouds/Inter Cloud: Characteristics and Definition, Cloud Federation Stack.

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 and Andrzej, Cloud Computing: Principles and paradigms Wiley, 2011.
3. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management, and Security by CRC, 2010.

Reference Books:

1. Kai Hwang, Geoffrey C.Fox, Jack J Dongarra and Elsevier, Distributed and cloud computing, 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. By Publisher: O'Reilly Media 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs42
2. https://aws.amazon.com/
3. https://azure.microsoft.com/en-in
4. https://cloud.google.com/

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 and Illustrate the broad perceptive of cloud architecture and model.
2. Apply and design suitable Virtualization concept.
3. Explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon Web Services and design other web cloud applications.
4. Assess Cloud storage systems and Cloud security, the risks involved, its impact and develop cloud application.
5. Devise performance negotiations between cloud service providers and consumers through SLAs.
6. Interpret enterprise level requirements by learning Energy efficient, Market ready, Federated cloud systems.

IV Year B.Tech II Semester **L T P C**

Course Code: 128LD **3 0 0 3**

BLOCKCHAIN TECHNOLOGIES

(Open Elective- 3)

Prerequisites: -Nil-

Course Objectives:

1. To enable students develop understanding on Blockchain Technology
2. To equip students with knowledge on cryptocurrencies working.
3. To empower students, gain knowledge on Blockchain implementation technologies.

UNIT 1: (~ 6 Lecture Hours)

Blockchain 101: The History of Blockchain and Bitcoin, Types of Blockchain, Consensus, CAP theorem and blockchain. Decentralization: - Decentralization using Blockchain, Methods of decentralization, Routes to decentralization Blockchain and Full Ecosystem, Smart contracts, Decentralized Organizations, Platforms for Decentralization.

UNIT 2: (~ 8 Lecture Hours)

Introducing Bitcoin: Bitcoin, Digital Keys and Addresses, Transactions, Mining. Bitcoin Network and Payments: – Wallets, Bitcoin payments, Innovation in Bitcoin Alternative Coins: – Theoretical Foundations, Bitcoin limitations, Namecoin, Primecoin, Zcash Smart Contracts: – Ricardian Contracts.

UNIT 3: (~ 10 Lecture Hours)

Ethereum 101: The Ethereum network, Components of the Ethereum ecosystem. Further Ethereum: - Programming Languages-Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols. Development Tools and Frameworks: - Solidity Language.

UNIT 4: (~ 10 Lecture Hours)

Introducing Web3: Web3 – Contract Deployment, POST Requests, Development frameworks. Hyperledger: - Hyperledger as a protocol, The reference architecture, Fabric-Hyperledger Fabric– Distributed Ledger, Sawtooth Lake, Corda.

UNIT 5: (~ 10 Lecture Hours)

Alternative Blockchains: Blockchains**-** Kadena, Ripple, Stellar, Rootstock, Quorum, Tezos, Storj, Maidsafe, BigchainDB, Multichain, Tendermint, Platforms and Frameworks-Eris. Scalability and Other Challenges: - Scalability, Privacy. Current Landscape and What's Next: – Emerging trends, Other Challenges, Blockchain Research, Notable Projects, Miscellaneous Tools.

Text Book:

1. Imran Bashir, Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, 2nd Edition, Packt Publishing, 2018.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands On Approach, VPT, 2017.
2. Blockchain Technology, Chandramouli Subramanian, Asha A George, Abilash KA and MeenaKarthikeyan, Universities Press, 2020.
3. The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing and Securing Distributed Blockchain-based projects, Elad Elrom, Springer Nature B.V, 2019.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105184/
2. https://github.com/rddill-IBM/ZeroToBlockchain
3. tech.seas.harvard.edu/free-blockchain
4. https://www.codecademy.com/learn/introduction-toblockchain/modules/fundamental-blockchain- concepts
5. The Basics of Blockchain & Bitcoin Fundamentals Course | Udemy

Course Outcomes:

After completion of this course, students will be able to

1. Acquire understanding on Blockchain Technology built-in way.
2. Interpret how various cryptocurrencies work.
3. Articulate Ethereum Blockchain for developing smart contracts.
4. Apprehend knowledge on Web3 and Hyperledger Fabric for decentralized apps.
5. Exemplifying different alternative and emerging Blockchains.
6. Discover real-time usage of Blockchain.

