ACADEMIC REGULATIONS
AND
COURSE STRUCTURE

CHOICE BASED CREDIT SYSTEM

MLR20

ELECTRONICS & COMMUNICATION ENGINEERING

for

Bachelor of Technology (B.Tech)

B. Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2020 - 2021)

MARRI LAXMAN REDDY
GROUP OF INSTITUTIONS

MLR Institute of Technology

(Autonomous)
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FOREWORD

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

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

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

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

PRINCIPAL

Vision of the Institution

Promote academic excellence, research, Innovation, and entrepreneurial skills to produce graduates with human values and leadership qualities to serve the nation.

Mission of the Institution

Provide student-centric education and training on cutting-edge technologies to make the student's globally competitive and socially responsible citizens and create an environment to strengthen the research; innovation and entrepreneurship to solve societal problems.

Vision of the Department

Provide quality technical education with innovation and importance to R&D, thereby fulfilling the needs of the society, and to achieve Academic Excellence in Electronics and Communication Engineering for Global Competent Engineers.

Mission of the Department

M1: To adopt innovative student-centric learning methods
M2: To develop an orientation towards futuristic view by research
M3: To enable them to compete in national and international levels
M4: Strengthen core competencies among the learners through an experiential Curriculum

(For batches admitted from the academic year 2020-21)
&
B. Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2021-22)

For pursuing four year Under Graduate Degree Programme of study in Engineering & Technology (UGP in E&T) offered by MLR Institute of Technology under Autonomous status is herein referred to as MLRIT (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2020-21 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for M L R Institute of Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, M L R Institute of Technology shall be the chairman Academic Council.

1. ADMISSION

1.1. **Admission into first year of four year B. Tech. degree programmes of study in Engineering**

1.1.1. **Eligibility:**

A candidate seeking admission into the first year of four year B. Tech. degree Programmes should have:

(i) Passed either Intermediate Public Examination (I.P.E) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.

(ii) Secured a rank in the EAMCET examination conducted by TSCHE for allotment of a seat by the Convener, EAMCET, for admission.

1.1.2. **Admission Procedure:**

Admissions are made into the first year of four year B. Tech. Degree Programmes as per the stipulations of the TSCHE.

(a) Category A seats are filled by the Convener, TSEAMCET.

(b) Category B seats are filled by the Management.

1.2. **Admission into the second year of four year B. Tech. degree Program in Engineering**

1.2.1 **Eligibility**:

A candidate seeking admission under lateral entry into the II year I Semester B. Tech. degree Programmes should have passed the qualifying exam (B.Sc. Mathematics or Diploma in concerned course) and based on the rank secured by the candidate at Engineering Common Entrance Test ECET

(FDH) in accordance with the instructions received from the Convener, ECET and Government of Telangana.

1.2.2 **Admission Procedure**:
Admissions are made into the II year of four year B. Tech. degree Programmes through Convener, ECET (FDH) against the sanctioned strength in each Programmes of study as lateral entry students.

2. PROGRAMMES OFFERED

MLR Institute of Technology, an autonomous college affiliated to JNTUH, offers the following B.Tech. Programmes of study leading to the award of B. Tech. degree under the autonomous scheme.

1) B.Tech. - Aeronautical Engineering
2) B.Tech. - Computer Science and Engineering
3) B.Tech - CSE (Artificial Intelligence & Machine Learning)
4) B.Tech - CSE(Data Science)
5) B.Tech - CSE (Cyber Security)
6) B.Tech - Computer Science & Information Technology
7) B.Tech. - Electronics and Communication Engineering
8) B.Tech - Electrical & Electronics Engineering
9) B.Tech. - Information Technology
10) B.Tech. - Mechanical Engineering

3. DURATION OF THE PROGRAMMES

3.1 Normal Duration

3.1.1 B. Tech. degree programme extends over a period of four academic years leading to the Degree of Bachelor of Technology (B.Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

3.1.2 For students admitted under lateral entry scheme, B. Tech. degree programme extends over a period of three academic years leading to the Degree of Bachelor of Technology (B. Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

3.2 Maximum Duration

3.2.1 The maximum period within which a student must complete a full-time academic programme is 8 years for B. Tech. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

3.2.2 For students admitted under lateral entry scheme in B. Tech. degree programme, the maximum period within which a student must complete a full-time academic programme is 6 years. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

3.2.3 The period is reckoned from the academic year in which the student is admitted first time into the degree Programme.

4. AWARD OF B.Tech. DEGREE

A student will be declared eligible for the award of the B.Tech. Degree if he/she fulfils the following academic regulations:

4.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight years.

4.2 The candidate shall register for 160 credits and secure 160 credits.

4.3 The degree will be conferred and awarded by Jawaharlal Nehru Technological University Hyderabad on the recommendations of the Chairman, Academic Council.

5. PROGRAMME STRUCTURE

5.1 UGC/AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed below.

Semester Scheme:

Each UGP is of 4 Academic Years (8 Semesters), each year divided into two Semesters of 22 weeks (≥90 working days), each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Curriculum/Course Structure as suggested by AICTE are followed.

5.1.2 The B.Tech. Programme of MLR Institute of Technology are of Semester pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 15-18 Weeks duration with a minimum of 90 Instructional Days per Semester.

5.1.3 Credit Courses:

a) All 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 (Lecture Periods: Tutorial Periods: Practical Periods : Credits) Structure, based on the following general pattern ..

- One Credit **-** for One hour/Week/Semester for Theory/Lecture(L)/Tutorial)T)Courses; and
- One Credit **-** for Two hours/Week/Semester for Laboratory/Practical (P) Courses, Mini Project...
- Mandatory Courses will not carry any Credits.

5.1.4 **Course Classification:**

All Courses offered for the UGP are broadly classified as:

- **Basic Science Courses (BSC)** includes Mathematics, Physics, Chemistry, Biology etc.
- **Engineering Science Courses (ESC)** courses include Materials, Workshop, Basics of Electrical/Electronics/ Mechanical/Computer Science & Engineering, Engineering Graphics, Instrumentation, Engineering Mechanics, Instrumentation etc.
- **Humanities and Social Science including Management Courses (HSMC)** courses include English, Communication skills, Management etc.

- **Professional Core Courses (PCC)** is core courses relevant to the chosen specialization/branch.

- **Professional Elective Courses (PEC)** is courses relevant to the chosen specialization/ branch offered as electives.
- **Open Elective Courses (OEC)** courses from other technical and/or emerging subject areas offered in the College by the Departments of Engineering, Science and Humanities.

- **Mandatory Course:** Course work on peripheral subjects in a programme, wherein familiarity considered mandatory. To be included as non-Credit, Mandatory Courses, with only a pass in each required to qualify for the award of degree from the concerned institution.

- **Project Work** and/or internship in industry or elsewhere, seminar.

- **MOOCS–** Massive Open Online Courses in a variety of disciplines available at both introductory and advanced levels, accessible from e-resources in India and abroad. .

5.1.5 **Course Nomenclature:**

The Curriculum Nomenclature or Course-Structure Grouping for the each of the UGP E&T (B.Tech. Degree Programme), is as listed below (along with AICTE specified Range of Total Credits).

S. No	Broad Course	Course Group/ Category	Course Description
1)	BSC,ESC & HSMC	BSC – Basic Sciences Courses	Includes - Mathematics, Physics and Chemistry Subjects
2)		ESC - Engineering Sciences Courses	Includes fundamental engineering subjects.
3)		HSMC – Humanities and Social	Includes subjects related to Humanities, Social Sciences and
4)	PCC	PCC – Professional Core Courses	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg.
5)	PEC	PEC– Professional Elective Courses	Includes Elective subjects related to the Parent Discipline / Department / Branch of Engg.
6)	OEC	OEC – Open Elective Courses	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline/ Department / Branch of Engg.
7)	PWC	Project Work	Major Project.
8)		Industrial Training/ Mini- Project	Industrial Training/ Internship/ Mini-Project.
9)		Seminar	Seminar / Colloquium based on core contents related to Parent Discipline/
10)	MC	Mandatory Courses	Mandatory Courses (non-credit)
Total Credits for UGP (B. Tech.)Programme			

- Minor variations as per AICTE guidelines

6. COURSE REGISTRATION

6.1 A 'Faculty Advisor or Counsellor' shall be assigned to each student, who advises him/her about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on his/her competence, progress, pre-requisites and interest.

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

6.3 A Student can apply for Registration, which includes approval from his faculty advisor, and then should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).

6.4 A student may be permitted to register for his/her course of CHOICE with a Total of prescribed credits per Semester (permitted deviation being±12%), based on his PROGRESS and SGPA/CGPA, and completion of the 'PRE-REQUISITES' as indicated for various courses in the Department Course Structure and Syllabus contents.

6.5 Choice for 'additional Courses' must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Counsellor.

6.6 If the Student submits ambiguous choices or multiple options or erroneous (incorrect) entries during Registration for the Course(s) under a given/specified Course Group/ Category as listed in the Course Structure, only the first mentioned Course in that Category will be taken into consideration.

6.7 Dropping of Courses or changing of options may be permitted, ONLY AFTER obtaining prior approval from the Faculty Advisor, 'within 15 Days of Time' from the commencement of that Semester. Course Options exercised through Registration are final and CAN NOT be changed, and CAN NOT is inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

7. COURSES TO BE OFFERED

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

7.2 courses may be offered to the Students, only if minimum of 20 students (1/3rd of the section strength) opt for it.

7.2 More than ONE TEACHER may offer the SAME SUBJECT (Lab/Practical's may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection choice for students will be based on - ‘CGPA Basis Criterion’ (i.e., the first focus shall be on early Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).

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

7.4 OPEN ELECTIVES will be offered by a department to the students of other departments.

8. B.Tech. (HONOURS) DEGREE

A new academic programme B.Tech. (Hons.) is introduced in order to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area.

8.1. B.Tech. Students in regular stream can opt for B.Tech.(Hons.), provided they have a CGPA of 8.0 and above up to the end of IVth semester without any history of arrears and attempting of betterment.

8.2 For B. Tech (Honors), a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). Student to opt for the courses from NPTEL/ SWAYAM / Coursera /other MOOCS platform as recommended by concern BOS relevant to her/his discipline through MOOCs as recommended by the BOS.

8.3 If the credits of NPTEL/ SWAYAM/ Coursera /other MOOCS platform courses do not match with the existing subject proper scaling will be done by the college.

8.4 After registering for the B.Tech (Honours) programme, if a student fails in any course he/she will not be eligible for B.Tech(Honours).

8.7 Students who have obtained “C grade” or “reappear” or “Repeat Course” / “Re Admitted” or “Detained” category in any course, including the MOOCs courses, are not eligible for B.Tech (Honors) degree. Up to 8 semesters without any history of arrears and attempting of betterment is not eligible to get B.Tech (Hons.).

8.8 Those who opted for B. Tech (Honours) but unable to earn the required additional credits in 8 semesters or whose final CGPA is less than 8 shall automatically fall back to the B.Tech. Programme. However, additional course credits and the grades thus far earned by them will be shown in the grade card but not included for the CGPA.

8.9 The students have to pay the requisite fee for the additional courses.

Table: Assigned Credits

Online Course Duration	Assigned Credits
04 Weeks	01 Credit
08 Weeks	03 Credits
12 Weeks	04 Credits

9. B.Tech. (MINOR) DEGREE

This concept is introduced in the curriculum of all conventional B. Tech. programmes offering a major degree. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. programme. In order to earn a Minor in a discipline a student has to earn 20 extra credits by studying any seven theory subjects from the programme core & professional elective courses of the minor discipline or equivalent MOOCS courses available under SWAYAM platform. The list of courses to be studied either in MOOCsor conventional type will be decided by the department at the time of registration for Minor degree.

a. B.Tech. students in regular stream can opt for B.Tech.(Minor.), provided they have a CGPA of 8.0 and above up to the end of IVth semester without any history of arrears and attempting of betterment.
b. Students aspiring for a Minor must register from **V** semester onwards and must opt for a Minor in a discipline other than the discipline he/she is registered in. However, Minor discipline registrations are not allowed before V semester and after VI semester.
c. Students will not be allowed to register and pursue more than two subjects in any semester.
d. Completion of a Minor discipline programme requires no addition of time to the regular Four year Bachelors' programme. That is, Minor discipline programme should be completed by the end of final year B. Tech. program along with the major discipline.
e. A student registered for Minor in a discipline shall pass in all subjects that constitute the requirement for the Minor degree programme. No class/division (i.e.,second class, fist class and distinction, etc.) shall be awarded for Minor degree programme.

10. ATTENDANCE REQUIREMENTS

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

b. 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 on genuine and valid grounds, based on the student's representation with supporting evidence by following the govt. rules in vogue.

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

d. Shortage of Attendance below 65% in aggregate shall in No case be condoned.

e. A student shall not be promoted to the next Semester unless he/she satisfies the attendance requirements of the current Semester. The student may seek readmission for the Semester when offered next. He / She shall not be allowed to register for the subjects of the Semester while he/she is in detention. A student detained due to shortage of attendance, will have to repeat that Semester when offered next. The academic regulations under which the student has been readmitted shall be applicable.

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

g. Students whose attendance is less than 75% are not entitled to get the scholarship / fee reimbursement in any case as per the TS Govt. Rules in force.

11. ACADEMIC REQUIREMENTS FOR PROMOTION/COMPLETION OF REGULAR B.TECH PROGRAMME COURSE STUDY.

11.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Course, if he secures not less than 35% marks in the End Semester Examination, and a minimum of 40% of marks in the sum Total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing P Grade or above in that Course.

11.2 A Student will not be promoted from I Year to II Year, unless he/she fulfils the Attendance requirements.

11.3 A Student will not be promoted from II Year to III Year, unless he/she fulfils the Attendance and Academic Requirements and (i) secure a Total 50% of Credits up to II Year II Semester from all the relevant regular and supplementary examinations.

11.4 A Student will not be promoted from III Year to IV Year, unless he/she fulfils the attendance and Academic Requirements and (i) secure a Total 50% of Credits up to III Year II Semester, from all the regular and supplementary examinations.

11.5 After securing the necessary 160 Credits as specified for the successful completion of the entire UGP, resulting in 160 Credits for UGP performance evaluation, i.e., the performance of the Student in these 160 Credits shall alone be taken into account for the calculation of the final CGPA.

If a Student registers for some more 'extra courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed courses Totalling to 160 Credits as specified in the Course Structure of his/her Department, the performances in those 'extra courses' (although evaluated and graded using the same procedure as that of the required 160 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra courses' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in items 8 and 9.1-9.5.

11.6 Students who fail to earn minimum of 160 Credits as per the Course Structure, and as indicated above, within 8 Academic Years from the Date of Commencement of their I Year shall forfeit their seats in B.Tech Programme and their admissions shall stand cancelled.

When a Student is detained due to shortage of attendance/lack of credits in any Semester, he may be re-admitted into that Semester, as and when offered. However the regulations at the time of admissions hold good.

12. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

12.1 The performance of a student in each Semester shall be evaluated Course-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory. The B.Tech Project Work (Major Project) will be evaluated for 100 marks in Phase-I and 200 Marks in Phase-II.

12.2 For all Theory Courses as mentioned above, the distribution shall be 30 marks for CIE, and 70 marks for the SEE.

12.3 a) For Theory Subjects (inclusive of Minor Courses), during the semester, there shall be two Continues Internal Evaluations (CIE) examinations for 30 marks each. Each CIE examination consists of one subjective paper for 25 marks, and assignment for 5 marks for each subject. Question paper contains two Parts (Part-A and Part-B.) The distribution of marks for PART-A and PART-B will be 10 marks & 15 marks respectively for UG programme.

Pattern of the question paper is as follows:

PART–A

Consists of ***one compulsory question*** with five sub questions each carrying two mark. For the I-Mid examinations the sub question would be from first 2 ½ units and for the II-Mid examination the sub question would be from the remaining 2 ½ units.

PART-B

Consists of five questions (out of which students have to answer three questions) carrying five marks each. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question). The questions can consist of sub questions also.

b) The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

c) First Assignment should be submitted before the commencement of the first mid-term examinations, and the Second Assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified/given by the concerned subject teacher.

d) If any candidate is absent for the CIE examinations or those who want to improve their internal marks in any subject can opt for improvement exam as and when offered. The improvement exam is a 45 minutes duration and consisting of 30 objective questions from the entire syllabus of the subject. Best marks is consider as a final marks from the average of two mid examinations or improvement examination marks. The improvement can be taken after the payment of prescribed fee. There is no Internal Improvement for the courses Machine Drawing, Production Drawing, Engineering Drawing, Engineering Graphics and practical, mandatory courses.

12.4 For Practical Courses, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks, and 70 marks are assigned for Lab/Practical End Semester Examination (SEE). Out of the 30 marks for internals, day-to-day work in the laboratory shall be evaluated for 15 marks; and for the remaining 15 marks - two internal practical tests (each of 15 marks) shall be conducted by the concerned laboratory teacher and the average of the two tests is taken into account. The SEE for Practical's shall be conducted at the end of the Semester by Two Examiners appointed by the Chief Controller of Examinations in consultation with the Head of the Department.

12.5 For the Subjects having Design and/or Drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Production Drawing Practice, and Estimation), the distribution shall be 30 marks for CIE (10 marks for day-to-day work and 20 marks for internal tests) and 70 marks for SEE. There shall be two internal tests in a semester and the average of the two shall be considered for the award of marks for internal tests.

12.6 Open Elective Course**:** Students can choose one open elective course (OE-I) during III-B.Tech I-semester, one (OE-II) during III-B.Tech II-semesterr, one (OE-III) in IV-B.Tech I-semester, and one (OE-IV) in IV-B.Tech II-semester from the list of open elective courses given. However, students cannot opt for an open elective courses offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any Semester.

12.7 There shall be an mini project to be taken up during the vacation after II-B.Tech. II-Semester examination. However, the mini project and its report shall be evaluated in III-B.Tech I-Semester SEE & CIE. The mini project shall be submitted in a report form and presented before the committee. There is an internal mark of 30, the evaluation should be done by the supervisor. The There is an external marks of 70 and the same evaluated by the external examiner appointed by the Chief Controller of Examinations and he secures a minimum of 35% of marks in the Semester End Examination and a minimum aggregate of 40% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

12.8 There shall be a independent study in III-B.Tech II-Semester and will be conducted SEE by through a test or a committee consisting of One External Examiner, Head of the Department and two Senior faculty members of the Department. The independent study is intended to assess the student's understanding of the subjects he/she studied during the B.Tech course of study and evaluated for 100 marks. There shall be no CIE for independent study.

12.9 Each Student shall start the Project Work Phase-I during the IV B.Tech I Semester(VII Semester), as per the instructions of the Project Guide/Project Supervisor assigned by the Head of Department. Total 100 marks allotted for the Project Work Stage-I. 40% of marks shall be evaluated Project Guide/Project supervisor CIE (Continuous Internal Evaluation) based on the reports submitted and conduct presentations. Remaining 60% of marks shall be evaluated by committee comprising of the Head of the Department, project supervisor and senior faculty member from concerned department based on Viva/Seminar Presentation. He/She must secure the 40% of the marks from CIE. For Project work Phase-II in IV Year II Sem. There is an internal marks of 50, the evaluation should be done by the supervisor. The There is an external marks of 150 and the same evaluated by the external examiner appointed by the Chief Controller of Examinations and he secures a minimum of 35% of marks in the Semester End Examination and a minimum aggregate of 40% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

12.10. **Semester End Examination:**

a) Question paper contains 2 Parts (Part-A and Part-B) having the questions distributed equally among all units.
b) The distribution of marks for i) PART-A for 20 marks ii) PART-B for 50 marks. Pattern of the question paper is as follows:

PART–A

Consists of one question which are compulsory. The question consists of ten sub-questions one from each unit and carry 2 marks each.

PART-B

Consists of 5 questions carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. Each question there will be an "either" "or" choice (that means there will be two questions from each unit and the student should answer any one question).

12.11 For Mandatory Non-Credit Courses offered in a Semester, after securing ≥ 65% attendance and has secured not less than 35% marks in the SEE, and a minimum of 40% of marks in the sum Total of the CIE and SEE taken together in such a course, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall be allotted for these courses/activities.However, for non credit courses '**Satisfactory'** or "**Unsatisfactory'** shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.12 SWAYAM: College intends to encourage the students to do a minimum of one MOOCS in discipline and open elective during third year. The respective departments shall give a list of **s**tandard MOOCs providers including SWAYAM whose credentials are endorsed by the BoS chairperson. In general, MOOCs providers provide the result in percentage. In such case, the college shall follow the grade table mentioned in 14.2. The Credits for MOOCS(s) shall be transferred same as given for the respective discipline or open electives. In case a student fails to complete the MOOCs he/she shall re-register for the same with any of the providers from the list provided by the department. Still if a student fails to clear the course/s, or in case a provider fails to offer a MOOCS in any semester, then in all such cases the college shall conduct the end semester examinations for the same as per the college end semester examination pattern. The syllabi for the supplementary examinations shall be same as that of MOOCSs. There shall be no internal assessment however the marks obtained out of 70 shall be scaled up to 100 marks and the respective letter grade shall be allotted. The details of MOOCS(s) shall be displayed in Memorandum of Grades of a student, provided he/she submits the proof of completion of it or them to the examination branch through the Coordinator/Mentor, before the end semester examination of the particular semester.

13. AWARD OF DEGREE

After a student has satisfied the requirement prescribed for the completion of the Programme and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes Shown in Table.

Table: **Declaration of Class based on CGPA (Cumulative Grade Point Average)**

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA ≥ 8.00
First Class	≥ 6.50 to < 8.00 CGPA
Second Class	≥ 5.50 to < 6.50 CGPA
Pass Class	≥ 5.00 to < 5.50 CGPA
FAIL	CGPA < 5

a) **Improvement of Grades and Completion of the Course**

i) Candidates who have passed in a theory course in a Semester are allowed to appear for improvement of Grade in the next immediate supplementary examination for a maximum of three subjects only. Candidates will not be allowed to improve grade in the Laboratory, Seminars, Internships and Project Work.

ii) Improved grade will not be counted for the award of prizes/medals and Rank. However the previous grade will be considered for the award of prizes/medals and rank in case of toppers.

iii) If the candidate does not show improvement in the grade, his/her previous grade will be taken into consideration.

14. LETTER GRADE AND GRADE POINT

14.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practical's, or Seminar, or Project, or Internship*/Mini-Project, Minor Course etc., based on the %marks obtained in CIE+SEE (Continuous Internal Evaluation + Semester End Examination, both taken together), and a corresponding Letter Grade shall be given.

14.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed...

% of Marks Secured (Class Intervals)	***Letter Grade (UGC Guidelines)***	***Grade Points***
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% ($\geq$ 60% , $<$ 70%)	B^+ (Good)	7
Below 60% but not less than 50% ($\geq$ 50% , $<$ 60%)	B (above Average)	6
Below 50% but not less than 40% ($\geq$ 40% , $<$ 50%)	C (Average)	5
Below 40% ($<$ 40%)	F (FAIL)	0
Absent	AB	0

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

14.4 A Letter Grade does not imply any specific % of Marks.

14.5 In general, a student shall not be permitted to repeat any Subject/Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Subjects/Courses pertaining to that Semester, when he is detained.

14.6 A student earns Grade Point (GP) in each Subject/Course, on the basis of the Letter Grade obtained by him 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 Point (GP) x Credits …. For a Course

14.7 The Student passes the Subject/Course only when he gets GP $\geq$ 4 (P Grade or above).

14.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

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

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to that ix Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i Subject.

Illustration of Computation of SGPA Computation

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	4	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x10= 30
Course5	3	C	5	3 x 5 = 15
Course6	4	B	6	4 x 6 = 24

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

14.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year 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

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

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards up to 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 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.

For CGPA Computation

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

Thus, **CGPA =** $\dfrac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144} = 6.73$

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

14.11 For Calculations listed in Item 12.6–12.10, performance in failed Subjects/Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

14.12 Conversion formula for the conversion of GPA into indicative percentage is

% of marks scored = (final CGPA -0.50) x 10

15. DECLARATION OF RESULTS

Computation of SGPA and CGPA are done using the procedure listed in 12.6– 2.10.

No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given Semester.

16. WITH HOLDING OF RESULTS

If the student has not paid fees to College at any stage, or has pending dues against his name due to any reason what so ever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

17. REVALUATION

Students shall be permitted for revaluation after the declaration of end Semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

18. SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even Semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write more than one examination per day.

ADVANCED SUPPLEMENTARY EXAMINATION

Advanced supplementary examinations will be conducted for IV year II Semester after announcement of regular results.

19. TRANSCRIPTS

After successful completion of prerequisite credits for the award of degree a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

20. RULES OF DISCIPLINE

20.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of controller of Examination for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

20.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that course(s) and grading is done accordingly.

20.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).

20.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Examiner is final.

21. MALPRACTICE PREVENTION COMMITTEE

A malpractice prevention committee shall be constituted to examine and punish the students who involve in malpractice / indiscipline in examinations. The committee shall consist of:

a) Controller of examinations - Chairman
b) Addl. Controller of examinations.- Member Convenor
c) Subject expert - member
d) Head of the department of which the student belongs to. - Member
e) The invigilator concerned - member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

22. TRANSITORY REGULATIONS

Student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the Degree Programme, may be considered eligible for readmission to the same Subjects/Courses (or equivalent Subjects/Courses, as the case may be), and same Professional Electives/Open Electives (or from set/category of Electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the Date of Commencement of his I Year I Semester).