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

Course Code: 128LL **3 0 0 3**

INTRODUCTION TO NATURAL LANGUAGE PROCESSING

(Open Elective–3)

Prerequisites: -Nil-

Course Objectives:

1. To introduce the fundamental concepts and techniques of natural language processing.
2. To understand the role of syntax and semantics of the text processing.
3. To gain an in-depth understanding of the computational properties and commonly used algorithms for processing linguistic information.
4. To explore different ways of building an NLP system through a case study on Question Answering system.

UNIT 1: (~10 Lecture Hours)

Introduction: What is Natural Language Processing (NLP), Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications.

Finding the Structure of Words: Words and their Components, Issues and Challenges, Morphological Models.

Finding the Structure of Documents: Introduction, Methods, Complexity of Approaches, Performances of the Approaches.

UNIT 2: (~9 Lecture Hours)

Syntax: Parsing Natural Language,

Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues: Tokenization, Case and Encoding, Word Segmentation, Morphology.

UNIT 3: (9 Lecture Hours)

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Wordsense, Predicate- Argument Structure, Meaning Representation.

UNIT 4: (~ 9 Lecture Hours)

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models- Class-Based Language Models, Syntax-Based Language Models, Neural Network language Models, Language-Specific Modeling Problems.

UNIT5: (~ 8 Lecture Hours)

Question Answering: Introduction and History, Architectures, Source Acquisition and Preprocessing, Question Analysis, Search and Candidate

Extraction, Answer Scoring, Cross Lingual Question Answering, A Case Study.

Text Book:

1. Daniel M. Bikel and ImedZitouni, Multilingual Natural Language Processing Applications: From Theory to Practice, Pearson Publication, 2013.

Reference Books:

1. Tanvier Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford Higher Education, 2008.
2. Daniel Jurafsky and James H. Martin, Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2011.
3. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O Reilly, 2009.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. Natural Language Processing Specialization (DeepLearning.AI) | Coursera
3. https://www.udemy.com/topic/natural-language-processing/
4. Stanford CS 224N | Natural Language Proce‘ssing with Deep Learning
5. CS 626-460: Natural Language Processing (iitb.ac.in)

Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate knowledge on the fundamental principles of natural language processing and document structure.
2. Understand the syntax processing and multilingual issues of language processing.
3. Analyze semantic interpretation and system paradigms for semantic parsing.
4. Understand various parameters to evaluate language models.
5. Identify suitable modeling techniques for solving real time problems.
6. Explore different ways to model the system similar to question answering system.

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IV Year B.Tech II Semester **L T P C**
Course Code: 128LF **3 0 0 3**

DATA MINING

(Open Elective–3)

Prerequisites: -Nil-

Course Objectives:

1. Learn data mining concepts understand association rules mining.
2. Discuss classification algorithms learn how data is grouped using clustering techniques.
3. To develop the abilities of critical analysis to data mining systems and applications.
4. To implement practical and theoretical understanding of the technologies for data mining.
5. To understand the strengths and limitations of various data mining models.

UNIT 1: (~9 Lecture Hours)

Introduction to Data Mining: What is Data Mining, Definition, KDD, Data Mining Architecture, Challenges, Data Mining Functionalities, Data Mining Task Primitives, and Major Issues in Data Mining?

Data Pre-processing: Data Cleaning, Data Integration and Transformation, Data Reduction: Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Measures of Similarity and Dissimilarity Basics, Similarities and dissimilarities between Simple Attributes and Data Objects.