23. AMENDMENTS TO REGULATIONS

The Academic Council of MLR Institute of Technology reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

24. STUDENT TRANSFERS

There shall be no Branch transfers after the completion of Admission Process. Transfer of students from other colleges or universities are permitted subjected to the rules and regulations of TSCHE (TE Department) and JNTUH in vogue.

25. GRADUATION DAY

The College shall have its own Annual Graduation Day for the award of Degrees issued by the College/University.

26. AWARD OF MEDALS

Institute will award Medals to the outstanding students who complete the entire course in the first attempt within the stipulated time.

27. SCOPE

i) Where the words “he”, “him”, “his”, occur in the write-up of regulations, they include “she”, “her”.

ii) Where the words “Subject” or “Subjects”, occur in these regulations, they also imply “Course” or “Courses”.

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

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

Academic Regulations for B. Tech. (Lateral Entry Scheme)

(Effective for the students getting admitted into II year from the Academic Year 2020-2021 on wards)

1. The Students have to acquire 124 credits from II to IV year of B.Tech Programme (Regular) for the award of the degree.

2. Students, who fail to fulfil the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

3. The same attendance regulations are to be adopted as that of B. Tech. (Regular)

Promotion Rule:

A Student will not be promoted from III Year to IV Year, unless he/she fulfils the Attendance and Academic Requirements and (i) secure a Total of 50% Credits up to III Year II Semester, from all the regular and supplementary examinations.

Award of Class:

After the student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes: The marks obtained for 124 credits will be considered for the calculation of CGPA and award of class shall be shown separately.

Table: **Declaration of Class based on CGPA (Cumulative Grade Point Average)**

Class Awarded	Grade to be Secured
First Class with Distinction	CGPA $\geq$ 8.00
First Class	$\geq$ 6.50 to < 8.00 CGPA
Second Class	$\geq$ 5.50 to < 6.50 CGPA
Pass Class	$\geq$ 5.00 to < 5.50 CGPA
FAIL	CGPA < 5

All other regulations as applicable for B. Tech. Four-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme).

MALPRACTICES RULES - DISCIPLINARY ACTION FOR /IMPROPER CONDUCT IN EXAMINATIONS

S. No	Nature of Malpractices / Improper Conduct	Punishment
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 he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that Semester/year. The candidate is also debarred for two consecutive

		Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	tendency to disrupt the orderly conduct of the examination.	
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical

		examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that Semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

MLR-20
COURSE STRUCTURE

I YEAR I SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5BS01	Calculus and Applications	BSC	3	1	0	4	30	70	100
A5BS11	Applied Chemistry	BSC	4	0	0	4	30	70	100
A5CS01	Programming for Problem Solving	ESC	3	0	0	3	30	70	100
A5HS01	English	HSMC	2	0	0	2	30	70	100
A5CS02	Programming for Problem Solving Lab	ESC	0	0	3	1.5	30	70	100
A5BS12	Applied Chemistry Lab	BSC	0	0	3	1.5	30	70	100
A5HS02	English Language and Communication Skills Lab	HSMC	0	0	2	1	30	70	100
		TOTAL	12	01	08	17	210	490	700
Mandatory Course (Non-Credit)									
A5MC01	Seminar-I	MC	0	0	2	0	30	70	100

I YEAR II SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5BS03	Integral Calculus and Numerical Techniques	BSC	3	1	0	4	30	70	100
A5BS09	Engineering Physics	BSC	3	1	0	4	30	70	100
A5EE03	Electrical Circuits	ESC	3	1	0	4	30	70	100
A5ME02	Engineering Graphics	ESC	1	0	4	3	30	70	100
A5BS10	Engineering Physics Lab	BSC	0	0	3	1.5	30	70	100
A5EE04	Electrical Circuits Lab	ESC	0	0	3	1.5	30	70	100
A5ME04	Engineering Workshop	ESC	0	0	2	1	30	70	100
		TOTAL	10	03	12	19	210	490	700
Mandatory Course (Non-Credit)									
A5MC02	Seminar-II	MC	0	0	2	0	30	70	100

II YEAR I SEMESTER										
Course Code	Course Title	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5EC02	Electronic Devices and circuits	ESC	3	0	0	3	30	70	100
A5CS03	Data Structures	PCC	3	0	0	3	30	70	100
A5EC03	Signals and Systems	PCC	3	1	0	4	30	70	100
A5EC04	Electronic Measurements and Instrumentation	ESC	3	0	0	3	30	70	100
A5EC05	Probability Theory and Stochastic Processes	ESC	3	1	0	4	30	70	100
A5EC06	Electronics Devices and Circuits Lab	ESC	0	0	3	1.5	30	70	100
A5CS04	Data Structures Lab	ESC	0	0	3	1.5	30	70	100
A5EC07	Basic Simulation Lab	ESC	0	0	3	1.5	30	70	100
		TOTAL	15	1	9	21.5	240	560	800
Mandatory Course (Non-Credit)									
A4MC04	Gender sensitization	MC	0	0	2	-	30	70	100

II YEAR II SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5EC08	Digital System Design	PCC	3	0	0	3	30	70	100
A5EC09	Analog and Digital Communication	PCC	3	0	0	3	30	70	100
A5EC10	Analog Circuits	PCC	3	0	0	3	30	70	100
A5BS07	Vector Calculus And Complex Analysis	BSC	3	1	0	4	30	70	100
A5EC11	Electromagnetic and Transmission Lines	PCC	3	0	0	3	30	70	100
A5EC12	Analog Circuits Lab	PCC	0	0	3	1.5	30	70	100
A5EC13	Digital System Design Lab	PCC	0	0	3	1.5	30	70	100
A5EC14	Analog and Digital Communications Lab	PCC	0	0	3	1.5	30	70	100
		TOTAL	15	1	9	20.5	240	560	800
Mandatory Course (Non-Credit)									
A5MC03	Environmental Studies	MC	3	0	0	-	30	70	100

III YEAR I SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5EC15	Linear and Digital Integrated Circuit Applications	PCC	3	0	0	3	30	70	100
A5EC16	Antennas and Wave propagation	PCC	3	0	0	3	30	70	100
A5EC17	Microprocessors and Microcontrollers	PCC	3	0	0	3	30	70	100
	Professional Elective – 1	PEC	3	0	0	3	30	70	100
	Open Elective-1	OEC	3	0	0	3	30	70	100
A5EC18	Microprocessors and Microcontrollers Lab	PCC	0	0	3	1.5	30	70	100
A5EC19	Analog & Digital IC Applications Lab	PCC	0	0	3	1.5	30	70	100
A5IT02	Object Oriented Programming Lab	PCC	0	0	3	1.5	30	70	100
A5EC20	Mini Projects*	PWC	0	0	4	2	30	70	100
		TOTAL	15	0	13	21.5	270	630	900
Mandatory Course (Non-Credit)									
A5MC05	Human Values and Professional Ethics	MC	3	0	0	-	30	70	100

III YEAR II SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5EC21	Digital Signal Processing	PCC	3	0	0	3	30	70	100
A5EC22	Microwave Engineering	PCC	3	0	0	3	30	70	100
	Professional Elective – 2	PEC	3	0	0	3	30	70	100
	Professional Elective – 3	PEC	3	0	0	3	30	70	100
	Open Elective-2	OEC	3	0	0	3	30	70	100
A5EC23	Digital Signal Processing Lab	PCC	0	0	3	1.5	30	70	100
A5EC24	Antennas and Microwave Lab	PCC	0	0	3	1.5	30	70	100
A5HS04	Advanced English Communication Skills Lab	HSMC	0	0	3	1.5	30	70	100
A5EC25	Independent Study/ MOOC'S	PWC	-	-	-	1	--	100	100
TOTAL			15	0	9	20.5	240	660	900

IV YEAR I SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
A5EC26	Embedded System Design	PCC	3	0	0	3	30	70	100
A5EC27	VLSI Design	PCC	3	1	0	4	30	70	100
A5EC28	Computer Networks	PCC	3	0	0	3	30	70	100
	Professional Elective -4	PEC	3	0	0	3	30	70	100
	Open Elective-3	OEC	3	0	0	3	30	70	100
A5EC29	Embedded & IoT Lab	PCC	0	0	3	1.5	30	70	100
A5EC30	VLSI Design Lab	PCC	0	0	3	1.5	30	70	100
A5EC31	Major Project Stage-I	PWC	0	0	8	4	100	0	100
		TOTAL	12	0	14	23	310	490	800

IV YEAR II SEMESTER									
Code	Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal	External	Total
	Professional Elective -5	PEC	3	0	0	3	30	70	100
	Professional Elective -6	PEC	3	0	0	3	30	70	100
	Open Elective-4	OEC	3	0	0	3	30	70	100
A5EC32	Major Project Stage-II	PWC	0	0	16	8	50	150	200
		TOTAL	9	0	16	17	140	360	500

PROFESSIONAL ELECTIVES			
PE-I		**PE-II**	
A5EC33	Sensors and Actuators	A5EC37	Digital Image Processing
A5EC34	Fiber Optic Communication	A5EC38	Telecommunication Switching and Networks
A5EC35	Digital Design through Verilog	A5EC39	Introduction to MEMS
A5EC36	Industrial Electronics	A5EC66	Introduction to Data Mining Techniques
PE-III		**PE-IV**	
A5EC40	Control Systems	A5EC43	Speech and Audio Processing
A5EC41	Artificial Intelligence	A5EC44	Satellite Communication
A5EC42	ASIC Design	A5EC45	Robotics Process Automation
A5EC46	Internet of Things & Applications	A5EC67	Machine Learning Techniques
PE- V		**PE-VI**	
A5EC47	Bio-Medical Instrumentation	A5EC50	Radar Systems
A5EC48	Cellular Mobile Communications	A5EC51	Wireless Communications and Networks
A5EC49	CMOS Analog Design	A5EC68	Deep Learning Algorithms
A5EC52	Artificial Neural Networks	A5EC53	Opto Electronics

OPEN ELECTIVE COURSES

OPEN ELECTIVE COURSE-I			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE62	Fundamentals of Avionics	Aeronautical Engineering
2.	A5AE63	Introduction to Aerospace Technology	
3.	A5CS30	Core Java Programming	Computer Science and Engineering
4.	A5CS26	Introduction to Data Analytics	
5.	A5EC54	Microprocessors and Interfacing	Electronics & Communication Engineering
6.	A5EC55	Principles of Communications	
7.	A5EE52	Electrical Wiring and Safety Measures	Electrical & Electronics Engineering
8.	A5EE53	Electrical Materials	
9.	A5IT21	Fundamentals of Data Structures	Information Technology
10.	A5IT22	Introduction to Machine Learning	
11.	A5ME72	Fundamentals Of Engineering Materials	Mechanical Engineering
12.	A5SH06	Business Economics and Financial Analysis	HSM
13.	A5HS07	Basics of Entrepreneurship	

OPEN ELECTIVE COURSE-II			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE64	Introduction to Jets and Rockets	Aeronautical Engineering
2.	A5AE65	Non-Destructive Testing Methods	
3.	A5CS31	Fundamentals of DBMS	Computer Science and Engineering
4.	A5CS07	Introduction to Design and Analysis of Algorithms	
5.	A5EC58	Microcontrollers and Applications	Electronics & Communication Engineering
6.	A5EC61	Fundamentals of Image processing	
7.	A5EE56	Analysis of Linear Systems	Electrical & Electronics Engineering
8.	A5EE57	Neural Networks and Fuzzy Logic	
9.	A5IT23	Basics of Python Programming	Information Technology
10.	A5IT11	Human Computer Interaction	
11.	A5ME73	Fundamentals of Mechatronics	Mechanical Engineering
12.	A5HS09	Advanced Entrepreneurship	HSM

OPEN ELECTIVE COURSE-III			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE66	Introduction to Aircraft Industry	Aeronautical Engineering
2.	A5AE67	Unmanned Aerial Vehicles	
3.	A5CS33	Introduction to Cloud Computing	Computer Science and Engineering
4.	A5CS34	Computer Organization and Operating Systems	
5.	A5CS29	Software Project Management	
6.	A5EC62	Introduction to Sensors and Actuators	Electronics & Communication Engineering
7.	A5EC63	Introduction to Computer Vision	
8.	A5EE60	Solar Energy and Applications	Electrical & Electronics Engineering
9.	A5IT24	Introduction to AI	Information Technology
10.	A5IT25	Software Testing Fundamentals	
11.	A5ME75	Basics of Robotics	Mechanical Engineering
12.	A5ME76	Fundamentals of Operations Research	
13.	A5HS10	Indian Ethos and Business Ethics	HSM

OPEN ELECTIVE COURSE-IV			
S. No.	**Course Code**	**Course Name**	**Offering Department**
1.	A5AE68	Fundamentals of Wind Power Technology	Aeronautical Engineering
2.	A5AE69	Guidance and Control of Aerospace Vehicles	
3.	A5CS20	Distributed Databases	Computer Science and Engineering
4.	A5CS29	Software Project Management	
5.	A5EC64	Introduction to Mobile Communications	Electronics & Communication Engineering
6.	A5EC65	Basics of Embedded System Design	
7.	A5EE61	Instrumentation and Control	Electrical & Electronics Engineering
8.	A5EE63	Energy Storage Systems	
9.	A5IT26	Introduction to Mobile Application Development	Information Technology
10.	A5IT27	Big Data	
11.	A5ME78	Renewable Energy Sources	Mechanical Engineering
12.	A5HS15	Management Science	HSM
13.	A5HS16	Intellectual Property Rights	

Note:

BSC- Basic Science Courses
ESC-Engineering Science Courses
HSMC-Humanities and Social Science including Management Courses
PCC- Professional Core Courses
PEC- Program Elective Courses
OEC- Open Elective Courses
PWC- Project work Related Courses
MC- Mandatory Courses

I B.TECH I SEMESTER

SYLLABUS

<table>
<tr><td colspan="10">CALCULUS AND APPLICATIONS</td></tr>
<tr><td>Course Code:</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5BS01</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 44</td><td>Tutorial Classes: 08</td><td colspan="4">Practical Classes:-- Nil</td><td colspan="3">Total Classes: 52</td></tr>
</table>

Course Objectives

To learn

1. The concept of differential equations and solve them using appropriate methods
2. Usage of the appropriate test to find the convergence and divergence of the given series
3. Concept of Rank of a matrix, Consistency and solving system of linear equations.
4. Evaluation of differential equation using Laplace Transform techniques.
5. The partial derivatives of several variable functions.

Course Outcomes

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

1. Identify the different types of differential equations and solve them using appropriate methods.
2. Apply the appropriate test to find the convergence and divergence of the given series.
3. Solve the system of linear equations using rank of the matrices.
4. Solve the differential equations using Laplace transform techniques.
5. Find the Maxima and Minima of several variable functions.

UNIT-I	**ORDINARY DIFFERENTIAL EQUATIONS**	**Classes: 10**

Introduction- Exact and reducible to Exact differential equations-Newton's Law of cooling-Law of Growth and Decay. Linear differential equations of second and higher order with constant coefficients - Non-Homogeneous term of the type $Q(x) = e^{ax}$, Sin ax, Cosax, $e^{ax}v(x)$, $x^n v(x)$ - Method of variation of parameters.

UNIT-II	**SEQUENCES AND SERIES**	**Classes: 12**

Basic definitions of Sequences and series – Convergence and divergence –Comparison Test- Ratio Test – Raabe's Test-Integral Test – Cauchy's n^{th} root Test –Absolute and Conditional convergence – Power Series.

UNIT-III	**THEORY OF MATRICES**	**Classes: 08**

Finding rank of a matrix by reducing to Echelon form,Consistency of system of linear equations (homogeneous and non-homogeneous) using the rank of a matrix, Eigen values and Eigen vectors and its properties(with out proof),Cayley-Hamilton theorem (Statement and verification)-Finding inverse and powers of a matrix by Cayley-Hamilton theorem, Diagonalisation of matrices

UNIT-IV	**LAPLACE TRANSFORMS**	**Classes: 12**

Laplace transforms of elementary functions- First shifting theorem - Change of scale property – Multiplication by t^n- Division by t – Laplace transforms of derivatives and integrals – Unit step function – Second shifting theorem – Periodic function – Evaluation of integrals by Laplace transforms – Inverse Laplace transforms- Method of partial fractions – Other methods of finding inverse transforms – Convolution theorem – Applications of Laplace transforms to ordinary differential equations.		
UNIT-V	**CALCULUS OF SEVERAL VARIABLES**	**Classes: 10**
Limit, Continuity - Partial derivative- Partial derivatives of higher order -Total derivative – Chain rule, Jacobians-functional dependence & independence. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints)		
Text Books:		
1. Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.		
Reference Books:		
1. G.B.Thomas, calculus and analytical geometry,9th Edition, Pearson Reprint 2006. 2. N.P Bali and Manish Goyal ,A Text of Engineering Mathematics, Laxmi publications,2008. 3. E.L.Ince, Ordinary differential Equations, Dover publications,1958.		
Web references:		
1. https://www.efunda.com/math/math_home/math.cfm 2. https://www.ocw.mit.edu/resources/#Mathematics 3. https://www.sosmath.com/ 4. https://www.mathworld.wolfram.com/		
E -Text Books:		
1.https://www.e-booksdirectory.com/details.php?ebook=10166		
MOOCSCourse:		
1. https://swayam.gov.in/ 2. https://onlinecourses.nptel.ac.in/		

<table>
<tr><td colspan="11">APPLIED CHEMISTRY</td></tr>
<tr><td>Course Code:</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5BS11</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 50</td><td>Tutorial Classes: 00</td><td colspan="4">Practical Classes: 00</td><td colspan="3">Total Classes: 50</td></tr>
</table>

COURSE OBJECTIVES

The course should enable the students to:

1. Impart knowledge on soft and hard water types and softening methods.
2. Introduce the basic concepts to develop electrochemical cells.
3. Familiarize the redox principle in batteries and fuel cells.
4. Enhance knowledge on corrosion and its significance.
5. Expose on polymer, nano and smart materials

COURSE OUTCOMES

At the end of the course students will be able to:

1. Illustrate the types of hard and soft water, treatment of drinking and industrial water.
2. Demonstrate the basic principles of Electrochemistry in electrochemical cells.
3. Interpret knowledge on the basic concepts of battery, biosensors and sources of renewable energy.
4. Apply the methods of metal finishing in solving corrosion related problems.
5. Identify the significance of polymers, nano and smart materials.

UNIT-I	**WATER AND ITS TREATMENT**	**Classes: 10**

Introduction - Hardness of water- Causes and effects of hardness - Expression and Units of Hardness - Determination of hardness by complex metric method- Numerical problems – Treatment of water by Ion exchange process - Potable water and its specifications – steps involved in treatment of potable water: screening, aeration, sedimentation, coagulation, filtration and sterilisation of water by Chlorination. Desalination of water by Reverse Osmosis.

UNIT-II	**ELECTROCHEMISTRY AND ITS APPLICATIONS**	**Classes: 10**

Electro chemical cells – electrode potential - standard electrode potential - Nernst Equation -Types of electrodes - SHE, Calomel, Quinhydrone and Glass electrode -Electrochemical series, and its application- Numerical Problems. Potentiometric: acid- base and redoxtitration.

UNIT-III	**BATTERIES AND SENSORS**	**Classes: 10**

Batteries - battery characteristics- classification of batteries: primary, secondary, solar batteries- Applications – Construction and Functioning of Primary batteries - Li/MnO_2 cell, lithium cells, Secondary batteries- Lead acid storage battery and Lithium ion battery- Advantages of battery. Solar cells – advantages of solar cells. Sensors - Biosensors their application and advantages.

UNIT-IV	CORROSION AND ITS CONTROL	Classes: 10
Introduction-causes and effects-Chemical and Electrochemical corrosion – Mechanism of electrochemical corrosion- factors affecting rate of corrosion- corrosion control methods - cathodic protection and Protective coatings – Metallic coatings- Methods of metallic coatings – Hot dipping methods: Galvanizing, Tinning, cementation (sherardizing) - electroplating (Copper), electroless plating (nickel). Organic coating - Paints (constituents and functions).		
UNIT-V	ENGINEERING MATERIALS	Classes: 10
Polymers -Polymeric materials – characteristics of Plastics, fibres and elastomers - thermoplastic and thermosetting resins - Conducting polymers – Preparation, properties and application of Polyacetylene and polyaniline (Polyaniline) - Biodegradable polymers – Advantages- Applications of Polylactic acid and poly glycolic acid. **Nano materials** - characteristics - synthesis (Sol- gel method) – application and Advantages of Nano materials. **Smart materials** - Introduction - Types of smart materials and applications.		

Text Books:

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi, 2014.
2. O G Palanna, Engineering Chemistry, Tata McGraw Hill, 2009.

Reference Books:

1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, 2003.
2. Engineering Chemistry (NPTEL Web-book), 11th edition by B.L. Tembe, Kamaluddin and M.S. Krishnan.
3. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press, 2013.

Web references:

1. https://www.scribd.com/document/23180395/Engineering-Chemistry-Unit-I-Water-Treatment
2. https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry-supplement%20text.pdf
3. https://www.nano.gov/you/nanotechnology-benefits

E -Text Books:

1. http://www.freebookcentre.net/Chemistry/Chemistry-Books-Online.html
2. http://www.freebookcentre.net/Chemistry/ElectroChemistry-Books-Download.html
3. http://www.freebookcentre.net/Chemistry/Materials-Chemistry-Books.html
4. http://www.freebookcentre.net/Chemistry/Polymer-Chemistry-Books.html
5. http://www.freebookcentre.net/chemistry-books-download/Engineering-Chemistry-by-Bharath-Institute-of-Science-and-Technology.html

MOOCSCourse:

1. http://nptel.ac.in/courses/122101001/34
2. https://ocw.mit.edu/courses/chemistry/

PROGRAMMING FOR PROBLEM SOLVING								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5CS01	ESC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To impart basic knowledge about simple algorithms for arithmetic and logical problems.
2. To understand how to write a program, syntax and logical errors.
3. To enable them how to implement conditional branching, iteration and recursion.
4. To understand how to decompose a problem into functions and synthesize a complete program.
5. To enable them to use arrays, pointers, strings and structures in solving problems.
6. To understand how to solve problems related to matrices, Searching and sorting.
7. To make them to understand the use files to perform read and write operations.

COURSE OUTCOMES

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

1. Formulate simple algorithms for arithmetic and logical problems.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Decompose a problem into functions and synthesize a complete program.
5. Use arrays, pointers, strings and structures to formulate algorithms and programs.
6. Apply programming to solve problems related to matrices, searching and sorting.

UNIT-I	INTRODUCTION	Classes: 12

Introduction to Programming: Computer system, computer languages, creating and running programs, Algorithms, flowcharts.

Introduction to C language: History of C, basic structure of C programs, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types, I/O statements.

UNIT-II	OPERATORS, EXPRESSIONS AND CONTROL STRUCTURES	Classes: 15

Operators and expressions: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators, bitwise and conditional operators, special operators, operator precedence and associatively, evaluation of expressions, type conversions in expressions.

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, go to statements.

UNIT-III	ARRAYS AND FUNCTIONS	Classes: 17

Arrays: Concepts, One dimensional array, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi dimensional arrays, Basic Searching Algorithms: Linear and Binary search

Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, call by reference, Passing arrays to functions, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Towers of Hanoi etc.

UNIT-IV	STRINGS AND POINTERS	Classes: 10

Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions.
Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, functions returning pointers, Dynamic memory allocation.

UNIT-V	STRUCTURES AND FILE HANDLING	Classes: 10

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, self-referential structures, unions, type def, enumerations.
File handling: command line arguments, File modes, basic file operations read, write and append, example programs

Text Books:

1. Byron Gottfried, "Programming with C",Schaum's Outlines Series, McGraw Hill Education, 3rdedition, 2017.
2. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education, 6th Edition, 2012.

Reference Books:

1. W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd Edition, 1988.
2. Yashavant Kanetkar, "Exploring C", BPB Publishers, 2nd Edition, 2003.
3. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014.
4. R. S. Bichkar, "Programming with C", Universities Press, 2nd Edition, 2012.
5. Dey Pradeep, Manas Ghosh, "Computer Fundamentals and Programming in C", Oxford University Press, 2nd Edition, 2006.
6. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.
7. B. A. Forouzan, R. F. Gillberg, "C Programming and Data Structures", Cengage Learning, India, 3rd Edition, 2014.