UNIT 2: (~9 Lecture Hours)

Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Algorithm, Support and Confidence Measures, Association Rule Generation, FP- Growth Algorithm, Mining various kinds of Association rules, Compact Representation of Frequent Item sets: Maximal Frequent Item Sets, Closed Frequent Item Sets.

UNIT 3: (~9 Lecture Hours)

Classification and Prediction: Problem Definition, General Approaches to solving a classification problem, Evaluation of classifiers, Classification Techniques, Decision Tree Induction, Naive Bayes Classifier, Bayesian Belief Networks, K–Nearest neighbor classification Algorithm and Characteristics, Prediction: Linear, Logistic Regressions.

UNIT 4: (~9 Lecture Hours)

Clustering: Cluster Analysis, Categorization of Major Clustering Methods, Partitioning Clustering - K-Means Algorithm, K- Means Additional issues, PAM Algorithm, Hierarchical Clustering : Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Specific techniques: MIN, MAX, Group Average, Ward's method and Centroid methods Key Issues in Hierarchical clustering, Strengths and Weakness, Outlier Detection.

UNIT 5: (~9 Lecture Hours)

Mining Time Series and Sequence Data: Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases.

Mining Multimedia, Text and Web Data: Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Text Books:

1. Jiawei Han and Michelinen Kamber, Data Mining-Concepts and Techniques, 2012, 3rd Edition, Morgan Kaufmann Publishers, Elsevier.
2. Pang-Ning Tan, Vipin Kumar and Michael Steinbanch, Introduction to Data Mining, Pearson Education.

Reference Books:

1. Arun K Pujari, Data Mining Techniques, 3rd Edition, Universities Press.
2. Pualraj Ponnaiah, Data Warehouse Fundamentals by Wiley- Interscience Publication.
3. VikaramPudi and P Radha Krishna, Data Mining by Oxford University Press.

Online Resources:

1. https://www.kdnuggets.com/websites/index.html
2. https://www.ngdata.com/data-mining-resources.

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamental concepts and tasks of data mining.
2. Perform the pre-processing of data.
3. Formulate the association rules using different Algorithms.
4. Evaluate various classifiers.
5. Analyze different clustering techniques.
6. Understand the mining of temporal and multimedia data.

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IV Year B.Tech II Semester **L T P C**
Course Code: 128LP **3 0 0 3**

WEARABLE DEVICES AND ITS APPLICATIONS

(Open Elective-3)

Prerequisites: -Nil-

Course Objectives:

1. Identify the need for development of wearable devices and its implications on various sectors.
2. Comprehend the design and development of various wearable inertial sensors and wearable and physiological activity monitoring devices for use in healthcare applications.
3. Discuss the usage of various biochemical and gas sensors as wearable devices.
4. Acquaint various wearable locomotive sensors as assistive devices for tracking and navigation.

UNIT 1: (~ 08 Lecture Hours)

Introduction to Wearable Devices

Motivation for development of Wearable Devices, The emergence of wearable computing and wearable electronics, Types of wearable Sensors: Invasive & Non-invasive; Intelligent clothing, Industry sectors' overview – sports, healthcare, Fashion and entertainment, military, environment monitoring, mining industry, public sector and safety.

UNIT 2: (~ 10 Lecture Hours)

Wearable Inertial Sensors

Wearable Inertial Sensors - Accelerometers, Gyroscopic sensors and Magnetic sensors; Modality of Measurement- Wearable Sensors, Invisible Sensors, In-Shoe Force and Pressure Measurement; Applications: Fall Risk Assessment, Fall Detection, Gait Analysis, Quantitative Evaluation of Hemiplegic and Parkinson's Disease patients. Physical Activity monitoring: Human Kinetics, Cardiac Activity, Energy Expenditure measurement: Pedometers, Actigraphs.

UNIT 3: (~ 10 Lecture Hours)

Wearable Devices for Healthcare

Wearable Blood Pressure (BP) Measurement: Cuff-Based Sphygmomano meter, Cuffless Blood Pressure Monitor. Study of flexible and wearable Piezoresistive sensors for cuffless blood pressure measurement.

Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – thermistor, infrared radiation, thermopile, Modality of measurement wearable, adhesive/tattoo type. Conductive textile electrodes, Knitted Piezoresistive Fabric (KPF) sensors.

UNIT 4: (~ 8 Lecture Hours)

Wearable Biochemical and Gas Sensors

Wearable Biochemical Sensors: Parameters of interest, System Design – Textile based, Microneedle based; Types: Non-invasive Glucose Monitoring Devices, GlucoWatch® G2 Biographer, GlucoTrackTM; Pulse oximeter, Portable Pulse Oximeters, wearable pulse oximeter; Wearable capnometer for monitoring of expired carbon dioxide. Wearable gas sensors: Metal Oxide (MOS) type, electrochemical type, new materials-CNTs, graphene, Zeolites; Detection of atmospheric pollutants.

UNIT 5: (~ 12 Lecture Hours)

Wearable Cameras and Microphones for Navigation

Cameras in wearable devices, Applications in safety and security, navigation, Enhancing sports media, Automatic digital diary. Cameras in smart-watches; Use of Wearable Microphones: MEMS microphones, Bioacoustics, Microphones and AI for respiratory diagnostics and clinical trials. Wearable Assistive Devices for the Blind - Hearing and Touch sensation, Assistive Devices for Fingers and Hands, Assistive Devices for wrist, forearm and feet, vests and belts, head-mounted devices.

Text Books:

1. Toshiyo Tamura and Wenxi Chen, "Seamless Healthcare Monitoring", Springer 2018.
2. EdwardSazonov and Michael R. Neuman, "Wearable Sensors - Fundamentals, Implementation and Applications",Elsevier Inc., 2014.
3. Aimé Lay-Ekuakille and Subhas Chandra Mukhopadhyay, "Wearable and Autonomous Biomedical Devices and Systems for Smart Environment", Springer 2010.

Reference Books:

1. Subhas Chandra "Wearable Electronics Sensors - For Safe and Healthy Living", Springer (June 8, 2015).
2. Shantanu Bhattacharya, A K Agarwal, NripenChanda, Ashok Pandey and Ashis Kumar Sen, "Environmental, Chemical and Medical Sensors", Springer Nature Singapore Pte Ltd. 2018.
3. M. Mardonova and Y. Choi, "Review of Wearable Device Technology and Its Applications to the Mining Industry," Energies, vol. 11, p. 547, 2018.
4. N. Luo, W. Dai, C. Li, Z. Zhou, L. Lu, C. C. Y. Poon, et al., "Flexible Piezoresistive Sensor Patch Enabling Ultralow Power Cuffless Blood Pressure Measurement," Advanced Functional Materials, vol. 26, pp. 1178-1187, 2016.

Online Resources:

1. https://www.udemy.com/course/wearable-technology-a-complete-primer-on-wearables
2. https://www.coursera.org/learn/wearable-technologies

Course Outcomes:

After completion of the course, students will be able to

1. Identify and understand the need for development of wearable devices and its influence on various sectors.
2. Discuss the applications of various wearable inertial sensors for biomedical applications.
3. Design and development of various Wearable monitoring devices for detection of biochemical and physiological body signals activity for use in healthcare applications.
4. Discuss and analyze the usage of various biochemical and gas sensors as wearable devices.
5. Identify the use of various wearable locomotive tools for safety and security, navigation.
6. Acquaint the usage of wearable devices as environmental monitoring, safety and navigational assistive devices and other modern applications.

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IV Year B.Tech II Semester	**L T P C**
Course Code: 128LG	**3 0 0 3**

SYSTEMS ENGINEERING

(Open Elective-3)

Prerequisites: -Nil-

Course Objectives:

This can be termed an advance level course in the electronic communication engineering domain. The course has the following main objectives:

1. To demonstrate an understanding of systems terminology, definitions, the design process, maintenance, and support of modern technological systems.
2. To applying tools, methodologies, and procedures to manage systems engineering problems and model systems.
3. To analyze the functions of a system and validate them
4. To understand the risks involved in systems engineering and developing effective systems solutions to mitigate or reduce the risks.
5. To employ systems engineering analytical tools, techniques, methodologies, and processes to assist in designing efficient and cost-effective design solutions.
6. To evaluate a system and subsequently test it.

UNIT 1: (~ 10 Lecture Hours)

Introduction to Systems engineering: Need for systems engineering, Systems engg viewpoint, perspectives, domains, Systems engineering fields, approaches, activities, and products, Systems engineering as a profession.

Complex system structure-building blocks, hierarchy, interfaces, environment, interactions, complexity, System development process – life cycle, evolutionary characteristics, Systems engineering method, Systems testing throughout development.

UNIT 2: (~ 10 Lecture Hours)

Managing systems: Development, risks, work breakdown structure (WBS), systems engineering management plan (SEMP), Systems risk management, organizing for systems engineering, Need analysis – originating, operations, functional, and feasibility, Need validation, systems ops requirement, System requirements development, performance requirements.

Implementing concept : exploration, validating requirements, Concept definition – selection and validation, functional analysis and allocation, Systems architecture, system modeling languages, Model-Based Systems Engineering (MBSE), Decision making, modeling for decisions, Simulation, Trade-off analysis.

UNIT 3: (~ 8 Lecture Hours)

Risk Management: Program risk reduction, prototype development for risk mitigation, Development testing, risk reduction, Revision of functional analysis and design, Overview of probability data analysis, Hypothesis testing.

UNIT 4: (~ 10 Lecture Hours)

Engineering design : Implementing system building blocks, component design, Design validation, change management, Concepts of reliability, redundancy, Concepts of maintainability, availability, producibility, User interface design and GUI, Case Studies and Case Study Presentation.

UNIT 5: (~ 12 Lecture Hours)

Testing and Evaluation and Installation: Integration, testing and evaluating total system, Test planning and preparation, system integration, Developmental and operational test and evaluation, Engineering for production, transition from development to production, Installation, Installation testing, In-service support, Upgrades and modernization.

Text Books:

1. Kossiakoff, A., Sweet, W.N., Seymour, S.J., and Biemer S.M., Systems Engineering Second ed. John Wiley Sons Inc., New Jersey, 2011
2. International Council of Systems Engineering, Systems Engineering Handbook, A guide for System Life Cycle Processes and Activities, version 3.2.1, January 2011.
3. Systems Engineering Fundamentals, Department of Defense, Defense Acquisition University, Systems Engineering Fundamentals, 2001.

Reference Book:

1. B. S., and Fabrycky, Systems Engineering and Analysis (5th Ed), Blanchard, W. J. (2006).
2. Pearson Prentice Hall: Upper Saddle River, NJ. [ISBN 978-0-13-221735-4]

Online Resources:

1. Systems Engineering: Theory and Practice by Prof. Deepu Philip (IIT Kanpur) https://onlinecourses.nptel.ac.in/noc21_mg39/preview

Course Outcomes:

Having gone through this course on Systems Engineering, the students would be able to

1. Explain the significance of Systems Engineering and the System development process.
2. Carry out the Systems engineering Management Plan and risk management.
3. Model a system and implement decision making functions.
4. Develop prototype for risk mitigation and test it.
5. Implement, validate, maintain and design the user interface of the system.
6. Install, Test and evaluate the entire system.

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

CourseCode: 128LN **3 0 0 3**

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 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, on site handling, storage, collection, transfer and transport.

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, – principal 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 equipment – chemical volume reduction –mechanical size reduction selection of equipment – 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, Landfill 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. Nicholas P. Cheremisinoff. Handbook of Solid Waste Management and Waste Minimization Technologies. An Imprint of Elsevier, New Delhi (2003)
2. P.AarneVesilind, William A. Worrell and Debra R. Reinhart. Solid Waste Engineering. Thomson Asia Pte Ltd. Singapore (2002)
3. M.Dutta, B .P .Parida, B. K. Guha and T. R. Surkrishnan. Industrial Solid WasteManagement and Landfilling practice. Narosa Publishing House, New Delhi (1999).