Web References:

1. https://www.bfoit.org/itp/Programming.html
2. https://www.khanacademy.org/computing/computer-programming
3. https://www.edx.org/course/programming-basics-iitbombayx-cs101-1x-0
4. https://www.edx.org/course/introduction-computer-science-harvardx-cs50x

E-Text Books:

1. http://www.freebookcentre.net/Language/Free-C-Programming-Books-Download.htm
2. http://www.imada.sdu.dk/~svalle/courses/dm14-2005/mirror/c/
3. http://www.enggnotebook.weebly.com/uploads/2/2/7/1/22718186/ge6151-notes.pdf

MOOCS Course

1. https://onlinecourses.nptel.ac.in/noc18_cs33/preview
2. https://www.alison.com/courses/Introduction-to-Programming-in-c
3. http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s096-effective-programming-in-c-and-c-january-iap-2014/index.htm

<table>
<tr><td colspan="9" align="center">ENGLISH</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5HS01</td><td rowspan="2">HSMC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
</table>

COURSE OBJECTIVES:

Student will be able to:

1 .Develop language proficiency with emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Apply the theoretical and practical components of English syllabus to study academic subjects more effectively and critically.
3. Analyze a variety of texts and interpret them to demonstrate in writing or speech.
4. Write/ compose clearly and creatively, and adjust writing style appropriately to the content, the context, and nature of the subject.
5. Develop language components to communicate effectively in formal and informal situations.

COURSE OUTCOMES:

By the end of this course, students will be able to:

1. Construct sentences by using appropriate parts of speech.
2. Write letters/paragraphs/reports etc for meaningful professional communication.
3. Make use of appropriate vocabulary in both written and spoken contexts.
4. Comprehend and analyze different levels of written documents.
5. Analyze and correct common errors in spoken and written forms.

UNIT-I	**OF STUDIES BY FRANCIS BACON**	**Classes: 06**

Vocabulary: The concept of Word Formation, Prefixes and Suffixes
Grammar: Word Families- Nouns, Pronouns, Verbs, Adjectives, Adverbs
Reading Skills: Reading for General Details
Writing Skills: Punctuation, Writing Paragraphs

UNIT-II	**SCIENTIST IN TRAINING: THE OXFORD YEARS STEPHEN HAWKING'S BIOGRAPHY BY KRISTINE LARSEN**	**Classes: 06**

Vocabulary: Synonyms and Antonyms, Standard Abbreviations
Grammar: Preposition, Conjunctions, Articles
Reading Skills: Reading for Specific Details, Making Inferences
Writing Skills: Letter Writing- Letters of Request, Apology and Complaint- Letter of Application with Resume

UNIT-III	**THE TEENAGE YEARS BY SARAH GRAY**	**Classes: 07**

Vocabulary: Idioms and Phrasal verbs, Technical Vocabulary
Grammar: Sentence Structures, Tenses
Reading Skills: Reading between the Lines
Writing Skills: Essay writing and Describing Objects, Places and Events.

UNIT-IV	**UNLOCK YOUR OWN CREATIVITY BY ROBERT VON OECH**	**Classes: 07**

Vocabulary: One word Substitutes, Words often confused
Grammar: Direct and Indirect Speech, Active and Passive Voice
Reading Skills: Reading Techniques- Skimming and Scanning of the Text
Writing Skills: Technical Report Writing, E-mail writing, Picture Essay

UNIT-V	**A TALK ON ADVERTISING BY HERMAN WOUK**	**Classes: 06**

Vocabulary: Misplaced Modifiers, Redundancies
Grammar: Subject Verb Agreement (Concord), Common Errors in English
Reading Skills:Reading Techniques- Intensive and Extensive Reading
Writing Skills: Memo, Précis and Resume Writing

Text Books:

1. Michael Swan. Practical English Usage. Oxford University Press. 2017.
2. Wren & Martin. High School English Grammar and Composition Book. S Chand Publishing. 2017

Reference Books:

1. Murphy, R. (2015). Essential Grammar in Use. Cambridge University Press.
2. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
3. Kumar, S and Lata, P. (2018). Communication Skills. Oxford University Press.
4. Zisser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.

Web References:

1. http//www.bbc.co.uk/learningenglish
2. http//learnenglish.britishcouncil.org
3. https//www.cambridgeenglish.org/learning-english/
4. https//study.com/academy/subj/english.html

E-Text Books:

1. https//www.pdfdrive.com/advanced-english-books.html

MOOCS Course

1. http//nptel.ac.in/courses/109/106/109106067
2. https//www.britishcouncil.org.tr/en/english/MOOCs

PROGRAMMING FOR PROBLEM SOLVING LAB

I B.TECH I SEM : ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5CS02	ESC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

1. To be familiarize with flowgorithm to solve simple problems
2. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
3. To develop modular, reusable and readable C Programs using the concepts like functions, arrays, strings, pointers and structures.

COURSE OUTCOMES:

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

1. Solve simple mathematical problems using Flowgorithm.
2. Correct syntax errors as reported by the compilers and logical errors encountered at run time.
3. Develop programs by using decision making and looping constructs.
4. Implement real time applications using the concept of array, pointers, functions and structures.

LIST OF EXPERIMENTS

Week-1 INTRODUCTION TO FLOGORITHM

a. Installation and working of Flowgorithm Software.
b. Write and implement basic arithmetic operations using Flowgorithm – sum, average, product, difference, quotient and remainder of given numbers etc.

Week-2 FLOWGORITHM - OPERATORS AND EVALUATION OF EXPRESSIONS

a. Draw a flowchart to calculate area of Shapes (Square, Rectangle, Circle and Triangle).
b. Draw a flowchart to find the sum of individual digits of a 3 digit number.
c. Draw a flowchart to convert days into years, weeks and days.
d. Draw a flowchart to read input name, marks of 5 subjects of a student and display the name of the student, the total marks scored, percentage scored

Week-3 FLOWGORITHM –CONDITIONAL STATEMENTS

a. Draw a flowchart to find roots of a quadratic equation.
b. Draw a flowchart to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd
c .Draw a flowchart to check whether the triangle is equilateral, isosceles or scalene triangle

Week-4 OPERATORS

a. Write a C program to swap values of two variables with and without using third variable.
b. Write a C program to enter temperature in Celsius and convert it into Fahrenheit.
c. Write a C program to calculate Simple and Compound Interest.
d. Write a C program to calculate s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2))

Week-5 CONDITIONAL STATEMENTS

a. Write a C program to find largest and smallest of given numbers.

b. Write a C program which takes two integer operands and one operator form the user(+,-,*,/,% use switch)
c. Write a program to compute grade of students using if else adder. The grades are assigned as followed:

marks<50	F
50≤marks< 60	C
60≤marks<70	B
70≤marks	B+
80≤marks<90	A
90≤mars≤ 100	A+

Week-6 LOOPING STATEMENTS

a. Write a C program to find Sum of individual digits of given integer
b. Write a C program to generate first n terms of Fibonacci series
c. Write a C program to generate prime numbers between 1 and n
d. Write a C Program to find the Sum of Series SUM=1-x2/2! +x4/4!-x6/6!+x8/8!-x10/10!
e. Write a C program to generate Pascal's triangle.
f. Write a C program to generate pyramid of numbers.

```
            1
        1   3   1
    1   3   5   3   1
```

Week-7 ARRAYS

a. Write a C Program to implement following searching methods
   i. Binary Search
   ii. Linear Search
b. Write a C program to find largest and smallest number in a list of integers
c. Write a C program
   i. To add two matrices
   ii. To multiply two matrices
d. Write a C program to find Transpose of a given matrix

Week-8 FUNCTIONS

a. Write a C program to find the factorial of a given integer using functions
b. Write a C program to find GCD of given integers using functions
c. Write a C Program to find the power of a given number using functions

Week-9	**RECURSION**

a. Write a C Program to find binary equivalent of a given decimal number using recursive functions.
b. Write a C Program to print Fibonacci sequence using recursive functions.
c. Write a C Program to find LCM of 3 given numbers using recursive functions

Week-10	**STRINGS**

a. Write a C program using functions to
    a. Insert a sub string into a given main string from a given position
    b. Delete n characters from a given position in a string
b. Write a C program to determine if given string is palindrome or not

Week-11	**POINTERS**

a. Write a C program to print 2-D array using pointers
b. Write a C program to allocate memory dynamically using memory allocation functions (malloc, calloc, realloc, free)

Week-12	**STRUCTURES**

a. Write a C Program using functions to
    i. Reading a complex number
    ii. Writing a complex number
    iii. Add two complex numbers
    iv. Multiply two complex numbers

    Note: represent complex number using structure
b. Write a C program to read employee details employee number, employee name, basic salary, hra and da of n employees using structures and print employee number, employee name and gross salary of n employees

Text Books:

1. Riley DD, Hunt K.A. Computational Thinking for the Modern Problem Solver. CRC press, 2014 Mar 27.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Yashavant Kanetkar, "Let Us C", BPB Publications, New Delhi, 13^{th} Edition, 2012.

Reference Books:

1. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018
2. King KN, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
3. Kochan Stephen G, "Programming in C: A Complete Introduction to the C Programming Language", Sam's Publishers, 3rd Edition, 2004.
4. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994..

Web References:

1. http://www.flowgorithm.org/documentation/
2. http://www.sanfoundry.com/c-programming-examples
3. http://www.geeksforgeeks.org/c
4. http://www.cprogramming.com/tutorial/c

APPLIED CHEMISTRY LAB

Course Code:	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5BS12	BSC	0	0	3	1.5	30	70	100

COURSE OUTCOMES:

At the end of the course students will be able to:.

1. Estimate hardness, alkalinity and chloride content in water to check its suitability for drinking.
2. Estimate the percentage content of metal oxide in construction material.
3. The measurement of physical properties like adsorption and viscosity.
4. Demonstrate the digital and instrumental methods of analysis.
5. Synthesize various organic compounds.

LIST OF EXPERIMENTS

Experiment-1	Determination of total hardness of water by complex metric method using EDT
Experiment-2	Determination of Alkalinity of given water sample
Experiment-3	Estimation of Chloride content of water by Argentometry.
Experiment-4	Estimation of amount of HCl by Conductometry.
Experiment-5	Estimation of amount of Acetic acid by Conductometry..
Experiment-6	Estimation of amount of ferrous ion by potentiometry using potassium dichromat
Experiment-7	Estimation of HCl by potentiometry
Experiment-8	Determination of Viscosity of a given liquid using Ostwald's Viscometer
Experiment-9	Determination of surface tension of a given liquid using Stalagmometer
Experiment-10	Synthesis of Aspirin
Experiment-11	Synthesis of Thiokol Rubber

Experiment-12	Separation of organic mixture by Thin layer Chromatography and calculation of RF values.
Experiment-13	Determination of percentage of Calcium Oxide in Cement
Experiment-14	Estimation of Manganese Dioxide in Pyrolusite
Reference Books:	
1. Senior practical chemistry, B.D.Khosla, A.Sulati and V.Garg (R.Chand and amp;co,Delhi. 2. An introduction to practical chemistry, K.K.Sharma and D.S.Sharma (Vikas publishing, N Delhi) 3. Vogel's textbook of practical organic chemistry 5th edition. 4. Text book on Experiments and calculations in Engineering chemistry - S.S.Dara	
Web References:	
1. http://www.arxiv.org/pdf/1510.00032 2. http://www nptel.ac.in/courses/122103010/ 3. http://www.researchgate.net/.../276417736_Video_Presentations_in_Engineering-Ph... 4. http://www. wileyindia.com/engineering-physics-theory-and-practical.html	

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5HS02	**HSMC**	**L**	**T**	**P**	**C**	**CI**	**SE**	**Total**
		0	0	2	1	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
2. Enhance English language skills, communication skills and to practice soft skills.
3. Improve fluency and pronunciation intelligibility by providing an opportunity for practice in speaking.
4. Get trained in different interview and public speaking skills such as JAM, debate, role play, group discussion etc.
5. Instill confidence and make them competent enough to express fluently and neutralize their mother tongue influence.

COURSE OUTCOMES:

By the end of the course students will be able to

1. Develop better perception of nuances of English language through audio-visual experience.
2. Acquire Neutralization of accent for intelligibility.
3. Participate in group activities.
4. Employ speaking skills with clarity and confidence which in turn enhances their employability.

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 to appreciate its 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.

Listening for specific information 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.

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

Exercise-I	

CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening. *Practice*: Introduction to Phonetics – Speech Sounds – Word Stress and Rhythm
ICS Lab:
Understand: Communication at Work Place- Spoken vs. Written language.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Introductions- Greetings – Taking Leave.

Exercise-II	

CALL Lab:
Understand: Structure of Syllables — Weak Forms and Strong Forms in Context.
Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.
ICS Lab:
Understand: Features of Good Conversation – Non-verbal Communication.
Practice: Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions- Telephone Etiquette.

Exercise-III

CALL Lab:
Understand: Intonation-Errors in Pronunciation-the Interference of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.
ICS Lab:
Understand: How to make Formal Presentations.
Practice: Formal Presentations- Extempore

Exercise-IV

CALL Lab:
Understand: Listening for General Details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: Public Speaking – Exposure to Structured Talks.
Practice: Group Discussions, Debate

Exercise-V

CALL Lab:
Understand: Listening for Specific Details.
Practice: Listening Comprehension Tests.
ICS Lab:
Understand: Introduction to Interview Skills.
Practice: Mock Interviews.

Reference Books:

1. Whitby, N. Business Benchmark. Cambridge University Press (with CD) 2nd Edition.
2. Kumar, S. & Lata, P. (2011). Communication Skills. Oxford University Press.
3. Balasubramanian, T. (2008). A Text book of English Phonetics for Indian Students, Macmillan.
4. Thorpe, E. (2006). Winning at Interviews, Pearson Education.
5. Sethi, J. et al. (2005). A Practical Course in English Pronunciation (with CD), Prentice Hall of India.

Websites:

1. https://www. britishcouncil.org
2. https://www. bbc.co.uk
3. https://www. grammarly.com
4. https://www. fluentu.com
5. https://www.cambridgeenglish.org/exams-and-tests/business-preliminary
6. https://www.cambridgeenglish.org/exams-and-tests/business-vantage

SEMINAR-I				
Course Code:	**Category**	**Hours / Week**	**Credits**	**Maximum Marks**

		L	T	P	C	CIA	SE E	Total
A5BS12	**BSC**	**-**	**-**	**2**	**0**	**30**	**70**	**100**

COURSE OUTCOMES:

At the end of the course students will be able to:.

1. Topic related to latest technology, latest trends and tools related topics, Introduction to phonetics
2. ORAL/WRITTEN PRESENTATION, POWER POINT (slides) presentation skills/ group discussions (GD-Debate)
3. Situational Dialogs and giving directions
4. Telephonic etiquettes, interview skills, formal introductions, greetings, extempore, listening skills, JAM

I B.TECH II SEMESTER

SYLLABUS

INTEGRAL CALCULUS AND NUMERICAL TECHNIQUES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5BS03	BSC	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100

COURSE OBJECTIVES

To learn

1. The concepts of finite differences, operators and relations between them.
2. Evaluation of integrals by using numerical methods.
3. Evaluation of the multiple integrals.
4. Fourier series for periodic functions.
5. Fourier transform and inverse transform of common functions.

COURSE OUTCOMES:

At the end of the course students will be able to:.

1. Find the interpolating polynomial for the given tabular data.
2. Solve the first-order differential equations using numerical techniques.
3. Evaluate multiple integrals.
4. Find the Fourier series of the given functions.
5. Find the Fourier Transforms of the given functions.

UNIT-I	INTERPOLATION AND CURVE FITTING	Classes: 11

INTERPOLATION: Finite differences: Forward, Backward and Central differences - Other difference operators and relations between them - Difference of a polynomial – Missing terms - Newton's forward interpolation, Newton's backward interpolation, Gauss's forward and backward interpolation formulae. Interpolation with unequal intervals – Lagrange's interpolation.
CURVE FITTING: Method of least squares - Fitting a straight line, second degree parabola and non-linear curves of the form $y= a e^{bx}$, $y= a x^{b,}$ $y = a b^{x}$ by the method of least squares.

UNIT-II	NUMERICAL TECHNIQUES	Classes: 11

ROOT FINDING TECHNIQUES :
Bisection method-Regula Falsi method and Newton Raphson method.
NUMERICAL INTEGRATION :
Trapezoidal rule - Simpson's one-third rule - Simpson's three-eighth rule.
NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor's series method – Euler's - modified Euler's Method – Runge-Kutta method.

UNIT-III	MULTIPLE INTEGRALS	Classes: 10

Double and triple integrals (Cartesian and polar), Change of order of integration in double integrals, Change of variables (Cartesian to polar) in double integrals. Finding the area and volume of a region using double and triple integral.

UNIT-IV	FOURIER SERIES	Classes:10

Periodic function-Determination of Fourier Coefficients-Fourier Series-Even and Odd functions-Fourier series in arbitrary interval-Even Odd periodic continuation-Half range Fourier sine and cosine expansions.

UNIT-V	FOURIER TRANSFORMS	Classes: 10

Fourier integral theorem (statement)-Fourier sine and cosine integrals –Fourier transforms –Fourier sine and cosine transforms-properties- Inverse transforms-Finite Fourier transforms.

Text Books:

1 .Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.

Reference Books:

1. G.B.Thomas, calculus and analytical geometry,9th Edition, Pearson Reprint 2006.
2. N.P Bali and Manish Goyal ,A Text of Engineering Mathematics,Laxmi publications,2008.
3. E.L.Ince, Ordinary differential Equations,Dover publications,1958.

Web references:

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

E -Text Book:

1.https://www.e-booksdirectory.com/details.php?ebook=10166

MOOCSCourse:

1.https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/

<table>
<tr><td colspan="10">ENGINEERING PHYSICS</td></tr>
<tr><td>Course Code:</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5BS09</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
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COURSE OBJECTIVES

The course should enable the students to:

1. Describe the chemical reaction and phase transformation in materials by using modern thermodynamic models
2. Learn the fundamentals of transport properties of materials
3. Describe the interactions of light with materials which results in colour and the temperature dependence of magnetic susceptibility
4. Learn the basic principles of optical fiber and its communication system
5. Understand the development of Nano technology and synthesis of Nano materials by using different techniques

COURSE OUTCOMES

The student will able to:

1. Analyze the bonding scheme and its physical properties of a given material.
2. Evaluate the dimensionality, rates of a nucleation and growth process from kinetic data.
3. Evaluate the Curie and Neel temperature of a given substance.
4. Justify how the graded index optical fiber is more efficient than step index optical fiber in fiber optic communication system.
5. Recommend appropriate synthesis method and explain the characterization techniques.

UNIT-I	**THE STRUCTURE OF MATERIALS &THERMODYNAMICS OF CONDENSED PHASES**	**Classes: 10**

The Structure of Materials: Structure of Metals and Alloys-- Space lattice, unit cell, basis, crystal systems, Bravais lattice, S.C, B.C.C & F.C.C Structures. Structure of Ceramics and Glasses – Rock salt structure, Diamond structure, structure of SiO_4.

Thermodynamics of Condensed Phases: Introduction – Thermodynamics of Metals and Alloys, - Gibbs rule, Cu- Ni phase diagram, Thermodynamics of Ceramics and Glasses- Cu- Fe-O system.

UNIT-II	**TRANSPORT PROPERTIES OF MATERIALS& BAND THEORY OF SOLIDS**	**Classes: 12**

Transport Properties of Materials: Introduction -Momentum Transport properties of Materials, -The Molecular Origins of Viscosity, Temperature Dependence of Pure Metal Viscosity, Composition Dependence of alloy Viscosity.

Band theory of solids: Free electron theory, Origin of energy band formation in solids, Estimation of Fermi-level, Kronig-Penny model, E-K diagram.

UNIT-III	PROPERTIES OF MATERIALS	Classes: 10

Electrical and Optical properties -Conduction, Semi conductivity, Electrical Conduction in Ionic Ceramics**.** Reflection, Refraction, Absorption and transmission. Opacity and Translucency in insulators. Light interaction with solids, EMR, atomic and electronic interaction.

Magnetic properties – Introduction, Types of magnetic materials, influence of temperature on magnetic behaviour, Hysteresis curve, Soft and Hard magnetic materials, Magnetic storage, Ferrite applications

UNIT-IV	OPTOELECTRONIC DEVICES AND OPTICAL FIBERS	Classes: 10

Optoelectronic devices: Introduction to Semiconductors, PN Junction Diode, V-I characteristics and applications. LED - Construction, working and applications. Solar cells- working and its applications. Efficiency issues of Solar cell, PIN diode characteristics.

Fiber Optics: Structure of fibers, Principle of fiber (TIR), Acceptance angle and NA. Types of fibers- SI and GI fibers- R.I profiles. Single and Multimode fibers-SMSI, MMSI, MMGI. OFC System with block diagram. Fiber optic sensors – Basic principle, working of Pressure and Temperature Sensors. Applications of fibers in different fields.

UNIT-V	INTRODUCTION TO ENGINEERED MATERIALS	Classes: 10

Synthesis of Nano materials: Introduction to nano particles, nano scale, Surface to volume ratio and quantum confinement. Techniques for synthesis of nano materials-Top Down and Bottom Up methods–Sol gel, CVD methods and Photolithography.

Characterization of Nanomaterials: Imaging methods – SEM, TEM and STM. Applications of Nano materials in engineering and Biomedical fields and other fields.

Text Books:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi – Cengage Learing
2. Haliday and Resnick, Physics – wiley
3. P.K Palanisamy, Engineering Physics, Sitech Publications, 2013, IVthEdn.
4. Essentials of Nano Tecnology by Jeremy Ramsden.
5. An introduction to materials engineering and science by Brian S. Mitchell

Reference Books:

1. Hecht, "Optics", Pearson Education, 2008.
2. D. A. Neamen, "Semiconductor Physics and Devices", Times Mirror High EducationGroup, Chicago, 1997.
3. Fundamentals of material science and engineering by William D. Callister, Jr. David G. Rethwisch

Web references:
1. https://www.edx.org/course?search_query=semiconductor+physics 2. https://www.edx.org/course/nanotechnology-fundamentals-purduex-nano530x 3. https://www.edx.org/course/physics-electronic-polymers-pep-purduex-nano600
E -Text Books:
1. http://www.phys.sinica.edu.tw/TIGP-NANO/Course/2010_Fall/classnotes/NanoB_week14.pdf 2. https://www.scribd.com/document/70908178/Semiconductor-Devices-Basic-Principles-Jasprit-Singh 3. https://www.scribd.com/doc/105174065/Fundamentals-of-Photonics 4. ftp://nozdr.ru/biblio/kolxo3/P/PE/PEo/Thyagarajan%20K.,%20Ghatak%20A.%20Lasers..%20Fundamentals%20and%20Applications%20(2ed.,%20GTP,%20Springer,%202010)(ISBN%20144196441X)(O)(674s)_PEo_.pdf 5. https://subodhtripathi.files.wordpress.com/2012/01/optical-fiber-communications-by-gerd-keiser_2.pdf 6. http://www.hailienene.com/resources/nano-technology.pdf
MOOCS Course
1. http://nptel.ac.in/courses/118104008/1 (Fundamentals of Nano technology) 2. http://nptel.ac.in/courses/118104008/13 (Nano structures, synthesis and characterization) 3. https://nptel.ac.in/courses/113/104/113104096/(mateiral science) 4. https://nptel.ac.in/courses/113/102/113102080/(Metallurgy and material science)

ELECTRICAL CIRCUITS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EE03	ESC	L	T	P	C	CIA	SEE	Total
		3	1	0	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand basics in electrical circuits with nodal and mesh analysis.
2. Understand the use of circuit analysis theorems and methods.
3. Analyze two port network parameters.
4. Apply Laplace Transform to steady state and transient state response.
5. Study the working principles of electrical machines

COURSE OUTCOMES

Upon successful completion of the course, the student is able to

1. Use network techniques, like node analysis and mesh analysis, to write equations for linear circuits.
2. Apply network theorems to analyze and design circuits for maximum power transfer.
3. Acquire skills to analyze and calculate two port network parameters.
4. Calculate the transient and steady state response for DC excitations using Laplace transform.
5. Acquire skills to understand working principles of electrical machines.

UNIT-I	INTRODUCTION TO ELECTRICAL CIRCUITS	Classes: 10
Electrical circuit elements (R, L and C), voltage and current sources, ohm's law, Kirchhoff's current and voltage laws, Source transformations, star-delta connections, nodal and mesh analysis		
UNIT-II	**NETWORK THEOREMS**	**Classes: 10**
Super position theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Tellegen's theorem –with DC excitation.		
UNIT-III	**FILTERS AND TWO PORT NETWORKS**	**Classes:10**
Two port network parameters-Z, Y, ABCD and Hybrid parameters. Interconnection of Two port networks in series, parallel and cascaded connections.		
UNIT-IV	**TRANSIENT ANALYSIS**	**Classes: 10**
Concept of complex frequency, Analysis of RL, RC, and RLC networks with and without initial conditions using Differential equations and Laplace transforms for DC excitations. Evaluation of initial conditions for various electrical circuits.		
UNIT-V	**MACHINES**	**Classes: 10**
DC MACHINES: Construction and working of DC generator, EMF equation, types of DC generators and Working of DC motor, torque equation of DC motor and its types. **AC MACHINES :** Construction and working of Transformer and EMF equation, problems, Construction		

and working principle of Three phase Induction motor.
Text Books:
1. Charles K. Alexander, Matthew N.O. Sadiku, "Fundamentals of Electric Circuit" 5th Edition, Tata McGrawHill New Delhi, 2013 2. Sudhakar, A., Shyammohan, S. P. "Circuits and Network" Tata McGraw-Hill New Delhi, 1994. 3. "Circuit theory analysis and Synthesis" by Abhijit Chakrabarti, DHANPAT RAI & CO.
Reference Books:
1. Van, Valkenburg. "Network analysis" Prentice hall of India, 2000 2. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education 3. N.C.Jagan, C.Lakshminarayana, "Network Theory", Anshan, 2005.