Reference Books:

1. C.S.Rao. Environmental pollution Control Engineering. Wiley Eastern Ltd.New Delhi (1995)
2. "E- waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011"
2. M.L. Davis and D.A. Cornwell. Introduction to environmental engineering. Mc Graw Hill International Edition, Singapore (2008)
3. S.K.Agarwal. Introduction to Environmental engineering. Mc Graw Hill International Edition, Singapore (2008)
4. Hagerty, D.Joseph; Pavoni . Joseph L; Heer , John E., " Solid Waste Management", New York, Van Nostrand , 1973

Online Resource:

1. https://nptel.ac.in/courses/103107125

Course Outcomes:

After completion of the course, 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.

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IV Year B.Tech II Semester **L T P C**

Course Code: 128LM **3 0 0 3**

MARKETING MANAGEMENT

(Open Elective-3)

Prerequisites:-Nil-

Course Objectives:

1. Outline the importance and key concepts of Marketing.
2. Understand and appreciate the emerging marketing trends
3. Highlight the foundation of Marketing mix and evolution of marketing mix in modern era.

UNIT 1: (~**08** Lecture Hours)

Introduction to Marketing Management

Marketing Management - Meaning and importance – Nature, Scope and Functions - Evolution of Marketing concepts from Production Concept to Holistic Marketing concept –Marketing Environment- Micro and Macro Environment.

UNIT 2: (~**10** Lecture Hours)

Market Segmentation

Market Segmentation: -STP Process- 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.

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

Marketing Mix

Product Offering: Product and Product Mix – Product Line decisions – Brand Decisions – Packaging and Labelling.

Pricing Strategies: - Meaning and objectives -factors influencing Pricing-Pricing Methods and Strategies.

UNIT 4: (~**09** Lecture Hours)

Distribution: - Concept and Importance- Different types of distribution channels - Channel Intermediaries.

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. Brief overview of People, Process and Physical evidence.

UNIT 5: (~**09** Lecture Hours)

Recent Trends in Marketing

Digital Marketing –Meaning and Importance - Green Marketing -– Managing Digital Communication – E-Marketing -M-Marketing and Services Marketing.

Case study/Marketing Plan for a Product or Service.

Text Books:-

1. Philip Kotler (2017). Marketing Management (15th ed.). Prentice – Hall of India Pvt. Ltd.
2. Philip Kotler, Kevin Lane Keller (2017). Marketing Management (15th ed.). Pearson.

Reference Books:

1. Rajagopal (2008). Marketing – Concept and Cases. New Age International (P) Ltd.
2. Tapan Panda (2009). Marketing Management(5th ed.). Excel Publication.
3. Ramaswamy, V.S. & Namakumari S. (2013). Marketing Management India (5th ed.). Macmillan Publication.
4. Saxena, R. (2019). Marketing Management (6th ed.). Tata McGraw Hill, New Delhi.
5. Richard, J. Semenik(2006). Promotion & Integrated Marketing Communication (1st ed.) Thomson South-Western.

Online Resources:

Marketing Management-I: https://nptel.ac.in/courses/110104068/

Marketing Management-II: https://nptel.ac.in/courses/110104070/

Course Outcomes (COs)

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

1. Remember and Comprehend the importance of the Marketing Management Process
2. Analyze the need and importance of Market segmentation, Targeting and Positioning.
3. Interpret the elements of Product mix.
4. Enumerate strategies of Pricing in fixation.
5. Comprehend the dynamics of distribution and Promotion mix elements to leverage marketing concepts for effective decision making.
6. Know the recent trends in marketing and understand the steps involved in developing a Marketing plan.