ENGINEERING GRAPHICS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5ME02	ESC	L	T	P	C	CIA	SEE	Total
		1	-	4	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Create awareness and emphasize the need for Engineering Drawing in various branches of engineering.
2. Enable the student with various concepts of dimensioning, conventions and standards related to engineering drawings.
3. Follow the basic drawing standards and conventions.
4. Develop skills in three-dimensional visualization of engineering component.

COURSE OUTCOMES:

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

1. Sketch the various curves used in engineering and their applications.
2. Apply the knowledge of quadrant system and say to which quadrant and angle of project the object belongs.
3. Evaluate the given object position and draw the projections of objects.
4. Convert the pictorial views into orthographic view and vice versa.
5. Develop the new drawings for the industry requirements.

UNIT-I	INTRODUCTION	Classes: 07

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, INTRODUCTION TO COMPUTER AIDED DRAFTING: 2D drawings-simple exercises Engineering Curves: Construction of Ellipse, Parabola and Hyperbola General method only

UNIT-II	DRAWING OF PROJECTIONS OR VIEWS: ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY	Classes: 10

Principles of Orthographic Projections – conventions – first and third angle projections. Projections of points-Projection of lines inclined to both the planes.

PROJECTIONS OF PLANES: Projections of regular planes, inclined to both planes.

UNIT-III	PROJECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	Classes: 08

PROJECTION OF SOLIDS-Solids inclined to both planes(Auxiliary plane method)

DEVELOPMENT OF SURFACE/SOLIDS: Theory of development, development of lateral surface along with base.

UNIT-IV	ISOMETRIC DRAWINGS	Classes: 05

Divisions of pictorial projection, theory of Isometric Drawing- Isometric view and Isometric projections; Drawing Isometric circles, Dimensioning Isometric Objects; Conversion of Isometric view to Orthographic views and Orthographic to isometric views.		
UNIT-V	**3D MODELING**	**Classes: 04**
Types of 3D models, 3D Coordinate Systems, basic commands in 3D, PEDIT command. CREATING SOLID MODELS: creating pre-defined Solid Primitives, Dynamic UCS, methods of creating solids by - Extrude Revolve, Swept, Loft, & Presspull, in 3Dcreating solid models, Dynamic UCS. MODIFYING 3D OBJECTS: Fillet, Chamfer, Rotate, Mirror, Array, and Slicing solid Models. EDITING 3D OBJECTS: SOLVIEW, SOLDRAW, SOLPROF, 3D wire-frame and shaded solids- Commands, Boolean operations. Creation of simple solid models relevant to the domain.		

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. D.M. Kulkarni,A.P.Rastogi,A.K. Sarka "Engineering Graphics with AutoCAD" PHI publications, 2013
6. Computer Aided Engineering Drawing / K Balaveera reddy et al-CBS publishers

Reference Books:

1. Johle (2009), Engineering Drawing, Tata Mc Graw Hill, New Delhi, India.
2. Trymbaka Murthy (2007), Computer Aided Engineering Drawing, I.K. International Publishers, New Delhi.
3. Sham Tickoo, D. saravanan, "AutoCAD 2010 for engineers and designers" Dreamtech Press, 2010
4. Sham Tickoo " AutoCAD 2011: A Problem solving approach" Autodesk Press, USA.

Web References:

1. nptel.ac.in/courses/112103019/
2. web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf
3. http://www.autocadtutorials.net/

E-Text Books:

1. https://www.researchgate.net/publication/305754529_A_Textbook_of_Engineering_Drawing_A_Textbook
2. https://www.researchgate.net/publication/305754529_A_Textbook_of_Engineering_Drawing

MOOCS Course

https://onlinecourses.nptel.ac.in/noc20_me79/preview

ENGINEERING PHYSICS LAB								
Course Code:	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5BS10	**BSC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	3	1.5	30	70	100

COURSE OBJECTIVES

The course should enable the students to:

1. To provide an experimental foundation for the theoretical concepts introduced in the lectures
2. To teach how to make careful experimental observations and how to think about and draw conclusions from such data
3. To help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments
4. To introduce the concepts and techniques which have a wide application in experimental science but have not been introduced in the standard courses
5. To teach how to write a technical report this communicates scientific information in a clear and concise manner

COURSE OUTCOMES:

By the end of the course students will be able:

1. Analyze the electric properties of semiconductor materials by determining energy gap of semiconductors, threshold voltage of LEDs and efficiency issues of solar cell with careful experimental and draw conclusions from such data.
2. Evaluate the mechanical properties of a given material using dynamic method in torsional pendulum and analyze how stationary waves are produced to determine A.C frequency using Melde‘s experiment.
3. Estimate the optical properties of light such as interference and polarization by using Newton‘s rings, calculation of the wavelength of Laser using diffraction phenomenon and to determine acceptance angle, NA of optical fiber.
4. Analyze the electromagnetic properties in a current carrying conductor using Stewart Gee‘s experiment.

LIST OF EXPERIMENTS	
Experiment-1	**Energy gap of P-N junction diode:** To determine the energy gap of a semiconductor diode.
Experiment-2	**Solar Cell:** To study the V-I and P-I characteristics of solar cell

Experiment-3	**Light Emitting Diode:** Plot V-I characteristics of light emitting diode Plot V-I characteristics of light emitting diode
Experiment-4	**Plank's Constant:** To determine value of plank's constant using by measuring radiation in fixed spectral range
Experiment-5	**Melde's Experiment:** To determine the frequency of a tuning fork by using Melde's experiment.
Experiment-6	**Optical fiber:** To determine the numerical aperture and acceptance angle of an optical fiber
Experiment-7	**LASER:** To determine the wavelength of a given laser source by using diffraction grating method
Experiment-8	**Malus Law:** To Verify the cosine law by using polarization phenomenon of light.
Experiment-9	**Newton's rings:** To determine the radius of curvature of a given Plano convex lens by forming Newton's rings
Experiment-10	**Torsional Pendulum:** To determine the rigidity modulus of a given metal wire by using Torsional pendulum
Experiment-11	**PIN Photo Diode** To study the V-I Characteristics of Photo Diode by calculating the photo current.
Experiment-12	**Stewart Gee's experiment:** To study the variation of magnetic field along the axis of a circular coil

Reference Books:

1. "Semiconductor Physics and Devices: Basic Principles" by Donald A Neamen.
2. "Optics, Principles and Applications" by K K Sharma.
3. "Principles of Optics" by M Born and E Wolf.
4. "Oscillations and Waves" by Satya Prakash and Vinay Dua.
5. "Waves and Oscillations" by N Subrahmanyam and Brij Lal.

Web References:

1. http://www.arxiv.org/pdf/1510.00032
2. http://www nptel.ac.in/courses/122103010/
3. http://www. researchgate.net/.../276417736_Video_Presentations_in_Engineering-Ph...
4. http://www. wileyindia.com/engineering-physics-theory-and-practical.html

ELECTRICAL CIRCUITS LAB

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EE04	ESC	L	T	P	C	CIA	SEE	Total
		0	0	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines

COURSE OUTCOMES:

Upon successful completion of this course, student will be able to:

1. Analyze the circuit using Kirchhoff‘s law and network simplification theorems.
2. Evaluate the resonance of series and parallel RLC circuits.
3. Evaluate the efficiency of single phase and three phase alternating quantities.
4. Evaluate the line voltage and phase voltage of three phase transformer.

LIST OF EXPERIMENTS

WEEK-1 INTRODUCTION AND USE OF MEASURING INSTRUMENTS & SAFETY PRECAUTIONS

To study the usage of electrical instruments and the required precautions to be taken

WEEK-2 KIRCHOFF'S LAWS(KVL & KCL)

To verify KVL and KCL

WEEK-3 SUPERPOSITION THEOREM

To verify superposition theorem

WEEK-4 THEVENIN'S THEOREM

To obtain equivalent circuit of a complex network

WEEK-5 NORTON'S THEOREM

To obtain equivalent circuit of a complex network

WEEK-6 MAXIMUM POWER TRANSFER THEOREM

To obtain equivalent circuit of a complex network

WEEK-7	OPEN CIRCUIT, SHORT CIRCUIT & LOAD TEST ON SINGLE PHASE TRANSFORMER
To calculate the efficiency of single phase transformer	
WEEK-8	**CUT OUT VIEW OF DC MACHINE**
Demonstration on constructional and cut out view of dc machine	
WEEK-9	**CUT OUT VIEW OF INDUCTION MOTOR**
Demonstration on constructional and cut out view of single phase induction motor	
WEEK-10	**MAGNETIZATION CHARACTERISTICS OF DC SHUNT GENERATOR**
To draw the open circuit characteristics of dc shunt generator	
WEEK-11	**BRAKE TEST ON DC SHUNT MOTOR**
To find the torque-speed characteristics of dc shunt motor.	
WEEK-12	**BRAKE TEST ON 3-PHASE INDUCTION MOTOR**
To find the torque-slip characteristics of induction motor	

Reference Books

1. Department Lab Manual
2. A.Chakrabarthi, " Circuit Theory", Dhanpat Rai Publications, 6th Edition,2006
3. V K Mehta, Rohit Mehta, "Principles of Electrical Machines", S Chand Publications, 1st Edition,2006
4. I Nagrath & DP Kothari, "Electrical Machines", Mcgraw Hill Education Publications, 4th Edition, 2010.

Web References:

1. http://www.ee.iitkgp.ac.in
2. http://www.citchennai.edu.in

ENGINEERING WORKSHOP								
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
A5ME04	**ESC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**1**	**30**	**70**	**100**

COURSE OBJECTIVES:

Student will

1. Get the hands on experience on various trades.
2. Capable to make useful products using one or more operations.

COURSE OUTCOMES:

Student should be able to:

1. Fabricate components with their own hands.
2. Get practical knowledge of the dimensional accuracies and tolerances.
3. Produce small devices of their interest.
4. Demonstrate safe practices and proper handling of tools and materials in a workshop environment.

WEEKS	BASIC TRADES
Fitting	
Week 1	Filing Four Sides of Work piece
Week 2	L- Fit
	Carpentry
Week 3	Half Lap Joint
Week 4	Dove Tail Joint
	Tin Smithy
Week 5	Tin Smithy- Prepare a Rectangular Tray
Week 6	Prepare A Square Tin
Electrical	
Week 7	House Wiring Parallel and Series Connection
Week 8	House Wiring Two Way Switch
Electronics	
Week 9	Soldering Parallel Connection
Week 10	Soldering Series Connection
Week 11	Useful product using 3 or more operations

SEMINAR-II								
I-B.TECH -II SEMISTER-ECE								
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
A5MC02	**MC (Non credit)**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**2**	**0**	**30**	**70**	**100**

COURSE OUTCOMES:

Student should be able to:

1. Topic related to latest technology, latest trends and tools related topics, Introduction to phonetics
2. ORAL/WRITTEN PRESENTATION, POWER POINT (slides) presentation skills / group discussions (GD-Debate)
3. Situational Dialogs and giving directions
4. Telephonic etiquettes, interview skills, formal introductions, greetings, extempore, listening skills, JAM

II B.TECH I SEMESTER

SYLLABUS

ELECTRONIC DEVICES & CIRCUITS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC 02	ESC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100

COURSE OUTCOMES:

The course should enable the students to:

1. Apply the concepts of semiconductor devices in practical electronic applications.
2. Construct a regulated DC power supply suitable for powering electronic circuits.
3. Analyze the operation of small-signal hybrid models of BJTs for circuit behavior interpretation.
4. Evaluate different biasing techniques for BJTs and their influence in audio amplifier design.
5. Design FET-based amplifier circuits to meet specific amplification requirements.

COURSE OBJECTIVES:

Upon successful completion of the course, the student is able to

1. Impart the knowledge of construction, principle of operation and working of various semiconductor devices.
2. Analyze the volt-ampere characteristics of various semi conductor devices.
3. Facilitate students in understanding various biasing methods for stability.
4. Provide the concepts involved in design of electronic Circuits

UNIT-I	P-N JUNCTION DIODE	Classes: 12

Introduction to Semiconductor Physics: Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics.

Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, SCR and Semiconductor Photo Diodes.

UNIT-II	RECTIFIERS AND FILTERS	Classes: 12

The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L Section Filters, π- Section Filters, Comparison of Filters, Voltage Regulation using Zener Diode.

UNIT-III	BIPOLAR JUNCTION TRANSISTOR AND UJT	Classes: 15

The Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, BJT Operation, BJT Symbol, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation , BJT Specifications, BJT Hybrid Model, Determination of h-parameters from Transistor Characteristics, Comparison of CB, CE, and CC Amplifier Configurations, UJT and Characteristics.

UNIT-IV	TRANSISTOR BIASING AND STABILIZATION	Classes: 15

Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in VBE and β, Bias Compensation using Diodes

and Transistors, Thermal Runaway, Thermal Stability, Analysis of a Transistor Amplifier Circuit using h-Parameters.		
UNIT-V	**FIELD EFFECT TRANSISTOR AND AMPLIFIERS**	**Classes: 11**
The Junction Field Effect Transistor (Construction, principle of operation symbol) – Pinch-off Voltage - Volt- Ampere characteristics, The JFET Small Signal Model, MOSFET (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes. **FET Amplifiers:** FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Biasing FET, FET as Voltage Variable Resistor, Comparison of BJT and FET.		
Text Books:		
1. Jacob Milliman, Christos C .Halkias, Satyabrata Jit (2015), *Electronic Devices and Circuits*, 3rd edition, Tata McGraw Hill, NewDelhi. 2. G. K. Mittal (1999), *Electronic Devices and Circuits*, 22nd edition, Khanna Publications, NewDelhi. 3. Robert Boylestad, Lowis Nashelsky (1993), *Electronic Devices and Circuit Theory*, 5th edition, Prentice Hall of India, New Delhi,India.		
Reference Books:		
1. David. A. Bell (1986), *Electronic Devices and Circuits*, 4th edition, Prentice Hall of India, NewDelhi. 2. S. Shalivahanan, N. Suresh Kumar, A. Vallavaraj (2007), *Electronic Devices and Circuits*, 3rdedition, McGraw Hill, New Delhi,India. *3.* Theodore. F. Bogart Jr, Jeffrey S. Beasley, Guillermo Rico (2004), *Electronic Devices and Circuits*, 6th editionPearsonEducation,India.		
Web References: 1. https://unacademy.com/course/electronic-devices-gate-ece/JTIAAKX1 2. https://freevideolectures.com/course/2261/basic-electronics-and-lab/2 **3.** https://unacademy.com/lesson/build-in-potential-and-depletion-width/ALHF5QVM		
E-Text Books:		
1. http://www.freebookcentre.net/electronics-ebooks-download/Electronic-Devices-and-Circuits-(PDF-313p).html 2. https://www.goodreads.com/book/show/25345857-electronic-devices-and-circuits 3. https://thebookee.net/el/electronic-devices-and-circuits-by-jb-gupta-pdf		
MOOCS Course		
1. https://www.edx.org/ 2. https://www.coursera.org/learn/electronics		

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<table>
<tr><td colspan="10">DATA STRUCTURES</td></tr>
<tr><td rowspan="3">Course Code

A5CS03</td><td rowspan="3">Category

PCC</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
</table>

COURSE OBJECTIVES:

1. Impart the basic concepts of structures, pointers and data structures.
2. Understand concepts linked lists and their applications.
3. Understand basic concepts about stacks, queues and their applications.
4. Understand basic concepts of trees, graphs and their applications.
5. Enable them to write algorithms for sorting and searching

COURSE OUTCOMES:

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

1. Use arrays, pointers and structures to formulate algorithms and programs.
2. Design and implement applications of Linked List.
3. Design and implement Stack ADT using Array and Linked List.
4. Design and implement Queue ADT using Array and Linked List.
5. Solve problems involving graphs and trees.
6. Analyze searching and sorting techniques based on time and space complexity.

UNIT-I	INTRODUCTION TO DATA STRUCTURES	Classes:09

Introduction to Structures - Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, self-referential structures, Pointer – Basics, Pointer to Structure.

Introduction to Data Structures- Definition, Linear Data Structures, Non-Linear Data Structures, Representation of single, two dimensional arrays, sparse matrices and their representation.

UNIT-II	LINKED LIST	Classes:09

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists- Operations-Insertion, Deletion, Doubly Linked Lists- Operations- Insertion, Deletion.

UNIT-III	STACKS	Classes:09

Stacks-Stack ADT, definition, operations, array and linked implementations in C,
Applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation

UNIT-IV	QUEUES	Classes:09

Queues-Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-array and linked implementations in C, Dequeue (Double ended queue)ADT, array and linked implementations in C.

UNIT-V	SEARCHING & SORTING AND NON-LINEAR DATA STRUCTURES	Classes:09

Searching- Linear Search, Binary Search, **Sorting-** Bubble Sort, Insertion Sort, Selection Sort, Quick sort, Merge Sort, Comparison of Sorting methods.
Non-Linear Data Structures-Trees – Introduction, Definition, Terminology, Applications, Tree Representations- List Representation, Left Child – Right Sibling Representation. **Graphs -** Introduction, Definition, Terminology, Applications, Graph Representations- Adjacency matrix, Adjacency lists

Text Books:

1. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education, 6th Edition, 2012.
2. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
3. Data Structures using C, R.Thareja 2nd Edition, Oxford Pres0073

Reference Books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education

WEB REFERENCES:

1. https://hackr.io/tutorials/learn-data-structures-algorithms
2. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
3. https://www.udemy.com/introduction-to-algorithms-and-data-structures-in-c/
4. https://leetcode.com

E-TEXT BOOKS:

1. http://www.freetechbooks.com/algorithm-analysis-and-design-t1030.html
2. http://www.freetechbooks.com/algorithmic-problem-solving-t373.html
3. http://www.freetechbooks.com/algorithms-and-data-structures-the-basic-toolbox-t871.html

MOOCS COURSE

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://onlinecourses.nptel.ac.in/noc16_cs06/preview

SIGNALS AND SYSTEMS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC03	PCC	3	1	-	4	30	70	100

COURSE OVERVIEW:

This course is an introductory course to study about the signals and systems. This course explain about the Fourier series and its importance to analyse the signals in both time and frequency domain. This course presents the both continuous-time and discrete time transforms to explore the signals in time domain to frequency domain. This course presents the fundamental difference of continuous-time and discrete time signals with the help of sampling theorem. This course describes how both the Signal and system are linked by Signal Transmission through Linear Systems. This course presents the importance of convolution and correlation concepts

COURSE OBJECTIVES:

1. Learn the different types of signals and systems
2. Know the continuous and discrete systems in time and frequency domain using different transforms
3. Check the properties of continuous and discrete systems
4. Understand the properties to analyze the CT and DT signals and systems
5. Represent the LTI systems in the Time domain and various Transform domains

COURSE OUTCOMES:

After going through this course the student will be able to

1. Analyze different types of signals and systems and their properties.
2. Represent continuous and discrete systems in both time and frequency domains using appropriate transforms.
3. Investigate the stability and causality of systems in different signal processing contexts.
4. Apply various transforms and their properties to analyze continuous-time (CT) and discrete-time (DT) signals.
5. Characterize Linear Time-Invariant (LTI) systems in both time domain and various transform domains.

SYLLABUS

UNIT-I	SIGNAL ANALYSIS AND FOURIER SERIES	Classes:09

Signals: Continuous and discrete time signals- representations of continuous, discrete and digital signals-Classifications of Signals based on properties - Energy and power signals, Even and Odd- Periodic and non-periodic-Causal Non causal Deterministic and non deterministic-Elementary signals-unit step- unit ramp-unit impulse-sinusoidal-signum and sinc signals - Basic operations on signals with examples.
Fourier Series: Representation of Fourier series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Properties of Fourier Series, Complex Fourier spectrum.

UNIT-II	FOURIER TRANSFORMS AND SAMPLING	Classes:09

Fourier Transforms: Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, and Introduction to Hilbert Transform.
Sampling: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal, Effect of under

sampling

UNIT-III	SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS	Classes:09

Systems: Continuous and discrete time Systems - representations of continuous and discrete time systems- Classifications of Systems based on properties – linearity - shift-invariance- causality- stability- static and dynamic
Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF, BPF&BSF characteristics, Relationship between Bandwidth and Rise time.

UNIT-IV	CONVOLUTION AND CORRELATION OF SIGNALS	Classes:09

Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Cross Correlation and Auto Correlation of functions, Properties of Correlation function, Energy density spectrum, Parseval's Theorem, Power density spectrum, Relation between Auto Correlation function and Energy/Power spectral density function, Relation between Convolution and Correlation, Detection of periodic signals in the presence of Noise by Correlation, Extraction of signal from noise by filtering.

UNIT-V	LAPLACE TRANSFORMS AND Z-TRANSFORMS	Classes:09

Laplace Transforms: Laplace transform, Concept of Region of Convergence (ROC) and its properties, Properties of L.T. Inverse Laplace Transform- problem solving - Relation between L.T and F.T of a signal
Z–Transforms: Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform and its properties, properties of Z transform, Inverse Z-transform and problem solving

Text Books:

1. Oppenheim A. V, Willisky (2009), *Signals and Systems*, 2nd edition, Prentice Hall of India, India.
2. P. Lathi (2001), *Signals, Systems & Communications*, BS Publications, New Delhi.

Reference Books:

1. Simon Haykin, Van Veen (2007), *Signals & Systems*, 2nd edition, Wiley publications, India.
2. Hwei Piao Hsu, Schaums (2003), *Outline of Theory Problems of Signals and Systems*, McGraw Hill, India.
3. Charles L. Phillips, John M. Parr, Eve A. Riskin (2007), *Signals, Systems and Transforms*, Prentice Hall of India, New Delhi

Web References:

1. https://www.khanacademy.org/science/electrical-engineering/ee -signals/ee-fourier-series/v/ee-fourierseries-intro
2. https://www.khanacademy.org/science/electrical-engineering/ee-signals
3. https://www.edx.org/course/signals-systems-part-2-iitbombayx-ee210-2x-3
4. https://www.edx.org/course/signals-and-systems-part-1-1

E-Text Books:

1. http://www.freebookcentre.net/Mathematics/Fourier-Analysis-Books.html
2. http://www.freebookcentre.net/Mathematics/Differential-Equations-Books_1.html

MOOCS Course

1. http://nptel.ac.in/courses/117101055/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC04	**ESC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

After going through this course the student will be able to

1. Apply knowledge of electronic instruments for measurement of electrical quantities.
2. Understand the principles and operations of instruments.
3. Select and use latest hardware for measurements.
4. Identify the various instruments for various measurements
5. Use the instruments in laboratory and real life

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply knowledge of electronic instruments for measurement of electrical quantities.
2. Understand the principles and operations of instruments.
3. Select and use latest hardware for measurements.
4. Identify the various instruments for various measurements.
5. Use the instruments in laboratory and real life.

UNIT-I	MEASUREMENT CONCEPTS	Classes:10

Measurement concepts : Quantities of Measurement- Performance Characteristics – Static and dynamic characteristics – units and standards of measurements – errors in measurements- accuracy and precision, statistical analysis – moving coil, moving iron types Instruments –DC Voltmeter multi-meter & Calibrations

UNIT-II	DIGITAL INSTRUMENTS AND SIGNAL GENERATORS	Classes:08

Digital instruments: Digital multi-meters – Digital frequency meter-digital tacho meter-digital PH meter-digital phase meter-digital capacitance meter-Microprocessor based instruments- IEEE 488 bus

Signal generators: Function generators – pulse and square wave generators, RF signal generators – Sweep generators– Frequency synthesizer

UNIT-III	CATHODE RAY OSCILLOSCOPES	Classes:09

Cathode ray oscilloscopes: Basic block diagram of CRO, features of CRT, triggered sweep CRO, dual beam CRO, dual trace CRO,

Special Oscilloscopes: delayed time base oscilloscopes, sampling oscilloscope, storage oscilloscope, digital storage oscilloscope, lissagious patterns.

UNIT-IV	MEASUREING INSTRUMENTS AND BRIDGES	Classes:09

Measuring instruments: Introduction-field strength meter –Q- meter- LCR Bridge-Transistor tester
Bridge: Wheatstone's bridges for resistance measurements-Maxwell's bridge for inductance measurements- Schering's bridge for capacitance measurements measurement

UNIT-V	TRANSDUCERS &DATA ACQUISITION SYSTEMS	Classes:10

Transducer: Introduction-electrical transducers-selecting a transducers-active and passive transducers with examples
Data acquisition systems: Elements of a digital data acquisition system – interfacing of transducers – multiplexing–data loggers –computer controlled instrumentation

Text Books:

1. Albert D.Helfrick and William D.Cooper – Modern Electronic Instrumentation and MeasurementTechniques, Pearson / Prentice Hall of India, 2007.
2. Ernest O. Doebelin, Measurement Systems- Application and Design, TMH, 2007.