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

Course Code: 128LH **3 0 0 3**

ENVIRONMENTAL IMPACT ASSESSMENT

(Open Elective-3)

Prerequisites: -Nil-

Course Objectives:

1. To explain various stages of EIA process in India.
2. To provide knowledge on various aspects of Environment Impact Assessment Methodologies and apply them on developmental activities.
3. To explain the outlines of EMP.
4. To explain the procedure on environmental audit.
5. To provide an overview of environmental legislation.
6. To review a few EIA reports.

UNIT 1: (~9 Lectures)

Basic Concepts of EIA: Introduction **-**Definition of Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS)**,** EIA Process Flow Chart- Initial Environmental Examination (IEE), (Screening, Scoping, Baseline Data Acquisition, Impact Identification, Prediction, Analysis, Public Hearing, Draft EIS, Final EIS), Classification of Impacts, Elements of EIA, Benefits of EIA, Preparation of Environmental Base map.

UNIT 2: (~9 Lectures)

EIA Methodologies: Introduction, Criteria for the Selection of EIA Methodology, Methods of Impact Analysis – Impact Identification, Impact prediction, Impact Evaluation

Different EIA Methods- (Rapid, Comprehensive, Adhoc, Checklist, Matrix, Network, Environmental Media Quality Index and Overlay Methods). Cost Benefit Analysis.

Impacts of Development Activities on Environmental Components: Deforestation – Causes, Effects and Control Measures, Guidelines for Preparation of Environmental Impact Statement.

UNIT 3: (~8 Lectures)

Environmental Management Plan: Introduction, Objectives, Goals, Purpose, Importance, Elements, EMP Preparation, Monitoring of EMP.

UNIT 4: (~9 Lectures)

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. Case Studies and Preparation of Environmental Impact Statement Report for various Industries.

UNIT 5: (~9 Lectures)

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, National Bio-Diversity Act, 2002, Concept of ISO 9001 and ISO 14000 Standards.

Text Books:

1. Environmental Impact Assessment by Larry Canter, Mc Graw-Hill Publications, 1996.
2. Environmental Impact Assessment by R. R Barthwal, New Age International Publications, 2010.
3. Environmental Impact Assessment: Theory & Practice by P. Wathern Publishers Rutledge, London, 1992.

Reference Books:

1. Environmental Pollution by R.K. Khitoliya, S. Chand Publishing, 2014.
2. Environmental Science and Engineering by J. Glynn and W. H. Gary, Prentice Hall Publishers, 1996.
3. Environmental Science and Engineering by Suresh K. Dhameja, S.K. Kataria and Sons Publication, New Delhi.2006.
4. Environmental Pollution and Control by, H. S. Bhatia, Galgotia Publication Private Limited, Delhi. 2003.
5. Environmental Impact Assessment by M.Anji Reddy, BSP Books Private Limited, 2017.

Web 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

Online Courses :

1. https://cept.ac.in/cce/admin/images/files/1347949702_po7tf.pdf
2. https://www.iisd.org/learning/eia/
3. https://www.iaia.org/iaia-training-courses.php
4. https://www.eiatraining.com/index.html.

Course Outcomes :

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

1. Identify the environmental attributes to be considered for EIA study.
2. Apply different methodologies in impact identification, prediction and analysis.
3. Prepare EMP based on environmental legislation.
4. Carry out environmental audit.
5. Prepare EIA reports.
6. Prepare EIS for various industries.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To Excel in chosen career
PEO2	To work effectively as an individual and as a team member, keeping in mind the high importance currently being given to sustainability and emerging Green Energy Technologies in the current scenario
PEO3	To contribute to the community/society development through acquired knowledge and skills
PEO4	Continuous up gradation of knowledge and skills.

PROGRAM OUTCOMES (POs)

PO1	Engineering knowledge : Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	Design/development of solutions :Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems : Use research – based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage : Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to asses societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and 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 and 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 and finance :Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Graduates will be able to analyze, develop and demonstrate Projects, both Software and Hardware in relevant topics of Electrical and Electronics Engineering.
PSO2	Graduates will be able to identify and solve problems in different core areas of Electrical and Electronics Engineering to meet the industry requirements along with overall personality and skills development.

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.