Reference Books:

1. Joseph J.Carr, Elements of Electronics Instrumentation and Measurement, Pearson Education,2003.
2. Alan.S.Morris,PrinciplesofMeasurementsandInstrumentation,2ndEdition,Prentice HallofIndia,2003.
3. David A. Bell, Electronic Instrumentation and measurements, Prentice Hall of India Pvt Ltd, 2003.
4. B.C. Nakra and K.K. Choudhry, Instrumentation, Measurement and Analysis, 2nd Edition, TMH, 2004.
5. James W. Dally, William F. Riley, Kenneth G. McConnell, Instrumentation for EngineeringMeasurements,2nd Edition, John Wiley, 2003

WEB REFERENCES:

1. https://www.sciencedirect.com/science/book/9780123819604
2. https://www.schneider-electric.com/en/.../86485-measurement-and-instrumentation/

E-TEXT BOOKS:

1. https://books.google.co.in/books/about/Electronics_Measurements_And_Instrumenta.html?id=mxVRJRYCi-QC
2. https://sway.com/V1Uclj1JCiLhqcCb

MOOCS COURSE

1. https://www.schneider-electric.com/en/.../86485-measurement-and-instrumentation/
2. https://www.schneider-electric.com/en/.../86485-measurement-and-instrumentation/
3. https://www.coursera.org/courses?query=measurements%20and%20instrumentat

PROBABILITY THEORY AND STOCHASTIC PROCESSES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC05	ESC	L	T	P	C	CIA	SEE	Total
		3	1	0	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Identify the random variable is belongs to continuous or discrete.
2. Analyze the given function and calculate the required function.
3. Calculate joint functions for multiple random variables.
4. Analyze similarity and dissimilarity between any two signals.
5. Analyze the time domain methods and frequency domain techniques for characterizing behaviour of random signals in electronic communication.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply probability axioms and Bayes' theorem to analyze discrete events and compute conditional probabilities.
2. Distinguish between types of random variables and derive corresponding probability distribution and density functions.
3. Compute statistical measures such as moments, variance, and skewness for single and multiple random variables using expected value operations.
4. Analyze joint distributions, statistical independence, and Gaussian processes to evaluate behavior of multiple random variables.
5. Examine temporal and spectral characteristics of stochastic processes including stationarity, ergodicity, and power spectral density.

UNIT-I	PROBABILITY AND RANDOM VARIABLE	Classes: 12
Probability Definitions and Axioms, Probability as a Relative Frequency, joint Probability, Conditional Probability, Total Probability, Bayes Theorem and Independent events **RANDOM VARIABLE**: Definition of Random variable, Conditions for a Function to be a Random Variable, Discrete and continuous, Mixed Random Variable. Distribution and density functions and properties, Binomial, Poisson, uniform, Gaussian, Exponential, Rayleigh.		
UNIT-II	OPERATION ON ONE RANDOM VARIABLE	Classes: 10

<table>
<tr><td colspan="3">Introduction , expected value of a Random Variable, Function of a Random variable, moments about the origin, central moments, variance and skew, chebychev's inequality, characteristic function, moment generating function,.</td></tr>
<tr><td>UNIT-III</td><td>MULTIPLE RANDOM VARIABLES AND OPERATIONS ON MULTIPLE RANDOM VARIABLES</td><td>Classes: 10</td></tr>
<tr><td colspan="3">Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Function, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof Not Expected). Unequal Distribution, Equal Distributions.
OPERATIONS ON MULTIPLE RANDOM VARIABLES: Expected value of a function of random variable, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, And Jointly Gaussian Random Variables: Tow Random Variables cases, N Random Variable Cases, Properties.</td></tr>
<tr><td>UNIT-IV</td><td>STOCHASTIC PROCESSES –TEMPORAL CHARACTERISTICS</td><td>Classes: 12</td></tr>
<tr><td colspan="3">The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationary and Statistical Independence. First – Order Stationary Processes, Second – Order and Wide-Sense Stationary, (N-Order) and Strictsense Stationary. Time Averages and Ergodicity, Mean-Ergoidc Processes, Correlation –Ergodic Processes, Autocorrelation Function and its Properties, Cross – Correlation Function and its Properties Covariance Functions, Gaussian Random Processes, Poisson Random Process</td></tr>
<tr><td>UNIT-V</td><td>STOCHASTIC PROCESSES – SPECTRALCHARACTERISTICS</td><td>Classes: 06</td></tr>
<tr><td colspan="3">The Power Spectrum: Properties, Relationship between power Spectrum and Autocorrelation Function, The Cross – Power Density Spectrum, Properties, Relationship between Cross – Power Spectrum and Cross – Correlation Function. Spectral Characteristics of a System Response: Power Density Spectrum of Response.</td></tr>
<tr><td colspan="3">Text Books:</td></tr>
<tr><td colspan="3">1. Probability, Random Variables &Random Signal Principles - Peyton Z. Peebles, TMH,4th Edition,2001..
2. A.PapoulisandS.Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes," Fourth Edition, McGrawHill.</td></tr>
<tr><td colspan="3">Reference Books:</td></tr>
<tr><td colspan="3">1. Probability and random process- Scott Miler, Donald Childers, 2 Ed, Elsevier,2012.
2. H.StarkandJ.Woods,``ProbabilityandRandomProcesseswithApplicationstoSignalProcessing,"ThirdEdition, PearsonEducation
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBSPublishers
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers.</td></tr>
<tr><td colspan="3">Web References:

1. https:// www.khanacademy.org/ math/ probability/ probability - geometry/ probability-
2. basics/ a/ probability -the- basics https:// www.khanacademy.org/ math/ statistics-probability/ random -variables-stats- library/ random - variables- discrete/v/discrete-and-</td></tr>
</table>

continuous-random-variables 3. https:// www .khanacadem y.org/ math/ statistics - probability/ random -variables-stats-library/ random - variables-discrete/v/random-variables 4. https://www.edx.org/course/probability-basic-concepts-discrete-random-variables.
E-Text Books:
1. http://www.freebookcentre.net/maths-books-download/Lecture-Notes-Probability-Theory.html 2. http://www.freebookcentre.net/maths-books-download/Probability-and-Stochastic-Processes.html 3. htt p:// www .freebookcentre.net/ electronics -ebooks-download/ Introduction-to - Communication- Systems.html 4. http://www.freebookcentre.net/electronics -ebooks-download/Communication-Systems-by-Dr.-Cong- Ling.html

ELECTRONIC DEVICES AND CIRCUITS LAB

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC06	ESC	L	T	P	C	CIA	SEE	Total
		0	0	3	1.5	30	70	100

COURSE OUTCOMES:
After going through this course the student will be able to

1. Calculate various parameters of semiconductor devices from their characteristics.
2. Use the semiconductor devices in real time applications.
3. Implement digital circuits using logic gates.
4. Design combinational and sequential circuits.

Electronic Workshop Practice (In 2 Lab Sessions): (Only for Viva-Voce Examination)

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Relays, Bread Boards, PCB„s.
2. Identification, Specifications and Testing of Active Devices: Diodes, BJTs, JFETs, MOSFETs, Power Transistors, LED„s, LCD„s, SCR, UJT.
3. Study and operation of Multimeter (Analog and Digital) Function Generator Regulated Power Supply (RPS)CRO
4. Soldering Practice.

LIST OF EXPERIMENTS (A Minimum of 10 experiments)

1. Find static and dynamic resistances from the Characteristics of a PN junction diode.
2. Plot the VI Characteristics of a Zener Diode
3. Construct a Half wave rectifier with and without filters and find its line and load regulation
4. Construct a Centre tapped FWR and BFWR with and without filters and find its load regulation
5. Plot the Input & output characteristics of transistor in CB configuration
6. Plot the Input & output characteristics of transistor in CE configuration
7. Plot the Input & output characteristics of transistor in CC configuration
8. Plot the Drain and Transfer characteristics of JFET
9. Design and verify Voltage divider bias Circuit using BJT
10. Design and verification of Fixed bias, Collector to base biasing Circuits using BJT
11. Plot the I-V Characteristics of a UJT
12. Plot the V-I Characteristics of SCR

Reference Books:

1. Jacob Milliman, Christos C .Halkias, SatyabrataJit (2015), *Electronic Devices and Circuits*, 3rd edition, Tata McGraw Hill, NewDelhi.
2. G. K. Mittal (1999), *Electronic Devices and Circuits*, 22nd edition, Khanna Publications, NewDelhi.
3. Robert Boylestad, LowisNashelsky (1993), *Electronic Devices and Circuit Theory*, 5th edition, Prentice Hall of India, New Delhi,India.
4. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
5. W.H.Gothmann, Digital Electronics-An introduction to theory and practice”,PHI, 2ndedition, 2006.
6. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill,1989

DATA STRUCTURES LAB

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5CS04	ESC	L	T	P	C	CIA	SEE	Total
		-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Ability to identify the appropriate data structure for given problem.
2. Effectively use compilers include library functions, debuggers and troubleshooting.
3. Write and execute programs using data structures such as arrays, linked lists to implement stacks, queues.
4. Write and execute programs in C to implement various sorting and searching.

COURSE OUTCOMES:

The course should enable the students to:

1. Use appropriate data structure for given problem.
2. Use compilers include library functions, debuggers and troubleshooting.
3. Execute write programs in C to implement various types Linked Lists.
4. Execute programs using data structures such as arrays, linked lists to implement stacks.
5. Execute programs using data structures such as arrays, linked lists to implement queues.
6. Execute write programs in C to implement various sorting and searching.

LIST OF EXPERIMENTS

WEEK-1 — **STRUTCURES**

Write a C Program using functions to

a. Reading a complex number
b. Writing a complex number
c. Add two complex numbers
d. Multiply two complex numbers

Note: represent complex number using structure

WEEK-2 — **ARRAYS**

1. Write a C program
   I. To add two matrices
   II. To multiply two matrices
2. Write a C program to implement Sparse Matrices.

WEEK-3 — **SINGLE LINKED LIST**

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

a. Create a singly linked list of integers.
b. Delete a given integer from the above linked list.
c. Display the contents of the above list after deletion.

WEEK-4 — **SINGLE LINKED LIST**

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

a. Create TWO singly linked list of integers.
b. Concatenate TWO Singly Linked Lists.
c. Display the contents of the above list after concatenation

WEEK-5	DOUBLE LINKED LIST
Write a C program that uses functions to perform the following: a. Create a doubly linked list of integers. b. Delete a given integer from the above doubly linked list. c. Display the contents of the above list after deletion	
WEEK-6	**STACK**
Write C programs to implement a Queue ADT using i) array ii) linked list	
WEEK-7	**STACK APPLICATION**
a. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array. **b.** Write a C program that uses Stack to evaluate Postfix Expression.	
WEEK-8	**QUEUE**
Write C programs to implement a Queue ADT using i) array ii) linked list	
WEEK-9	**DOUBLE ENDED QUEUE**
Write C programs to implement a double ended queue ADT using i) array **ii)** doubly linked list	
WEEK-10	**SEARCHING**
Write C programs for implementing the following searching methods: a) Linear Search b) Binary Search	
WEEK-11	**SORTING**
Write C programs for implementing the following sorting methods to arrange a list of integers in Ascending order : a) Insertion sort b) Merge sort	
Week-12	**SORTING**
Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order: a) Quick sort b) Selection sort	
TEXT BOOKS	
1. C and Data Structures, Prof. P.S. Deshpande and Prof. O.G. Kakde, Dreamtech Press. 2. Data structures using C, A.K.Sharma, 2nd edition, Pearson. **3.** Data Structures using C, R.Thareja, Oxford UniversityPress	
WEB REFERENCES	
1. http://www.sanfoundry.com/data structures-examples 2. http://www.geeksforgeeks.org/c 3. http://www.cs.princeton.edu	

BASIC SIMULATION LAB								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC07	**ESC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**

COURSE OUTCOMES:

After going through this course the student will be able to

1. Perform basic signal operations such as time shifting, scaling, reversal, and amplitude modulation to generate various standard signals and sequences.
2. Compute convolution and correlation between discrete and continuous time signals to analyze system behavior.
3. Verify system properties such as linearity, time invariance, stability, and physical realizability using simulation tools.
4. Apply Fourier and Laplace transforms to signals and visualize their frequency characteristics including magnitude and phase spectrum.
5. Analyze the impact of noise on signals and implement correlation-based techniques for noise removal and periodic signal extraction.

(Minimum 6 experiments from each Cycle using Lab view or MAT Lab or open source software).

LIST OF EXPERIMENTNS

CYCLE –I:

1. Basic Operations on Matrices.
2. Generations of Various Signals and sequences (periodic and Aperiodic),such as UNIT Impulses, UNIT step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
3. Operation on Signals and sequences such as addition, Multiplication, Scaling, Shifting, Folding, Computation of energy and average power
4. Finding the even and odd parts of signal/sequence and real and imaginary parts of signal
5. Convolution between Signals and Sequences
6. Auto correlation and cross correlation between signals and sequences.
7. Verification of linearity and time invariance properties of a given continuous/discrete systems
8. Computation of UNIT samples, UNIT step and sinusoidal response of the Given LTI system and verifying its physical realiazability and stability properties.
9. Gibbs phenomenon

CYCLE –II:

1. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
2. Wave form synthesis using Laplace Transforms.
3. Locating the zeros and poles and plotting the pole-zero maps in S-plane and Z-plane for the given transfer function.
4. Generation of Gaussion noise (Real and Complex), computation of its mean, M.S. value and its Skew, kurtosis, and PSD, probability distribution function.
5. Sampling theorem verification.
6. Removal of noise by auto correlation/cross correlation.

7. Extraction of periodic signal masked by noise using correlation.
8. Verification of wiener – Khinchine relations.
9. Checking a random process for stationary in widesense

GENDER SENSITIZATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5HS03	HSMC	L	T	P	C	CIA	SEE	Total
	(Non credit)	0	0	2	-	30	70	100

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

UNIT-I	UNDERSTANDING GENDER	Classes: 03

Introduction: Introduction to Gender, What is Gender, Why should we study it.. Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste: Different Masculinities.

UNIT-II	GENDER ROLES AND RELATIONS	Classes: 03

Two or Many? -Struggles with Discrimination- Missing Women-Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences- Gender Spectrum: Beyond the Binary		
UNIT-III	**GENDER AND LABOUR**	**Classes: 03**
Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.		
UNIT-IV	**GENDER - BASED VIOLENCE**	**Classes: 04**
Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…." Additional Reading: The Caste Face of Violence.		
UNIT-V	**GENDER AND COEXISTENCE**	**Classes: 03**
Gender Issues- Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks The Brave Heart.		
Text Books:		
All the five Units in the Textbook, "Towards a World of Equals: A Bilingual Textbook on Gender" written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by Telugu Akademi, Hyderabad,Telangana State in the year 2015.		
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/		
Web References: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/		
E-Text Books: 1. 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/		

II B.TECH II SEMESTER

SYLLABUS

DIGITAL SYSTEM DESIGN								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC 08	**PCC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**

COURSE OBJECTIVES:
The course should enable the students to:

1. Learn basic techniques for the design of digital circuits.
2. Understand number representation in digital electronic circuits and to be able to convert between different representations.
3. Implement simple logical operations using logic gates, design of combinational and sequential logic circuits.
4. Analyze sequential systems in terms of state machines and implement synchronous state machines using flip-flops.

COURSE OUTCOMES:
Upon successful completion of the course, the student is able to

1. Convert numbers between different systems, and apply error-detecting and error-correcting codes in digital circuits.
2. Simplify Boolean expressions using algebraic theorems and Karnaugh Maps for optimized combinational circuit design.
3. Design and implement combinational circuits such as adders, comparators, encoders, decoders, multiplexers, and demultiplexers.
4. Analyze and construct sequential circuits using flip-flops, and build synchronous sequential systems like counters, registers, and shift registers.
5. Evaluate and design Finite State Machines (FSMs) with Mealy and Moore models, and represent them using Algorithmic State Machine (ASM) charts.

UNIT-I	**REVIEW OF NUMBER SYSTEMS**	**Classes:09**
Representation of numbers of different radix, conversion of numbers from one radix to another radix, Complements of Numbers, problem solving for addition and subtraction. 4-bit codes: BCD, EXCESS 3, etc, Error Detecting and Correcting Codes, Parity checking and Hamming Code.		
UNIT-II	**BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS**	**Classes:09**
Boolean algebra: Boolean theorems and properties, Minimization of logic functions using theorems, Complement and dual of logical expressions, Canonical and Standard Forms, Digital Logic Gates, Universal Logic Gates, Multilevel NAND/ NOR realizations, Minimization of logic functions using K-		

maps. **Combinational Circuits:** Combinational Design, Arithmetic Circuits, Comparator, Decoder, Encoder, Multiplexers, De-Multiplexers, Implementation of Higher Order Multiplexers/ Decoder Using Lower Order Multiplexers/ Decoder		
UNIT-III	**SEQUENTIAL MACHINES FUNDAMENTALS**	**Classes:09**
Introduction, Basic Architectural Distinctions between Combinational and Sequential circuits, Classification of sequential circuits, The binary cell, The S-R-Latch and Flip-Flop The D-Latch and Flip-Flop, The “Clocked T” Flip-Flop, The “ Clocked J-K” Flip-Flop, Conversion from one type of Flip-Flop to another, Timing and Triggering Consideration, Clock Skew		
UNIT-IV	**SEQUENTIAL CIRCUIT DESIGN AND ANALYSIS**	**Classes:09**
Sequential Circuit Design and Analysis: Introduction, State Diagram, Analysis of Synchronous Sequential Circuits, Approaches to the Design of Synchronous Sequential Finite State Machines, Design Aspects, State Reduction, Design Steps, Realization using Flip-Flops Counters - Design of Ripple Counter, Synchronous counter, Ring Counter, Registers, Shift Register.		
UNIT-V	**FINITE STATE MACHINE AND ALGORITHMIC STATE MACHINES**	**Classes:09**
Sequential Circuits: Finite state machine- capabilities and limitations, Mealy and Moore models, minimization of completely specified and incompletely specified sequential machines, Partition techniques and Merger chart methods-concept of minimal cover table. **Algorithmic State Machines:** Salient features of the ASM chart-Simple examples- Weighing machine and binary multiplier.		
Text Books:		
1. Digital Design- Morris Mano, PHI, 3rd Edition. 2. Switching Theory and Logic Design-A. Anand Kumar, PHI, 2nd Edition. 3. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge**.**		
Reference Books:		
1. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed,John Wiley & Sons Inc. 2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013. 3. Switching Theory and Logic Design – Bhanu Bhaskara –Tata McGraw Hill Publication, 2012 4. Fundamentals of Logic Design- Charles H. Roth, Cengage LEanring, 5th, Edition, 2004. 5. Digital Logic Applications and Design- John M. Yarbrough, Thomson Publications, 2006. Digital Logic and State Machine Design – Comer, 3rd, Oxford, 2013		
Web References:		
1. www.wikipedia.org 2. www.pa.msu.edu 3. www.tutorvista.com 4. www.globalspec.com **5.** www.ee.bilkent.edu.tr		
E-Text Books:		
1. http://www.site.uottawa.ca/~petriu/Digital-Logic.pdf 2. http://uav.ece.nus.edu.sg/~bmchen/courses/EG1108_Digital.pdf 3. http://info.iet.unipi.it/~luigi/biomedica/sito/cosc205.pdf		
MOOCs Course		

1. https://onlinecourses.nptel.ac.in/noc18_ee33/preview
2. https://onlinecourses.nptel.ac.in/noc18_ee34/preview

ANALOG AND DIGITAL COMMUNICATIONS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC09	**PCC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**

COURSE OUTCOMES:

The course should enable the students to:

1. Apply the need for modulation and explain the different types of Amplitude Modulation techniques.
2. Implement Frequency Modulation concepts in real-time communication applications.
3. Evaluate the performance of digital signaling schemes in digital communication channels.
4. Analyze the key characteristics of various digital carrier modulation techniques.
5. Design methods to minimize the effects of errors caused by channel noise using error correction techniques.

COURSE OBJECTIVES:

1. To introduce the communication system and need of modulation and explain the concepts of Amplitude Modulation and its types (DSB-SC & SSB).
2. Classify the concepts of Angular Modulation, FM and types of FM and Noise in AM & FM Systems
3. To acquire the fundamentals of modern digital communication system design and to evaluate the performance of digital signaling schemes for digital communication channels.
4. To review the key characteristics and salient features of various digital carrier modulation and schemes for various receiver and transmitter requirements used in different applications.
5. To understand the concepts of minimizing the effects of errors due to channel noise, with various channel coding techniques.

UNIT-I	**ANALOG AND ANGLEMODULATION**	**Classes: 10**

Amplitude Modulation: Amplitude modulation theory, single tone modulation, power relations in AM waves, Envelop detector. Linear modulation schemes: DSB modulation, SSB modulation: Frequency discrimination method, Phase discrimination method, Coherent detection of DSB/SSB.

UNIT-II	**FM DEMODULATORS AND NOISE ANALYSIS**	**Classes: 10**

Frequency modulation, Phase modulation, Relationship between PM and FMSpectral characteristics of angle modulated signals,Generation of FM waves: Narrow band FM (Indirect method), Wide band FM, Power and bandwidth of FM, Balanced Frequency Slope discriminator, Noise in Amplitude modulation systems (DSB & SSB), Noise in Angle Modulation systems(FM). Pre-emphasis andDe-emphasis.

UNIT-III	**PULSE CODE MODULATION**	**Classes: 09**

Pulse Code Modulation (PCM): Sampling, quantization and coding, quantization error, Companding in PCM systems. Differential PCM and Delta Modulation. Time Division Multiplexing, Noise in PCM. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion

UNIT-IV	OPTIMUM DETECTION	Classes: 08
Optimum receiver and errorprobability, Matched filter, Correlator, Pass band Digital Modulation schemes- Phase Shift Keying, Amplitude Shift Keying, Frequency Shift Keying.		
UNIT-V	**ERROR CONTROL CODES**	**Classes: 10**
Error Control Codes: Linear Block Codes: Matrix description of Linear Block Codes, Error detection and error Correction capabilities of linear block codes. Cyclic Codes: Algebraic structure, encoding, syndrome calculation, Decoding.		
Text Books:		
1. Haskin S., "Communications Systems", John Wiley and Sons, 2001. 2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education,2002		
Reference Books:		
1. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill,2001. 2. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley,1965. 3. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers,2004. 4. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill,2000.		

ANALOG CIRCUITS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC10	**PCC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**

COURSE OUTCOMES:

The course should enable the students to:

1. Analyze various transistor amplifier circuits and their frequency responses at low, mid and high frequencies.
2. Designing amplifier circuits using BJTs.
3. Study the influence of positive and negative feedback on the performance and stability of electronic circuits
4. Design, construct & analyze oscillator circuits to generate signals in various frequency ranges.
5. Elucidate and design the linear and non-linear applications of an op-amp and special application ICs.

COURSE OBJECTIVES:

The course should enable the students to:

1. Analyze various transistor amplifier circuits and their frequency responses at low, mid and high frequencies.
2. Designing amplifier circuits using BJTs.
3. Analyze the concepts of both positive and negative feedback in electronic circuits.
4. Design, construct &analyze oscillator circuits to generate signals in various frequency ranges.
5. Elucidate and design the linear and non-linear applications of an op-amp and special application ICs.

UNIT-I	**SINGLE STAGE AMPLIFIER AND MULTISTAGE AMPLIFIER**	**Classes: 12**

SINGLE STAGE AMPLIFIERS: Classification of Amplifiers, Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model, Analysis of CE amplifier with emitter resistance. Miller's theorem and its dual. Design of single stage RC coupled Amplifier using BJT.

MULTISTAGE AMPLIFIERS: Different Coupling Schemes used in Amplifiers. Analysis of Cascaded RC coupled amplifier, Cascode Amplifier and Darlington Pair.

UNIT-II	**SMALL SIGNAL AND LARGE SIGNAL AMPLIFIER ANALYSIS**	**Classes: 12**

BJT AMPLIFIERS: Frequency response, effect of coupling and bypass capacitors, hybrid-pi model of CE amplifier, CE short circuit current gain,Gain-BandwidthProduct.

LARGE SIGNAL AMPLIFIERS: Classification, series fed and transformer coupled class A power amplifiers. Efficiency of Class A amplifiers. Push pull and complementary symmetry Class B power amplifiers, Efficiency of Class B amplifiers. Distortion in PowerAmplifiers.

UNIT-III	CONCEPTS OF FEEDBACK AMPLIFIER AND OSCILLATORS	Classes: 10

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NEGATIVE FEEDBACK AMPLIFIERS: General characteristics of negative feedback amplifiers. Effect of negative feedback on amplifier characteristics. Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations.

OSCILLATORS: Barkhausen criterion, RC Phase shift oscillators, Wien Bridge oscillators, Hartley oscillators, Colpitts oscillators, and crystal oscillators.

UNIT-IV	LINEAR AND NON LINEAR WAVE SHAPING	Classes: 14

LINEAR WAVE SHAPING: High pass and low pass RC circuits, their response for Step, Pulse and Squareinputs. HPF asDifferentiator and LPF as an integrator, basic concepts ofattenuators.

NON-LINEAR WAVE SHAPING: Diode and transistor clippers, clamping circuits, clamping circuit theorem, comparator and its applications.

UNIT-V	MULTIVIBRATORS AND SWEEP GENERATORS	Classes: 10

MULTIVIBRATORS: Analysis of Bistable, Monostable and AstableMultivibrators, Schmitt Trigger usingTransistors.

SWEEEP GENERATORS: Operation and applications of bootstrap and miller time base generators.

Text Books:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh (2015), Integrated Electronics-Analog and Digital Circuits and Systems, 2nd edition, Tata McGraw Hill Education Private Limited, NewDelhi.
2. G. K. Mithall (1998), Electronic Devices and Circuits, Khanna Publishers, New Delhi.
3. S.Anand Kumar, “Pulse and Digital circuits “Prentince hall of India, India 2005.

Reference Books:

1. Robert L. Boylestad, Louis Nashelsky (2006), Electronic Devices and Circuits Theory, 9th edition, Pearson/Prentice Hall, India.
2. Jacob Millman, Arvin Grabel (2003), Microelectronics, 2nd edition, Tata McGraw Hill, New Delhi.Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4 th Edition, 2014.
3. Mothiki S. PrakashRao (2006), Pulse and Digital Circuits, Tata McGraw Hill, India

E-Text Books:

1. http://www.freebookcentre.net/Electronics/Analog-Circuits-Books.html
2. http://www.freebookcentre.net/Electronics/Operational-Amplifiers-Books.html

MOOCs Course

1. https://onlinecourses.nptel.ac.in/noc18_ee19/preview
2. http://www.nptelvideos.in/2012/12/circuits-for-analog-system-design.html

<table>
<tr><td colspan="10">VECTOR CACULUS AND COMPLEX ANALYSIS</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5BS07</td><td rowspan="2">BSC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
</table>

COURSE OUTCOMES:

To learn

1. The concepts of finite differences, operators and relations between them.
2. Evaluation of integrals by using numerical methods.
3. Evaluation of the line integrals along piece wise smooth paths.
4. Concepts of Taylors and Maclaurin‘s series.
5. Finding Residues using Laurent series.

COURSE OBJECTIVES:

Upon successful completion of the course, the student is able to

1.Find Interpolating polynomial for the given tabular data.
2. Solve the first order ordinary differential equations using numerical techniques.
3. Calculate line integrals along piece wise smooth paths.
4. Express the given complex function as a power series using Taylor’s series and Maclaurin’s series.
5. Evaluate Residues by Laurent series
6. Find the bilinear transformation mapping to three given points

UNIT-I	**INTERPOLATION AND CURVE FITTING**	**Classes: 10**

INTERPOLATION: Finite differences: Forward, Backward and Central differences - Other difference operators and relations between them - Difference of a polynomial – Missing terms - Newton’s forward interpolation, Newton’s backward interpolation, Gauss’s forward and backward interpolation formulae . Interpolation with unequal intervals – Lagrange’s interpolation.

CURVE FITTING: Method of least squares - Fitting a straight line, second degree parabola and non-linear curves of the form $y= a e^{bx}$, $y= a x^{b}$, $y = a b^{x}$ by the method of least squares.

UNIT-II	**NUMERICAL TECHNIQUES**	**Classes: 08**

ROOT FINDING TECHNIQUES: Bisection method-Regula Falsi method and Newton Raphson method.

NUMERICAL INTEGRATION : Trapezoidal rule - Simpson’s one-third rule - Simpson’s three-eighth rule.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor’s series method –- Euler’s - Modified Euler’s Method – Runge -Kutta method

UNIT-III	**FUNCTIONS OF COMPLEX VARIABLES AND COMPLEX**	**Classes: 08**

	INTEGRATION	

Complex functions and its representation on Argand plane, Concepts of limit &Continuity, Differentiability, Analyticity and Cauchy-Riemann conditions, Harmonic functions- Milne-Thompson method.

Line integral-Evaluation along a path and by indefinite integration-Cauchy's integral theorem- Cauchy's integral formula -Generalized integral formula.

UNIT-IV	**COMPLEX POWER SERIES AND CONTOUR INTEGRATION**	**Classes: 08**

Radius of convergence-expansion in Taylor's series - Maclaurin's series and Laurent series - Singular point - Isolated singular point-pole of order m - essential singularity.

Residue- Evaluation of residue by formula and by Laurent's Series- Residue Theorem. Evaluation of integrals of the type

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

UNIT-V	**CONFORMAL MAPPING**	**Classes: 08**

Transformation by e^z, $\log z, z^2, z^n$ (n is a positive integer), $\sin z, \cos z, \frac{z+a}{z}$, Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio properties – invariance of circles and cross ratio – determination of bilinear transformation mapping three given points.

Text Books:

1. Ervin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, 36th Edition, 2010.

Reference Books:

1. G.B.Thomas, calculus and analytical geometry, 9th Edition, Pearson Reprint 2006.
2. N.P Bali and Manish Goyal, A Text of Engineering Mathematics, Laxmi publications, 2008.
3. E.L.Ince, Ordinary differential Equations, Dover publications, 1958

Web References:

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

E-Text Books:

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

<table>
<tr><td colspan="11">ELECTROMAGNETIC AND TRANSMISSION LINES</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5EC11</td><td rowspan="2">PCC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
</table>

COURSE OUTCOMES:
The course should enable the students to:

1. Apply vector calculus and fundamental electrostatic principles to determine electric field intensity, electric flux density, and potential distribution for different charge configurations.
2. Analyze magnetostatic fields using Biot–Savart's law, Ampere's law, and Maxwell's equations to compute magnetic field parameters and inductance.
3. Derive and interpret electromagnetic wave equations and characteristics such as reflection, refraction, and polarization in dielectric and conducting media.
4. Evaluate transmission line parameters and wave propagation characteristics using primary and secondary constants under various loading conditions.
5. Determine input impedance, VSWR, and reflection coefficient, and apply Smith chart techniques for impedance matching using single and double stubs.

COURSE OBJECTIVES:
The course should enable the students to:

1. Impart the knowledge of electric and magnetic fields.
2. Introduce the fundamental theory of electromagnetic waves in transmission lines.
3. Study the propagation characteristics of electromagnetic wave in bounded and unbounded media.
4. Calculate various line parameters by conventional and graphical methods

UNIT-I	**ELECTROSTATICS**	**Classes: 11**

Basics of Vectors, ,Coulomb's law, Electric field Intensity, Fields due to different charge distributions, Electric Flux Density, Gauss law and its Applications, Electric Potential, Relation Between E and V, Maxwell's Two equations for Electrostatic Fields, energy Density, illustrative problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations, Capacitance- Parallel plate, Co-axial and Spherical capacitors, Illustrative Problems.

UNIT-II	**MAGNETO STATICS**	**Classes: 11**

Magnetic field intensity and Magnetic flux density, Biot - Savart Law, Ampere's circuital Law and Applications. Maxwell's Two Equations for Magneto static fields, Magnetic Scalar and Vector Potentials, Ampere's force Law, Inductances and Magnetic Energy, Illustrative Problems. Faraday's Law and Transformer EMF, Inconsistence of Ampere's Law and Displacement Current density,Maxwell's Equations in different Final Forms and Word Statements for stationary and time varying fields, Conditions at a boundary Surface: Dielectric-dielectric, dielectric- conductor Interfaces.

UNIT-III	**EM WAVE CHARACTERISTICS**	**Classes: 11**

EM Wave Characteristics: Wave Equations for conducting and Perfect Dielectric Media, Uniform Plane Waves- Definition, Relations between E and H, Sinusoidal Variations, Wave Propagation in various

media, Polarization, Illustrative Problems. EM Wave Characteristics: Reflection and Refraction of Plane waves-Normal and Oblique Incidences for Perfect Dielectric Brewster angle, Critical Angle, Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem Power Loss in Plane Conductor, Illustrative Problems.		
UNIT-IV	**TRANSMISSION LINES-I**	**Classes:11**
Transmission line types, Transmission line Parameters, Transmission line Equations, Primary and Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities. Infinite Line Concepts, Lossless/Lossy Characterization, Distortion, Conditions for distortion-less transmission lines and condition for minimum attenuation Loading- Types of loading, Illustrative Problems.		
UNIT-V	**TRANSMISSION LINES-II**	**Classes: 11**
Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR, UHF Lines as Circuit Elements, $\lambda/4$, $\lambda/2$ and $\lambda/8$ Lines- Impedance Transformations, Significance of Z_{min} and Zmax, Smith Chart-Configuration and Applications. Single Stub Matching and Double Stub Matching, Illustrative Problems.		

Text Books:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
3. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan (Tech. India Publications),New Delhi

Reference Books:

1. Engineering Electromagnetics – Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2nd ed., 2005.
2. Networks, Lines and Fields – John D. Ryder, PHI, 2nd ed.,1999.
3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006

Web References:

1. web.media.mit.edu/~aggelos/papers/EM_Hayt_6th.pdf
2. https://books.google.co.in/books/.../Electromagnetic_Waves_Transmission_Lines.html..

E-Text Books:

1. web.media.mit.edu/~aggelos/papers/EM_Hayt_6th.pdf
2. https://books.google.co.in/books/.../Electromagnetic_Waves_Transmission_Lines.html..

MOOCS Course

1. https://onlinecourses.nptel.ac.in/noc18_ee22/preview
2. https://onlinecourses.nptel.ac.in/noc18_ee23
3. https://onlinecourses.nptel.ac.in/noc18_ee24

ANALOG CIRCUITS LAB								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC12	**PCC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**3**	**1.5**	**30**	**70**	**100**

COURSE OUTCOMES:

Upon successful completion of the course, student is able to

1. Design BJT and FET amplifiers.
2. Analyze various BJT Feedback amplifiers.
3. Design various BJTO oscillators and multi Vibrators.
4. Simulate various power amplifiers and tuned amplifier
5. Implement Linear and Non Linear wave shaping circuits

LIST OF EXPERIMENTS *(Minimum of 6 experiments from each cycle)*

Cycle-I

1. Design and testing of Common Emitter Amplifier
2. Design and testing of Two Stage RC Coupled Amplifier
3. Design and testing of Common Collector Amplifier
4. Class A Power Amplifier (Transformer less).
5. Construct and testing of Class B Power Amplifier
6. Design and testing of Common Source Amplifier
7. Darlington Pair Configuration
8. Voltage and Current Shunt Feedback Amplifiers
9. Design and testing of RC Phase Shift Oscillator
10. Design and testing of Hartley and Colpitt’s Oscillator

Cycle-II

1. Linear Wave Shaping.
   a. RC Low Pass Circuit for different time constants.
   b. RC High Pass Circuit for different time constants.
2. Non - Linear Wave Shaping.
   a. Transfer Characteristics and response of Clippers:
      i. Positive and Negative Clippers
      ii. Clipping at two independent levels
   b. The Steady state output waveform of clampers for a square wave input
      i. Positive and Negative Clampers
      ii. Clamping at reference voltage
3. Switching characteristics of a transistor
4. Design a Bi-stable Multi-vibrator and draw its waveforms
5. Design a Mono-stable Multi-vibrator and draw its waveforms
6. Design a A-stableMulti-vibrator and draw its waveforms
7. Response of Schmitt Trigger circuit for loop gain less than and greater than one

8. UJT relaxation Oscillator

DIGITAL SYSTEM DESIGN LAB

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC13	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to

1. To get familiarity with functionalities of IC's.
2. To learn how to design a Boolean expression using ICs.
3. To learn designing of combinational and sequential logic circuits
4. To learn complex circuits like counter using the combination of ICs.

COURSE OUTCOMES:

After going through this course the student will be able to

1. Demonstrate the functionality of basic logic gates and verify their truth tables.
2. Implement and simplify Boolean expressions using combinational logic circuits.
3. Design and analyze arithmetic circuits including adders, subtractors, and code converters.
4. Construct and test flip-flop-based sequential circuits and registers.
5. Develop and verify the operation of counters, multiplexers, encoders, and decoders.

To Verify the Functionality of the following using ICs

1. Study of logic gates and verify their truth tables
2. Implement boolean function using AOI logic
3. Adder and sub-tractors
4. BCD to EXCESS-3 converter
5. Binary to gray /gray to binary code converter
6. Verification of truth tables of R-S flip-flop , J-K flip-flop , T flip-flop and D flip-flop
7. Verification of 4-bit Comparator
8. Implementation and verification of decoder.
9. Implementation and verification of encoder.
10. Implementation of 8x1 multiplexer.
11. Verification of Universal shift register.
12. Design and verify the 4-bit synchronous counter.
13. To design and verify 4 bit ripple (asynchronous counter).

Reference Books:

1. Digital Design- Morris Mano, PHI, 3rd Edition.
2. Switching Theory and Logic Design-A. Anand Kumar, PHI, 2nd Edition.
3. Switching and Finite Automata Theory- ZviKohavi&Niraj K. Jha, 3rd Edition, Cambridge.

ANALOG AND DIGITAL COMMUNICATIONS LAB							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC14	**PCC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**3**	**1.5**	**30**	**70**	**100**

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Perform Analog and Digital modulation techniques.
2. Analyze the modulated wave forms.
3. Observe receiver characteristics.
4. Design Time and Frequency division multiplexing Techniques.
5. Evaluate the effectiveness of various modulation and multiplexing techniques based on experimental outcomes.

LIST OF EXPERIMENTS *(Minimum of 6 experiments from each cycle)*

Cycle – 1

1. Amplitude Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. SSB-SC Modulation and Demodulation (PHASE SHIFTMETHOD)
4. Frequency Modulation and Demodulation
5. Pre-Emphasis and De-Emphasis
6. Time division &De-Multiplexing
7. Verification of Sampling Theorem
8. Phase Locked Loop

Cycle - 2

1. Pulse Amplitude Modulation and Demodulation
2. Pulse Width and Position Modulation and Demodulation
3. Delta Modulation
4. Phase Shift Keying Modulation
5. Differential Phase Shift Keying Modulation
6. Amplitude Shift Keying Modulation
7. Frequency Shift Keying Modulation
8. Frequency Division Multiplexing and De-Multiplexing

Reference Books:

1. Haykin S., "Communications Systems", John Wiley and Sons,2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education,2002.
3. TaubH.and SchillingD.L.,"PrinciplesofCommunicationSystems”,TataMcGrawHill,2001.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering", John Wiley,1965

ENVIRONMENTAL STUDIES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5MC03	**MC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
	(Non credit)	**3**	**0**	**0**	**0**	**30**	**70**	**100**

COURSE OBJECTIVES:

The course should enable the students to:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations.
4. Determine the Natural resources on which the structure of development is raised for sustainability of the society through equitable maintenance of natural resources.
5. Illustrate about biodiversity that raises an appreciation and deeper understanding of species, ecosystems and also the interconnectedness of the living world and thereby avoids the mismanagement, misuse and destruction of biodiversity.
6. Summarize a methodology for identification, assessment and quantification of global environmental issues in order to create awareness about the international conventions for mitigating global environmental problems.
7. Sustainable development that aims to meet raising human needs of the present and future generations through preserving the environment.
8. Outline green environmental issue provides an opportunity to overcome the current global environmental issues by implementing modern techniques like CDM, green building, green computing etc.

COURSE OUTCOMES:

On Successful completion of this course, Students will be able to

1. Demonstrate an understanding of the Significance of environmental education.
2. Outline the context of environmentalism.
3. Comprehend the multidisciplinary nature of the course Environmental Studies.
4. Illustrate the components of the environment and its interactions.
5. Outline the causes, effects and management options for various environmental problems related to Air, Water and land.
6.

UNIT-I	**ECOSYSTEMS**	**Classes: 7**
Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem, Food chains, food web and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity.		
UNIT-II	**NATURAL RESOURCES & MINERAL RESOURCES**	**Classes: 10**

Natural Resources: Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.		
UNIT-III	**BIODIVERSITY AND BIOTIC RESOURCES**	**Classes: 08**
Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.\		
UNIT-IV	**ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES**	**Classes: 10**
Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. Global Environmental Problems and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS).. International conventions / Protocols: Earth summit, Kyoto protocol and Montréal Protocol.		
UNIT-V	**ENVIRONMENTAL POLICY, LEGISLATION & EIA**	**Classes: 10**
Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Towards Sustainable Future: Concept of Sustainable Development, Urban Sprawl, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.		
Text Books:		
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission. 2. Environmental Studies by R. Rajagopalan, Oxford University Press.		
Reference Books:		
1. Environmental Science: towards a sustainable future by Richard T.Wright. 2008 PHL Learning Private Ltd. New Delhi. 2. Environmental Engineering and science by Gilbert M.Masters and Wendell P. Ela .2008 PHI		

Learning Pvt. Ltd.

3. Environmental Science by Daniel B. Botkin & Edward A.Keller, Wiley INDIA edition.

4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications

Web References:

1. https://www.youtube.com/watch?v=M0mx8S05v60&list=PLBlnK6fEyqRjMH3mWf6kwqiTbT798eAOm
2. https://www.youtube.com/watch?v=CeD2L6KbtVM&list=PL018B3BB2E6FE781D
3. https://www.youtube.com/watch?v=CeD2L6KbtVM&list=PL803563859BF7ED8C

E-Text Books:

1. http://www.cl.cam.ac.uk/teaching/1011/SysOnChip/socdam-notes1011.pdf
2. https://www.doc.ic.ac.uk/~wl/teachlocal/cuscomp/notes/cc11.pdf

MOOCS Course

1. https://onlinecourses.nptel.ac.in/noc18_ee33/preview
2. https://onlinecourses.nptel.ac.in/noc18_ee34/preview

III B.TECH I SEMESTER

SYLLABUS

<table>
<tr><td colspan="10">LINEAR AND DIGITAL INTEGRATED CIRCUIT APPLICATIONS</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
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<tr><td>A5EC15</td><td>PCC</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
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COURSE OBJECTIVES:

The course should enable the students:

1. To introduce the basic building blocks of linear integrated circuits.
2. To teach the linear and non-linear applications of operational amplifiers.
3. To introduce the concepts of waveform generation and introduce some special functionICs...
4. Design digital circuits using Verilog HDL.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Analyze the characteristics and internal structure of operational amplifiers to design fundamental analog circuits.
2. Design linear and nonlinear applications of op-amps including various active filters.
3. Construct waveform generators using the 555 timer and implement A/D and D/A converter circuits.
4. Model basic combinational circuits using Verilog HDL at the gate level.
5. Create and optimize combinational and sequential circuits for practical applications.

UNIT-I	**OP-AMP AND ITS APPLICATIONS**	**Classes: 09**

Introduction, Classification of IC's, Op-Amp internal circuit, Op-Amp characteristics - DC and AC. Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, V to I and I to V converters.

UNIT-II	**APPLICATIONS OF OP-AMP& ACTIVE FILERS**	**Classes: 09**

Integrator and differentiator, Log and Antilog amplifier, Comparators, Schmitt trigger, Astable Multivibrator, Triangular waveform generators, Oscillators. Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject filter and allpass filters.

UNIT-III	**IC 555 TIMER&DATA CONVERTERS**	**Classes: 09**

Introduction to IC 555 timer: Description of functional diagram, operations and applications of Astable, Monostable, Schmitt trigger. D/A converter – specifications - weighted resistor type, R-2R Ladder types, A/D Converters – specifications - Flash type - Successive Approximation type - Dual Slope type (Voltage-to-Time Conversion).		
UNIT-IV	**INTRODUCTION TO VERILLOG HDL**	**Classes: 09**
Introduction: Verilog as an HDL, Levels of design description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks. **Language Constructs and Conventions:** Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. **Gate Level Modelling:** Introduction, Gate Primitives, Module Structure, Illustrative Examples.		
UNIT-V	**GATE, DATAFLOW AND BEHAVIORAL LEVEL MODELING**	**Classes: 09**
Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignment examples. **Behavioural Modeling:** Introduction, Operations and Assignments, Initial Construct, Always Construct, Implementation of counters in behavioural modeling.		

Text Books:

1. D. Roy Choudhury, Shail B. Jain, " Linear Integrated Circuit", 4th edition, New Age International Pvt.Ltd.,NewDelhi,India,2012.
2. Ramakant A. Gayakwad, "OP-AMP and Linear Integrated Circuits", 4th edition, Prentice Hall / Pearson Education, NewDelhi, 2012.
3. T. R. Padmanabhan and B. Bala Tripura Sundari, Design through Verilog HDL Wiley, 2009.(T1)

Reference Books:

1. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill, New Delhi, 1997.
2. Gray,Meyer,"AnalysisandDesignofAnalogIntegratedCircuits",WileyInternational,NewDelhi,1995
3. Zainalabdien Navabi, Verilog Digital System Design, TMH, 2nd Edition (T2)

Web References:

1. https://www.electronics-tutorials.ws/opamp/opamp_1.htm
2. https://circuitdigest.com/article/555-timer-ic

E-Text Books:

1. http://dea.unsj.edu.ar/sredes/Biblioauxi/130107134-106147696-S-Franco-Design-With-Operational-Amplifiers-and-Analog-Integrated-Circuits-1-pdf.pdf2.
2. https://www.u-cursos.cl/usuario/9553d43f5ccbf1cca06cc02562b4005e/mi_blog/r/%5Bgray Meyer%5D_Analysis_and_Design_of_Analog_Integrated_Circuits_5th_cropped.pdf

MOOC Course

1.http://nptel.ac.in/courses/117107094/30 2.http://nptel.ac.in/courses/117108107/Lecture%2035.pdf

ANTENNAS AND WAVE PROPAGATION									
Course Code	Category	Credits				Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC16	PCC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basic terminology and concepts of Antennas.
2. Attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
3. Analyze the electric and magnetic field emission from various basic antennas and their mathematical analysis
4. Analyze the wave spectrum and respective band based antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.
5. To impart the key skill of Design methodology of transmission lines and wave propagation techniques.

CORSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply the fundamental principles of antennas and compute key parameters such as radiation resistance and power.
2. Compare various antenna types and examine their structural characteristics and performance metrics.
3. Investigate modern antenna systems like microstrip patch antennas and analyze beamforming in antenna arrays.
4. Interpret wave propagation mechanisms through different atmospheric layers and media.
5. Assess antenna performance using analytical methods and measurement techniques for gain and directivity.

UNIT-I	Antenna Basics	Classes: 10

Introduction, Basic Antenna Parameters - Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Related Problems.

Thin Linear Wire Antennas: Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance

UNIT-II	VHF, UHF AND Microwave Antennas - I:	Classes: 10

Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics, Helical Antennas - Helical geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas - Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

UNIT-III	VHF, UHF AND Microwave Antennas - II:	Classes: 12

Microstrip Antennas - Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas - Geometry and Parameters, Characteristics of Micro strip Antennas. Impact of Different Parameters on Characteristics, Reflector Antennas.

Antenna Arrays: Point Sources - Definition, Pattern, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays - Broadside Arrays, End fire Arrays, Binomial Array Antenna, EFA with Increased Directivity.

UNIT-IV	Wave Propagation - I:	Classes: 10
Introduction, Definitions, Categorizations and General Classifications Different Modes of Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation (Qualitative Treatment)- Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections, Space Wave Propagation- Introduction, Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation, Fading and Path Loss Calculations		
UNIT-V	**Wave Propagation – II & Antenna Measurements**	Classes: 12
Sky Wave Propagation- Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation **Antenna Measurements:** Introduction, Concepts –Reciprocity Near and Far Fields, Coordinate System, Sources of Errors Patterns to be Measured, Pattern Measurement Arrangement Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)		
Text Books:		
1. Antennas for All Applications – John D. Kraus and R. J. Marhefka, and Ahmad S. Khan TMH, New Delhi, 4th ed., (Special Indian Edition) 2010. 2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd edition 2000.		
Reference Books:		
1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd ed., 2005. 2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.		
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1.http://www.bing.com/videos/search?q=WEB+REFERENCE+FOR+ANTENNAS&&view=detail&mid=72ED51D8D7981620B0CE72ED51D8D7981620B0CE&&FORM=VRDGAR		
E-Text Books:		
1. wireless.ictp.it/school_2007/lectures/Struzak/5Anten_theor_basics.pdf		
MOOC Course		
1. https://onlinecourses.nptel.ac.in/noc18_ee23/ 2. https://onlinecourses.nptel.ac.in/noc18_ee22/		

MICROPROCESSORS AND MICROCONTROLLERS							
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC17	PCC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basic of 8, 16 bit microprocessor architectures and its functionalities.
2. Write an assembly language programming skills of various processors.
3. Interface different peripheral devices with microprocessors and microcontrollers.
4. Develop systems using different microprocessors and microcontrollers.
5. Analyze RISC and ARM microprocessor based systems.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply the knowledge of microprocessor and microcontroller architecture to design and implement basic control and processing tasks.
2. Develop the programming model of microprocessors and microcontrollers.
3. Interface different external peripheral devices with microprocessors and microcontrollers.
4. Analyze a problem and formulate appropriate computing solution for processor or controller based application.
5. Implement an assembly language program for solving specific tasks.

UNIT-I	MICROPROCESSORS ARCHITECTURE	Classes: 09

Overview of 8085, 8086 architecture- functional diagram, Register organization, memory segmentation, Memory addresses, physical memory organization, Signal descriptions of 8086, timing diagrams, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine.

UNIT-II	INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086	Classes: 09

Programming model, Addressing modes, Instruction set, Assembler directives, Programs involving logical, branch and call instructions, Sorting, evaluating arithmetic expressions, and string manipulations.

UNIT-III	INTERFACING WITH 8086	Classes: 09

8255 PPI, various modes of operation and interfacing to 8086, Stepper motor interfacing, D/A &A/D converter, Memory interfacing to 8086, DMA controller (8257) , 8251 USART architecture and Interfacing.

Interfacing With advanced devices: Serial communication standards, serial data transfer schemes		
UNIT-IV	**INTRODUCTION TO MICROCONTROLLERS**	**Classes: 09**
overview of 8051 microcontroller, Architecture, I/O ports, Memory organization, addressing modes and instruction set of 8051, Simple programs, Programming 8051 timers/ counters, Programming 8051 interrupts.		
UNIT-V	**8051 REAL TIME CONTROL**	**Classes: 09**
Programming Timer Interrupts, Programming External Hardware Interrupts, Interrupts, Programming serial communication interrupts, Programming 8051 timers and counters, Introduction to ARM-Architecture.		

Text Books:

1.D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006.
2. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010
3. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.
R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.

Reference Books:

1. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
2.Micro computer system 8086/8088 family architecture, programming and design- By Liu and GA Gibson, PHI, 2nd Ed.,
3. Microcontrollers and application, Ajay.V.Deshmukh, TMGH, 2005.
The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Janice Gillispie Mazidi, Second Edition.

Web References:

1.http://www.freebookcentre.net/electronics-ebooks-download/Microprocessor-and-Microcontroller.html
2.http://coen.boisestate.edu/smloo/smloo-courses/ece-332-microprocessors-fall07/lecture-notes/
3.http://www.freebookcentre.net/electronics-ebooks-download/Introduction-to-Microcontrollers-Lecture-Notes.html

E-Text Books:

1.http://gen.lib.rus.ec/book/index.php?md5=67C5AC79DC8180A7F0641609D0C7800C
2.http://www.faadooengineers.com/threads/9039-8085-microprocessor-by-RAMESH-GANOKAR-ebook-pdf-download
3.https://e.edim.co/123389964/The_8051_Microcontroller_Architecture_Programming_And_Applications.pdf
4.https://e.edim.co/123389964/A.K._Ray_and_K.M._Bhurchandi-Advanced_Microprocessors_and_Peripherals_3e-Tata_Mcgraw_Hill.pdf

MOOC Course

1.https://www.mooc-list.com/tags/microprocessors
2.https://www.coursera.org/courses?query=microprocessor

MICROPROCESSORS AND MICROCONTROLLERS LAB								
Course Code	**Category**	**Hours /Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
A5EC18	**PCC**	-	-	3	1.5	30	70	100

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Formulate problems and implement algorithms using Assembly language.
2. Develop programs for different applications.
3. Interface peripheral devices with 8086 and 8051.
4. Use Assembly/Embedded C programming approach for solving real world problems.

LIST OF EXPERIMENTS

1.	**PROGRAMS FOR 16 BIT ARITHMETIC OPERATIONS (Using various addressing modes)**
2	**PROGRAMS INVOLVING BIT MANIPULATION INSTRUCTIONS**
	a. Write an ALP to find the given data is positive or negative. b. Write an ALP to find the given data is odd or even. c. Write an ALP to find Logical ones and zeros in a given data.
3	**PROGRAMS ON ARRAYS FOR 8086**
	a. Write an ALP to find Addition/subtraction of N no’s. b. Write an ALP for finding largest/smallest no. c. Write an ALP to sort given array in Ascending/descending order.
4	**PROGRAM FOR STRING MANIPULATIONS FOR 8086**
	a. Write an ALP to find String length. b. Write an ALP for Displaying the given String. c. Write an ALP for Comparing two Strings. d. Write an ALP to reverse String and Checking for palindrome.
5.	**PROGRAM FOR DIGITAL CLOCK DESIGN USING 8086**
	a. Write an ALP for Designing clock using INT 21H Interrupt. b. Write an ALP for Designing clock using DOS Interrupt Functions. c. Write an ALP for Designing clock by reading system time.
6	**INTERFACING STEPPER MOTOR WITH 8086**

a. Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
b. Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.

7 INTERFACING ADC/DAC WITH 8086

a. Write an ALP to 8086 processor to Interface ADC.
b. Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Step signal.

8 COMMUNICATION BETWEEN TWO MICROPROCESSORS

a. Write an ALP to have Parallel communication between two microprocessors using 8255.
b. Write an ALP to have Serial communication between two microprocessor kits using 8251.

9 PROGRAMS USING ARITHMETIC AND LOGICAL INSTRUCTIONS FOR 8051

a. Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction, Multiplication and Division.
b. Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
c. Programs related to Register Banks.

10 PROGRAM TO VERIFY TIMERS/COUNTERS OF 8051

a. Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
b. Write a program to create a delay of 50 µsec using Timer1 in mode 0 and blink all the Pins of P2.
c. Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
d. Write a program to create a delay of 80 µsec using counter1 in mode 1 and blink all the Pins of

11 UART OPERATION IN 8051

a. Write a program to transfer a character serially with a baud rate of 9600 using UART.
b. Write a program to transfer a character serially with a baud rate of 4800 using UART.
c. Write a program to transfer a character serially with a baud rate of 2400 using UART.

12 INTERFACING LCD WITH 8051

a. Develop and execute the program to interface16*2 LCD to 8051.
b. Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Janice GillispieMazidi, Second Edition.

ANALOG & DIGITAL IC APPLICATIONS LAB

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CI	SEE	Total
A5EC19	PCC	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the students to

1. Demonstrate the characteristics and applications of Op-Amps
2. Verify the functionality of specific ICs like 555 timer, and voltage regulators.
3. Verify the various digital functions using Verilog HDL.
4. Verify the combinational and sequential functions using Verilog HDL.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Design and analyze basic analog circuits such as adder, subtractor, comparator, integrator, and differentiator using IC 741 operational amplifier.
2. Construct and evaluate active Low Pass and High Pass Butterworth filters (1st and 2nd order) using IC 741 op-amp.
3. Develop and simulate basic logic gates, adders, and subtractors using Verilog HDL.
4. Implement and verify multiplexers, de-multiplexers, encoders, and decoders through Verilog simulations.
5. Understand the working of IC 555 timer in Astable and Monostable modes and design related timing circuits.

LIST OF EXPERIMENTS

The following experiments from 1 to 8 are using ICs and the remaining experiments are using EDA simulation tools

1. Basic applications of IC741 op-amp.
2. Integrator and differentiator using IC741 op-amp.
3. Adder, Subtractor, Comparator using IC 741 Op-Amp.
4. Active Low Pass & High Pass Butterworth filters (1st &2nd Order).
5. RC Phase Shift and Wien Bridge Oscillators using IC 741 Op-Amp
6. IC 555 timer in Astable and Monostable operation.
7. Schmitt trigger circuits using IC 741 op-amp & IC 555 timer.
8. Voltage regulator IC 723, three terminal voltage regulators- 7805, 7809, 7912.
9. Design and simulate all logic gates.
10. Implement a Verilog code for AOI logic
11. Design and check the truth tables of adders and subtractors.
12. Implementationof binary to gray and gray to binary code convertor using Verilog.
13. Design and simulate Multiplexer and De-multiplexer.
14. Design and simulate Encoder and Decoder.
15. Designand simulate 8*1 multiplexer using lower order multiplexers.

Reference Books:

1. D. Roy Choudhury, Shail B. Jain (2012), Linear Integrated Circuit, 4th edition, New Age International Pvt.Ltd.,NewDelhi,India.
2. Thomas L. Floyd (2013), Digital Fundamentals – A Systems Approach –Pearson

OBJECT ORIENTED PROGRAMMING LAB

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT02	PCC	-	-	3	1.5	30	70	100

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Understand and apply object oriented features and C++ concepts.
2. Apply the concept of polymorphism and inheritance.
3. Implement exception handling and templates.
4. Develop applications using console I/O and file I/O GUI applications with JDBC connectivity.
5. Demonstrate Java compiler and Eclipse platform and learn how to use NetBeans IDE to create Java application.

LIST OF EXPERIMENTS

1

a) Write a Java program that prints all real solutions to the quadratic equation ax2 + bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions.

b) The Fibonacci sequence is defined by the following rule:

c) The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that uses both recursive and non recursive functions to print the nth value in the Fibonacci sequence.

2

a) Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)

b) Write a Java program to multiply two given matrices.

c) Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)

3

a) Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome. b) Write a Java program for sorting list of names. Read input from command line. c) Write a Java program to make frequency count of words in a given text.	
4	
a) Write a Java program to create a Student class with following fields i. Hall ticket number ii. Student Name iii. Department	
5	
a) Write a java program to create an abstract class named Shape that contains an empty method named number Of Sides ( ).Provide three classes named Trapezoid, Triangle and Hexagon such that each one of the classes extends the class Shape. Each one of the classes contains only the method number Of Sides ( ) that shows the number of sides in the given geometrical figures. b) Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using JTable component.	
6	
a) Write a Java program to read copy content of one file to other by handling all file related exceptions.	
7	
a) Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes. b) Write a Java program that reads a file and displays the file on the screen, with a line number before each line.	
8	
a) Write a Java program that creates three threads. First thread displays ―Good Morning‖ every one second, the second thread displays ―Hello‖ every two seconds and the third thread displays ―Welcome‖ every three seconds. b) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.	
9	
a) 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.	

10	
a. Write a Java program for handling mouse events. b. Write a Java program for handling key events using Adapter classes	
11	
a) Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts. b) Write a Java program that allows the user to draw lines, rectangles and ovals.	
12	
a. Develop simple calculator using Swings. b. Develop an applet that displays a simple message in center of the screen	

REFERENCE BOOKS:

1. Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M. Deitel, PHI.
2.Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
3.Thinking in Java, Bruce Eckel, Peason Education
4.Programming in Java, S. Malhotra and S. Choudary, Oxford Univ. Press.

MINI PROJECTS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC20	**PWC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	4	2	30	70	100

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Identify and define engineering or research problems in emerging domains such as VLSI, Communication, Embedded Systems, IoT, Deep Learning, and Audio Signal Processing, considering societal and industrial relevance.
2. Design appropriate solutions by selecting and utilizing suitable hardware and software tools (e.g., HFSS, MATLAB, Arduino, Raspberry Pi, VLSI CAD tools, Python frameworks).
3. Develop and implement functional prototypes or simulations by integrating software algorithms and hardware components for real-time applications, including AI/ML models, communication systems, or IoT platforms.

4. Collaborate effectively in teams, demonstrating project planning, time management, ethical responsibility, and multidisciplinary communication skills throughout the project lifecycle.
5. Evaluate and validate system performance through testing and analysis, propose improvements based on outcomes, and present comprehensive technical documentation and project presentations.

HUMAN VALUES AND PROFESSIONAL ETHICS

Course Code	Category	Hours / Week			Credit s	Maximum Marks		
A5MC05	Mandatory Course (Non-Credit)	L	T	P	C	CIE	SEE	Total
		3	0	0	-	30	70	100

COURSE OBJECTIVES:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.

COURSE OUTCOMES:

1. It ensures students sustained happiness through identifying the essentials of human values and skills.
2. It facilitates a correct understanding between profession and happiness.
3. It helps students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature.
4. Ability to develop appropriate technologies and management patterns to create harmony in professional and personal life.

UNIT-I

Course Introduction - Need, basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration - what is it? - its content and process; 'Natural Acceptance' and Experiential Validation - as the mechanism for self exploration. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-II

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

UNIT-III

Understanding Harmony in the Family and Society - Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; **Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.** Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astiva as comprehensive Human Goals. Visualizing a universal harmonious order in society - Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family!

UNIT-IV

Understanding Harmony in the nature and Existence - Whole existence as Co-existence: Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astiva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

UNIT-V

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

Ability to utilize the professional competence for augmenting universal human order,

Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

Ability to identify and develop appropriate techologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order.

At the level of individual: as socially and ecologically responsible engineers, technologists and managers

At the level of society: as mutually enriching institutions and organizations.

TEXT BOOKS:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

REFERENCE BOOKS:

1. Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
2. E. F. Schumancher, 1973, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.
3. A Nagraj, 1998 Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986, 1991.
5. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.
6. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth - Club of Rome's report, Universe Books.
9. E G Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
10. M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Humna Values), Eastern Economy Edition, Prentice Hall of India Ltd.

RELEVANT CDS, MOVIES, DOCUMENTARIES & OTHER LITERATURE:

1. value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. AI Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charle Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology - the Untold Story

III YEAR II SEMESTER SYLLABUS

DIGITAL SIGNAL PROCESSING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC21	PCC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Learn various DFT and FFT algorithms
2. Realize the various digital filters
3. Know the various digital filter design techniques
4. Understand the concepts of multi-rate signal processing and its applications
5. Introduce the concepts of DSP processor and its architectures.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Solve the Discrete Fourier Transform (DFT) using various Fast Fourier Transform (FFT) algorithms.
2. Construct various digital filters for signal processing applications.
3. Design and implement digital filters using various techniques to meet specific filtering requirements.
4. Apply the knowledge of multi-rate signal processing in real-time applications.
5. Create DSP processors effectively in real-time environments for signal processing tasks.

UNIT-I	Discrete Fourier Transforms	Classes: 12

Introduction, Computation of DFT, Properties of DFT, Inverse DFT. Linear and Circular convolutions, Overlap add method and overlap save method. Relationship of DFT to other transforms. Radix-2 FFT algorithms, Inverse FFT.

UNIT-II	IIR Digital Filters	Classes: 12

Basic structures of IIR systems - Direct form-I, Direct form-II, Cascade form, Parallel form. Analog filter approximations – Butterworth and Chebyshev: Low pass, Band pass, Band stop and High pass filters. Design of IIR digital filters from analog filters by impulse invariant method & Bilinear transformation method.

UNIT-III	FIR Digital Filters	Classes: 12

Basic structures of FIR systems -Direct form, Cascade form, Linear Phase method. Characteristics of FIR digital filters, Design of linear phase FIR Digital Filters using Windows and Design of FIR digital filters using Fourier Series method, Comparison of IIR and FIR filters

UNIT-IV	Multirate Digital Signal Processing	Classes: 12
Introduction, Decimation by a factor D, interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Filter Design & Implementation for sampling rate conversion, Multi stage Implementation of sampling rate conversion, and Applications of multirate DSP.		
UNIT-V	**Introduction to DSP Processors**	**Classes: 12**
Introduction to commercial Digital signal processors, Basic Architectural features, DSP computational Building Blocks, Bus Architecture and Memory, TMS320C54XX DSP's: Architecture, Data Addressing modes, Instruction set, On-Chip Peripherals, Interrupts, and Concept of pipelining.		

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications – John G. Proakis, Dimitris G.Manolakis, Pearson Education/PHI, 2007.
2. Digital Signal Processors: Architecture, Programming and Applications, B. Venkataramani, M. Bhaskar, TMH Edition, 2002.
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH

Reference Books:

1. Digital Signal Processing – Andreas Antoniou, Tata McGraw Hill , 2006.
2. Digital Signal Processing – MH Hayes, Schaum's Outlines, Tata Mc-Graw Hill, 2007.
3. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI

Web References:

1. www.ti.com
2. www.analog.com
3. www.dspguru.com
4. www.dsptutor.freeuk.com
5. www. dspguide.com
6. www.youtube.com(lecture on DSP)

E-Text Books:

1. https://www.textbooks.com/Digital-Signal-Processing-4th-Edition/9780131873742/John-Proakis-and-Dimitris-Manolakis.php
2. https://www.textbooks.com/Digital-Signal-Processing-2nd-Edition/9780124158931/Li-Tan-and-Jean-Jiang.php
3. https://www.textbooks.com/Digital-Signal-Processing-using-MATLAB-3rd-Edition/9781305635197/Robert-Schilling.php
4. https://www.textbooks.com/Fundamentals-of-Digital-Signal-Processing-86-Edition/9780471603634/Lonnie-C-Ludeman.php

MOOC Course

1. nptel.ac.in/courses/117102060/
2. https://www.mooc-list.com/tags/digital-signal-processing

MICROWAVE ENGINEERING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC22	PEC	3	-	-	3	30	70	100

Course Overview:

This subject starts with the introduction of principles of microwave and transmission lines with their applications. This subject explains about the microwave transmission lines like waveguides (rectangular, circular), micro-strips etc. and the various microwave components like T-junctions, circulator, isolator etc. Finally about the M-type tubes, microwave solid state devices and microwave measurements.

COURSE OBJECTIVES:

1. To develop the knowledge on transmission lines for microwaves, cavity resonators and wave guide components and application.
2. To enable the students understand and analyze the operation of microwave tubes like klystron, magnetron, travelling wave tube, etc.,
3. To familiarize with microwave solid state devices.
4. To understand the scattering matrix parameter and its use.
5. To introduce the student the microwave test bench for measure different parameter like attenuation, VSWR, etc.,

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

1. Understand the significance of microwaves and microwave transmission lines.
2. Analyze the characteristics of microwave tubes and compare them.
3. Be able to list and explain the various microwave solid state devices.
4. Can set up a microwave bench for measuring microwave parameters.
5. Evaluate the performance of microwave components and systems based on experimental results and theoretical analysis.

UNIT-I	MICROWAVE AND TRANSMISSION LINES	Classes 10

Introduction, microwave spectrum and bands, applications of microwaves. rectangular waveguides – solution of wave equations in rectangular coordinates, TE/TM mode analysis, expressions for fields, characteristic equation and cut-off frequencies, filter characteristics, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section, mode characteristics -phase and group velocities, wavelengths and impedance relations related problems rectangular guide- power transmission and power losses Impossibility of TEM mode, micro strip lines– introduction, ZO relations, effective dielectric constant, losses, Q factor ,cavity resonators– introduction, rectangular cavities, dominant modes and resonant frequencies, Q factor and coupling coefficients, related Problems.		
UNIT-II	**WAVEGUIDE COMPONENTS AND APPLICATIONS**	**Classes 10**
Coupling mechanisms – probe, loop, aperture types, waveguide discontinuities – waveguide windows, tuning screws and posts, matched loads, waveguide attenuators – resistive card, rotary vane types; waveguide phase shifters – dielectric, rotary vane types, waveguide multiport junctions – E plane and H plane tees, magic tee, hybrid ring, directional couplers – 2 hole, bethe hole types, related problems ferrites– composition and characteristics, faraday rotation, ferrite components – gyrator, isolator, circulator, scattering matrix– significance, formulation and properties, S matrix calculations for – 2 port junction, e plane and h plane tees, magic tee, directional coupler, circulator and isolator, related problems.		
UNIT-III	**MICROWAVE TUBES**	**Classes 11**
Limitations and losses of conventional tubes at microwave frequencies, microwave tubes – O type and M type classifications, O-type tubes: 2 cavity klystrons – structure, re-entrant cavities, velocity modulation process and apple gate diagram, bunching process and small signal theory – expressions for o/p power and efficiency. reflex klystrons – structure, apple gate diagram and principle of working, mathematical theory of bunching, power output, efficiency, oscillating modes and o/p characteristics, effect of repeller voltage on power o/p, related problems, HELIX TWTS: Significance, types and characteristics of slow wave structures, structure of TWT and amplification process (qualitative treatment), suppression of oscillations, gain considerations.		
UNIT-IV	**M-TYPE TUBES**	**Classes 9**
Introduction, cross-field effects, magnetrons – different types, 8-cavity cylindrical travelling wave magnetron – Hull Cut-off and Hartree Conditions, modes of resonance and PI-mode operation, separation of Pi-mode, o/p characteristics. **MICROWAVE SOLID STATE DEVICES:** Introduction, Classification, Applications. TEDs - Introduction, Gunn Diode - Principle, RWH Theory, Characteristics, Basic Modes of Operation, Gunn Oscillation Modes. LSA mode Avalanche Transit Time Devices.		
UNIT-V	**MICROWAVE MEASUREMENTS**	**Classes 9**

Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement - Bolometers, Measurement of Attenuation, Frequency standing wave measurements –measurement of low and High VSWR, Cavity Q. Impedance Measurements.

TEXT BOOKS:

1. Samuel Y. Liao (1994), *Microwave Devices and Circuits*, 3rd edition, Prentice Hall of India, New Delhi.
2. Herbert J. Reich, J. G. Skalnik, P. F. Ordung, H. L. Krauss (2004), *Microwave Principles*, CBS Publishers, New Delhi, India.
3. M. Kulkarni (1998), *Micro Wave and Radar Engineering*, Umesh Publications, New Delhi.

REFERENCE BOOKS:

1. R. E. Collin (2002), *Foundations for Microwave Engineering*, 2nd edition, IEEE Press, John Wiley India.
2. M. L. Sisodia, G. S. Raghuvanshi (1995), *Microwave Circuits and Passive Devices*, Wiley Eastern Ltd., New Age International Publishers Ltd.
3. Peter A. Rizzi (1999), *Microwave Engineering Passive Circuits*, Prentice Hall of India, New Delhi.

WEBLINKS:

https://www.cambridge.org/core/browse-subjects/engineering/rf-and-microwave-engineering

E TEXTBOOK:

https://open.umn.edu/opentextbooks/textbooks/753

MOOCS:

https://www.coursera.org/learn/microwave-antenna

DIGITAL SIGNAL PROCESSING LAB								
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
A5EC23	**P C C**	-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

Upon successful completion of the course, the student is able to

1. Learn DFT/IDFT of a sequence using FFT
2. Understand recursive and filtering methods
3. Plot Magnitude and phase characteristics of digital filters.
4. Know the multirate digital signal Processing using I/D factors
5. Write a C code and Implement it on DSP TMS320C6713 Processor.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Find DFT/IDFT of a sequence using FFT.
2. Use of recursive and filtering methods to generate sinusoidal signal.
3. Analyze and observe magnitude and phase characteristics of digital filters.
4. Implement the multirate digital signal processing using I/D factors.
5. Develop a C code and implement it on DSP TMS320C6713 Processor.

LIST OF EXPERIMENTS

1. Generation of Sinusoidal waveform / signal based on recursive difference equations
2. Find DFT / IDFT of given DT signal
3. Find frequency response of a given system given in (Transfer Function/ Differential equation form)
4. Implementation of FFT of given sequence
5. Determination of Power Spectrum of a given signal(s).
6. Implementation of LP,HP,BP and BS IIR filter for a given sequence
7. Implementation of LP,HP,BP and BS FIR filter for a given sequence
8. Generation of Sinusoidal signal through filtering
9. Implementation of Decimation and Interpolation Process
10. Impulse response of first order and second order systems
11. Find Linear and Circular Convolution between the sequences using a computer language such as C with TMS320C6713 Processor.

ANTENNAS AND MICROWAVE LAB								
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
A5EC24	**PCC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	1.5	30	70	100

Course Outcomes:

Upon Successful Completion of the Course, the Student is Able To

1. Analyze the performance characteristics of various antennas.
2. Applying the basic antenna theorems/theories for the designed antennas.
3. Design and analyze wire & aperture antennas and antenna arrays.
4. Study and interpret the radiation characteristics of various antennas.
5. Evaluate the impact of different feeding techniques and substrate materials on antenna performance through simulation and experimental analysis.

PART-A

The following experiments will be conducted using simulation software (HFFS)

1. Introduction on simulation software to Design various antennas.
2. Investigation on effects of Dipole Antenna's Lengths on Radiation Pattern and Gain Characteristics.
3. Investigate the various characteristics of a Monopole Antenna.
4. Investigate the various characteristics of a Dipole Antenna.
5. Design and investigate the radiation characteristics of dish antenna.
6. To analyze the characteristics and radiation Pattern of End Fire Arrays
7. Simulation of patch antenna and to understand the radiation characteristics.
8. To design and analyze 3- Elements and 5-Element Yagi-Uda Antenna
9. To analyze the characteristics and radiation pattern of Broad Side Arrays.
10. To simulate and synthesize the characteristics and radiation pattern of a Horn Antennas
11. To simulate and synthesize the radiation strength at a given distance from the Antenna
12. Investigate the radiation characteristics of reflector antennas.

PART-B Microwave Lab

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Directional Coupler Characteristics
4. Measurement of Scattering Parameters of a Magic Tee.
5. Measurement of Scattering Parameters of a Circulator
6. Microwave Frequency Measurement

ADVANCED ENGILISH COMMUNICATION SKILLS LAB								
Course Code	**Category**	**Hours / Week**			**Credit**	**Maximum Marks**		
A5HS04	**HSMC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	3	1.5	30	70	100

Introduction

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course is a laboratory course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organize ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

COURSE OUTCOMES

By the end of the course students will be able to

1. Organize ideas coherently from the given text or context.
2. Participate effectively in debates and group discussions.
3. Write project reports, research reports, technical reports, and formal letters.

Syllabus:

The following course content to conduct the activities is prescribed for the Advanced Communication Skills (ACS) Lab:

1 .Activities on Fundamentals of Inter-personal Communication

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2.Activities on Building Vocabulary

Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary

3.Activities on Reading Comprehension

General Vs Local Comprehension, Reading for facts, guessing meanings from context, Scanning and Skimming.

4.Activities on Reading for Specific Purposes

Inferring meaning, Critical reading & Effective goggling.

5.Activities on Writing Skills- Technical Reports

Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence

6.Activities on Writing Skills
Technical report writing/ Portfolio writing - planning for writing - improving one's writing.
7.Activities on Presentation Skills
Oral presentations (individual and group) through JAM sessions and Seminars.
8.Activities on Presentation Skills Using ICT
PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.

9.Activities on Group Discussion
Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process
10.Interview Skills
Pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews.
Books Recommended:

1. Raman, M & Sharma, S. (2009). Technical Communication. Oxford University Press.
2. Rani. S. (2011). Advanced Communication Skills Laboratory Manual. Pearson Education.
3. Anderson, V. (2007). Technical Communication. Cengage Learning pvt. Ltd.
4. Kelly M. Quintanilla & Shawn T. Wahl. (2011). Business and Professional Communication: Keys for Workplace Excellence. Sage South Asia Edition. Sage Publications.
5. Stev. D & David T. Mc Mahan. (2012). The Basics of Communication: A Relational Perspective. Sage South Asia Edition. Sage Publications.
6. Mc Murrey. D & Buckley. J. (2012). Handbook for Technical Communication Cengage Learning.
7. Sen. L. (2009). Communication Skills. PHI Learning Pvt Ltd.
8. Vishvamohan, A. (2009). English for Technical Communication for Engineering Students. Tata Mc Graw Hill.
9. Books on TOFEL/ GRE/ GMAT/ CAT/ IELTS by Barron's/ DELTA/ Cambridge University Press.
10. Tomalin, B & Thomas, B. (2009). International English for Call Centers. Macmillan Publishers.

INDEPENDENT STUDY								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC25	**PWC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	-	1	-	100	100

COURSE OUTCOMES
By the end of the course students will be able to

1. Identify and define a complex engineering problem relevant to electronics and communication.
2. Conduct a structured and critical review of technical literature and identify knowledge gaps.
3. Apply appropriate theoretical and practical tools to analyze and design systems/solutions.
4. Work independently with minimal supervision while managing time and resources efficiently.
5. Document and present findings clearly, both in writing and orally, demonstrating professional communication skills.

IV YEAR I SEMESTER

SYLLABUS

EMBEDDED SYSTEM DESIGN								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC26	PCC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Learn about the Basic functions, Structure, Concepts and Applications of Embedded systems.
2. Understand embedded hardware such as processor cores, memories, Sensors and Actuators.
3. Introduce Embedded C Programming and debugging tools & techniques of embedded system.
4. Impart Real Time Operating System structure and functions for embedded systems.
5. Understand Architectures Advanced Processor and Communication interfaces used in Embedded System Design.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply the fundamental concepts of embedded systems to develop simple application-oriented solutions using appropriate hardware and software components.
2. Formulate embedded hardware components such as processor cores, memories, sensors, and actuators.
3. Program Embedded C programming and debugging techniques for real-time embedded applications.
4. Assess the structure and functions of Real-Time Operating Systems (RTOS) for embedded system design.
5. Construct advanced processor architectures and communication interfaces used in embedded systems.

7.

UNIT-I	INTRODUCTION TO CONCEPTS OF EMBEDDED SYSTEMS	Classes: 9
Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, the Embedded system design process, Characteristics and Quality Attributes of Embedded Systems.		
UNIT-II	EMBEDDED HARDWARE & INTERFACING WITH 8051 MICROCONTROLLER	Classes: 9

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).
Memory: ROM, RAM, Memory Shadowing, Memory selection for Embedded Systems.
Interfacing of Sensors and Actuators – Switch, IR Sensor, LED, Temperature Sensor, Relay, DC Motor

UNIT-III	EMBEDDED C PROGRAMMING & DEBUGGING TECHNIQUES	Classes: 9

Embedded C Programming for 8051– Difference between C and Embedded C, Basic Structure of Embedded C Programming, Keywords, Data types, Operators, Conditional Branching, Loops, Macros, functions; I/O Programming, Timer Programming, Serial Port Programming. **Debugging tools & techniques:** Host and Target machines, Linker/Locators for Embedded software, getting Embedded Software into the Target system, Testing on Host machine, Using Laboratory tools.

UNIT-IV	REAL TIME OPERATING SYSTEMS	Classes: 9

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Shared data problems, Semaphores, Task Scheduling, Message queues, Mail boxes, Pipes, Timer functions, Events, Memory management, Interrupt routines in an RTOS environment, an example RTOS like uC-OS (open source).

UNIT-V	INTRODUCTION TO ADVANCED ARCHITECTURES	Classes: 9

ARM and SHARC, processor and memory organization and instruction level parallelism; networked embedded systems: bus protocols, I2C bus and CAN bus; internet-enabled systems, design example- Elevator controller.

Text Books:

1. Wayne Wolf (2008), Computers as Components-principles of embedded computer system design, Elsevier, New Delhi, India.
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.
3. David E. Simon (1999), An Embedded Software Primer, Pearson Education, India.

Reference Books:

1. Jean J. Labrosse (2000), Embedding System Building Blocks, 2nd edition, CMP publishers, USA.
2. Raj Kamal (2004), Embedded Systems, Tata McGraw hill, India.
3. Ajay V. Deshmukh (2005), Micro Controllers, Tata McGraw hill, India.
4. Frank Vahid, Tony Givargis (2002), Embedded System Design, John Wiley, India.

Web References:

1. http://www.freebookcentre.net/electronics-ebooks-download/Microprocessor-and-Microcontroller.html
2. http://coen.boisestate.edu/smloo/smloo-courses/ece-332-microprocessors-fall07/lecture-notes/
3. http://www.freebookcentre.net/electronics-ebooks-download/Introduction-to-Microcontrollers-Lecture-Notes.html
4. https://www.elprocus.com/basics-of-embedded-system-and-applications/
5. https://www.radio-electronics.com/info/processing-embedded/embedded-systems/embedded-processing-unit.php
6. https://www.theengineeringprojects.com/2016/11/top-10-embedded-systems-software-development-tools.html

7. https://www.controleng.com/single-article/six-debugging-techniques-for-embedded-system-development/468754f1404e71332ea2bad35f1d0166.html

E-Text Books:

1. http://www2.thu.edu.tw/~emtools/DOE_project/NCCU/An%20Embedded%20Software%20Primer%281ed%20-%20Simon%29.pdf
2. http://www.faadooengineers.com/threads/9039-8085-microprocessor-by-RAMESH-GANOKAR-eb pdf-download
3. https://e.edim.co/123389964/The_8051_Microcontroller_Architecture_Programming_And_Applica .pdf
4. https://e.edim.co/123389964/A.K._Ray_and_K.M._Bhurchandi-Advanced_Microprocessors_and_Peripherals_3e-Tata_Mcgraw_Hill.pdf

MOOC Course:

1. https://www.mooc-list.com/tags/Embedded-systems
2. https://www.online.colostate.edu/certificates/Embedded-systems-certificate/

VLSI DESIGN

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC27	PCC	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the Basic NMOS, CMOS & Bi CMOS fabrication process
2. Understand the basic VLSI design flow and CMOS design rules.
3. Learn the concepts of Technology Scaling of MOS transistors.
4. Design basic CMOS logic circuits.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Discuss various I.C fabrication technologies like NMOS, PMOS, CMOS, and Bi-CMOS and their electrical properties.
2. Illustrate the stick diagrams and layout diagrams of various logic circuits.
3. Evaluate the various design rules for IC layout and logic circuit design.
4. Analyze the building blocks of data path and array sub-systems for digital circuits.
5. Create and apply different programmable logic devices (PLDs) for customizable digital circuit design.

UNIT-I	INTRODUCTION TO MOS TECHNOLOGY	Classes: 12

Introduction MOS and related VLSI technology – NMOS-CMOS-BICMOS fabrication Technology – Electrical properties of MOS circuits. Ids-Vds relationships, MOS transistor threshold voltage, gm, gds, figure of merit.

UNIT-II	VLSI CIRCUIT DESIGN PROCESS	Classes: 12

VLSI Design Flow, MOS layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-III	GATE LEVEL DESIGN	Classes: 12

Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, time delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers.

UNIT-IV	VLSI SYSTEM DESIGN	Classes: 12

Data path subsystem: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters. **Array subsystems**: SRAM, DRAM, ROM, Serial access memories.

UNIT-V	CMOS TESTING :	Classes: 12

Design for testability - built in self test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques.

Text Books:

1. Basic VLSI design by Douglas A, Pucknell, Kamran Eshraghian, Prantice Hall, 1996 3rd edition.
2. VLSI DESIGN - K. Lal Kishore, V.S.V Prabhakar, I.K International, 2009.
3. CMOS VLSI Design- Neil H.E Weste, David Harris, AyanBanerjee, Pearson Education, 1999

Reference Books:

1. Mead, C.A and Conway, L.A., Introduction to VLSI Systems, Wesley – Wesley.
2. CMOS logic circuit design- John P. Uyemura, Springer, 2007.
3. Modern VLSI Design – Wayne Wolf, Pearson Education, 3rd Edition, 1997.
4. Introduction to VLSI-Mead and convey, BS publications, 2010
5. Application Specific Integrated Circuits-smith

Web References:

1. www.wikipedia.org
2. www.pa.msu.edu
3. www.tutorvista.com
4. www.globalspec.com
5. www.ee.bilkent.edu.tr

COMPUTER NETWORKS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC28	PCC	3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1 **COURSE OBJECTIVES:**

The course should enable the students to:

1. Have a good understanding of the OSI Reference Model and in particular have a good knowledge of layers.
2. Describe the functions of data link layer and explain the protocols.
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network.
4. Describe the Session layer design issues and Transport layer services.
5. Analyse the functions of Application layer and Presentation layer paradigms and Protocols

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to:

1. Understand the organization of computer networks, factors influencing computer network development and the reasons for having different types of networks.
2. Recognize the different inter networking devices and their functions.
3. Apply the contemporary issues in networking technologies.
4. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
5. Specify and identify the deficiencies in existing protocols and then go on to formulate new and better protocols.

UNIT-I	INTRODUCTION	Classes: 09

Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay. THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

UNIT-II	THE DATA LINK LAYER	Classes: 09

Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet.

THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth

UNIT-III	THE NETWORK LAYAER	Classes: 09

Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.		
UNIT-IV	**THE TRANSPORT LAYER**	**Classes: 09**
Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.		
UNIT-V	**THE APPLICATION LAYER**	**Classes: 09**
Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.		
Text Books:		
1. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition, TMH, 2006. 2. Computer Networks – Andrew S Tanenbaum, 4th Edition, Pearson Education.		
Reference Books:		
1. An Engineering Approach to Computer Networks – S.Keshav, 2nd Edition, Pearson Education. 2. Understanding Communications and Networks, 3rd Edition, W.A. Shay, Cengage, Learning. 3. Computer and Communication Networks, Nader F. Mir, Pearson Education. 4. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K.W. Ross, 3rd Edition, Pearson Education. 5. Data and Computer Communications, G.S.Hura and M.Singhal, CRC Press, Taylor and Group. Data Communications and Computer Networks, P.C.Gupta, PHI.		

EMBEDDED AND IOT LAB							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum**	
A5EC29	PCC	**L**	**T**	**P**	**C**	**CIA**	**SEE**
		-	-	3	1.5	30	70

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Formulate problems and implement algorithms using Embedded C programming language.
2. Program, simulate and test the 8051 processor-based circuits and their interfaces.
3. Focuses on using KEIL software for various embedded applications.
4. Concentrates on the importance and functions of Arduino.
5. Prepares students to apply the process of Software Testing during Arduino software development.

LIST OF EXPERIMENTS

1	**EMBEDDED C PROGRAMS - AT89C51**
Program to toggle all the bits of Port P1 continuously with 250 mS delay	
2	**EMBEDDED C PROGRAMS - AT89C51**
Develop and execute the program such that whenever a Switch is pressed corresponding LED glows.	
3	**EMBEDDED C PROGRAMS - AT89C51**
Develop and execute the program to Toggle all the bits of port P1 continuously with some delay in between. Use Timer 0, in 16-bit mode to generate the delay.	
4	**EMBEDDED C PROGRAMS - AT89C51**
Interface LCD And Seven Segment Display with 8051 & write Embedded C program.	
5	**EMBEDDED C PROGRAMS - AT89C51**
Interface DC motor with 8051 & write Embedded C program.	
6	**IoT Lab –Arduino**
Blinking of LED with different delay	
7	**IoT Lab –Arduino**
Interfacing Sensors (IR and PIR)	
8	**IoT Lab –Arduino**

Interfacing Analog Sensors (Temperature)	
9	**IoT Lab –Arduino**
Interfacing of DC motor	
10	**IoT Lab –Arduino**
Interfacing DC motor with bluetooth with an example	
11	**IoT Lab –Arduino**
Interfacing sensors with Wi-fi module	
12	IoT Lab –Arduino
Smart phone Android App development	
Reference Books:	

1. Ajay V. Deshmukh (2005), Micro Controllers, Tata McGraw hill, India.
2. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
3. Michael J. Pont, “Embedded C”, Pearson Education, 2nd Edition, 2008.
4. Nigel Gardner, “The Microchip PIC in CCS C”, Ccs Inc, 2nd Revision Edition, 2002.

VLSI DESIGN LAB								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC30	PCC	L	T	P	C	CIA	SEE	Total
		-	-	3	1.5	30	70	100

COURSE OBJECTIVES:

The course should enable the student to

1. Understand different circuit parameters.
2. Learn the schematic editor for circuit design.
3. Understand different simulation tools.
4. Lear to draw the layout of CMOS circuits.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Develop logic circuits utilizing CMOS transistors.
2. Apply various Cadence tools for circuit design and analysis.
3. Construct and simulate both analog and digital circuits.
4. Create layouts for CMOS-based circuits.
5. Evaluate the performance of CMOS circuits by analyzing power, delay, and area trade-offs using post-layout simulation results.

LIST OF EXPERIMENTS

The following experiments are using any CAD tools.

1. Design and analysis of CMOS Inverter

a) Implement CMOS inverter schematic using 180 nm technology and design its symbol.

b) Implement test bench for CMOS Inverter and check its output response.

c) Perform DC and AC analysis for CMOS inverter.

d) Check the performance of CMOS inverter using parametric sweep.

2. Design and analysis of NAND and NOR Logic gates

a) Implement NAND/NOR schematic using 180 nm technology and design its symbol.

b) Implement test bench for NAND/NOR and check its output response.

c) Perform DC and AC analysis for NAND/NOR.

d) Check the performance of NAND/NOR using parametric sweep.

3. Design and analysis of XOR and XNOR Logic gates

a) Implement XOR/XNOR schematic using 180 nm technology and design its symbol.

b) Implement test bench for XOR/XNOR and check its output response.

c) Perform DC and AC analysis for XOR/XNOR.

d) Check the performance of XOR/XNOR using parametric sweep.

4. Design of AOI logic

a) Design Schematic for AB+C'D and check its output response.

b) Design Schematic for AB'+C'D and check its output response.

c) Design Schematic for (A+B')(C+D) and check its output response.

d) Design Schematic for (A+B')(C'+D) and check its output response.

5. Design and analysis of Full adder

a) Design full adder using Full custom IC design.

b) Design full adder using Semi custom IC design.

6. Analysis of NMOS and PMOS characteristics

a) Implement test bench for NMOS/PMOS transistor.

b) Perform DC and AC analysis for NMOS/PMOS transistor

c) Check the performance of NMOS/PMOS transistor using parametric sweep.

7. Design and analysis of Common source amplifier

a) Implement CS amplifier schematic using 180 nm technology and design its symbol.

b) Implement test bench for CS amplifier and check its output response.

c) Perform DC and AC analysis for CS amplifier.

d) Check the performance of CS amplifier using parametric sweep.

8. Design and analysis of Common drain amplifier

a) Implement CD amplifier schematic using 180 nm technology and design its symbol.

b) Implement test bench for CD amplifier and check its output response.

c) Perform DC and AC analysis for CD amplifier.

d) Check the performance of CD amplifier using parametric sweep.

9. Design of MOS differential amplifier

a) Design differential amplifier schematic using 180 nm technology and its symbol.

b) Implement test bench for differential amplifier and check its output response.

c) Perform DC and AC analysis for differential amplifier.

d) Check the performance of differential amplifier using parametric sweep.

10. Design of two stage differential amplifier

a) Design two stage differential amplifier schematic using 180 nm technology and its symbol.

b) Implement test bench for two stage differential amplifier and check its output response.

c) Perform DC and AC analysis for two stage differential amplifier.

d) Check the performance of two stage differential amplifier using parametric sweep.

11. Design of Inverter Layout

a) Design and implement inverter schematic.

b) Design the layout for inverter using 180 nm tech file.

c) Perform LVS for schematic and layout

d) Check and remove all DRC violations.

e) Extract parasitic R and C in layout.

12) Design of NAND/NOR Layout

a) Design and implement NAND/NOR schematic.

b) Design the layout for inverter using 180 nm tech file.

c) Perform LVS for schematic and layout

d) Check and remove all DRC violations.

e) Extract parasitic R and C in layout.

MAJOR PROJECT STAGE-I							
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC31	PWC	L	T	P	C	CIA	SEE	Total
		-	-	8	4	100	0	100

COURSE OUTCOMES:

Upon successful completion of the Project, the student is able to

1. Identify and define engineering problems relevant to Electronics and Communication Engineering.
2. Analyze literature to propose a feasible and innovative project solution.
3. Formulate objectives and design methodologies for project development.
4. Develop and simulate initial models or prototypes using suitable engineering tools.
5. Present progress through effective documentation and communication skills.

IV B. TECH II SEMESTER

SYLLABUS

MAJOR PROJECT STAGE-II								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC32	**PWC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	16	8	50	150	200

COURSE OUTCOMES:

Upon successful completion of the Project, the student is able to

1. Apply engineering knowledge and principles to design and develop hardware and/or software-based solutions for complex engineering problems.
2. Conduct systematic testing, validation, and performance analysis of the implemented project, utilizing modern engineering tools and techniques.
3. Demonstrate effective problem-solving abilities, teamwork, and project management skills throughout the project lifecycle, considering societal, health, safety, legal, and cultural issues.
4. Prepare comprehensive project reports and documentation in accordance with standard engineering formats, effectively communicating technical information.
5. Exhibit effective oral presentation skills, defending the project work before a technical committee, and recognize the need for lifelong learning in the context of technological advancements.

PROFESSIONAL ELECTIVES-I

SENSORS AND ACTUATORS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC33	PEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understanding basic laws and phenomena on which operation of sensors and actuators- Transformation of energy
2. Create analytical design and development solutions for sensors and actuators.
3. To know the basic laws of behaviour of sensors and actuators.
4. To able to know about the Standards for Smart Sensor Interface
5. Analyse the development and application of sensors and actuators.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply the fundamental physical and technical base of sensors and actuators,
2. Analyse various premises, approaches, procedures and results related to sensors and actuators
3. Analyse basic laws and phenomena that define behaviour of sensors and actuators.
4. Apply the Smart Sensor Interface in various applications
5. Develop the application of sensors and actuators

UNIT-I	Sensors / Transducers	Classes: 9

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-II	Thermal Sensors	Classes: 9

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo-EMF Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermo-electric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

UNIT-III	Radiation Sensors	Classes: 9
Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors. Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization–– Reference Electrodes – Sensor Electrodes – Electro ceramics in Gas Media .		
UNIT-IV	Smart Sensors	Classes: 9
Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.		
UNIT-V	Actuators	Classes: 9
Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydrauli Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Proc valves, Rotary actuators.		

Text Books:

1. D. Patranabis, “Sensors and Transducers”, PHI Learning Private Limited.
2. W. Bolton, “Mechatronics”, Pearson Education Limited.

Reference Books:

1. Renganathan S.,” Transducer Engineering”, Allied Publishers (P) Ltd., 2003

Web Link:
https://www.journals.elsevier.com/sensors-and-actuators

E Text books:
https://www.sciencedirect.com/handbook/handbook-of-sensors-and-actuators

Moocs:
https://www.classcentral.com/course/swayam-sensors-and-actuators-14285

FIBER OPTIC COMMUNICATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC34	PEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers.
2. To know about the signal degradation in optical fibers.
3. To learn about the various optical sources, detectors and transmission techniques.
4. To explore various idea about optical fiber measurements and various coupling techniques.
5. To enrich the knowledge about optical communication systems

.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. Understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
3. Learn the various optical source materials, LED structures, quantum efficiency, Laser diodes.
4. Analyse the performance of various connectors and couplers in fiber optic system.
5. Design an optical link for a given specifications

UNIT-I	INTRODUCTION TO OPTICAL FIBERS	Classes: 9

Evolution of fiber optic system- Element of an Optical Fiber Transmission link– Total internal reflection- Acceptance angle – Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations - Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers- Graded Index fiber structure.

UNIT-II	SIGNAL DEGRADATION OPTICAL FIBERS	Classes: 9

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in Single Mode fibers-Polarization Mode dispersion, Intermodal dispersion.

UNIT-III	FIBER OPTICAL SOURCES	Classes: 9
Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser.		
UNIT-IV	COUPLERS AND CONNECTORS	Classes: 9
Power Launching and coupling, Lencing schemes, Fiber -to- Fiber joints, Fiber splicing- Distribution Networks, Directional Couplers, Star Couplers, Switches, Fiber Optical Isolator, Fiber Bragg Gratings, Optical Amplifier-EDFA		
UNIT-V	SYSTEM DESIGN AND NOISE	Classes: 9
Analog System Design,Digital System Design, Applications of Fiber Optics-Link power budget-rise Optical noise-Thermal noise, shot noise, Modal noise and Amplifier noise		

Text Books:

1. Gerd Kaiser, " Optial fiber communication", McGraw Hill, 4th Edition,2010.
2. Joseph. C. Palais, ―Fiber Optic Communications Pearson Education, Asia, 2002.
3. John M.Senior, ―Optical Fiber Communication: Principles and Practice, Pearson Education, 2nd e

Reference Books:

1. John Powers ,Fiber Optic Systems, Irwin Publications, 1997.
2. Howes M.J., Morgan, D.V.Optical Fiber Communication‖, John Wiely.1992.

Web links:

1.https://www.electronics-notes.com/articles/connectivity/fibre-optics/optical-fibre-telecommunications-bas

E text books:

1.https://easyengineering.net/optical-fiber-communications-principles-and-practice-by-senior-nw/cvr_seni6812_03_se_cvr-indd/

MOOCs:

https://onlinecourses.nptel.ac.in/noc20_ee83/preview

DIGITAL DESIGN THROUGH VERILOG

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC35	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basics of Digital design using Verilog HDL
2. Understand the Digital design using Gate primitives.
3. Understand the concepts of Behavioural modeling .
4. Gain the knowledge on Switch level modelling and testing of verilog codes.

COURSE OUTCOMES

At the end of the course the student shall be able to:

1. Describe the basic concepts of Verilog language.
2. Comprehend the structural procedures in Verilog language.
3. Design a Verilog code using behavioural modeling.
4. Design and verify Verilog codes.

UNIT-I	INTRODUCTION TO VERILOG	Classes: 09

Introduction to VerilLog HDL: Verilog as HDL, Levels of design description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis tools.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.

UNIT-II	GATE AND DATAFLOW LEVEL MODELING	Classes: 09

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, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit.

Modelling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

UNIT III	BEHAVIORAL MODELING	Classes: 09

Behavioural Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioural Level, Blocking and Non-Blocking Assignments, The case statement, Simulation Flow *if* and *if*-else constructs, Assign-De-Assign construct, Repeat construct, for loop, the Disable construct, While loop, Forever loop, Parallel Blocks, Force-Release construct, Event

UNIT-IV	SWITCH LEVEL MODELING	Classes: 09

Switch Level Modelling: Basic Transistor Switches, CMOS Switches, Bi-Directional Gates, Time Delays with Switch Primitives, Instantiation with 'Strenths' and 'Delays' Strength Contention with Tri-reg Nets.

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters.

System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.		
UNIT-V	**FUNCTIONS AND RECURSION**	**Classes: 09**
Sequential Circuit Description: Sequential Models – Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis. **Components Test and Verification:** Test Bench- Combinational Circuit Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assertion Verification.		
TEXT BOOKS 1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall PTR, 2003. 2. Srikanth Vijayaraghavan, Meyyappan Ramanathan, "A Practical Guide for System Verilog Assertions", Springer, 2005. 3. Cook Book Mentor Graphics, http://verificationacademy.com.		
REFERENCE BOOKS: 1.T.R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL'', WSE, 2004 IEEE Press. 2. J. Bhaskar, "A Verilog Primier", BSP, 2003. 3. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", Phi,2005.		
Web References: 1. https://www.altera.com/support/training/course/ohdl1120.html 2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_verilog_introduction.htm 3. https://www.doulos.com/knowhow/verilog_designers_guide/what_is_verilog/		
E Text Books **1.** http://www.freebookcentre.net/electronics-ebooks-download/Digital-Design-Through-Verilog-Hdl.html 2. www.ece.umd.edu/class/enee359a/verilog_tutorial.pdf		
MOOC Course 1. . http://vol.verilog.com/ 2. https://www.mooc-list.com/tags/verilog		

<table>
<tr><td colspan="11" align="center">INDUSTRIAL ELECTRONICS</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>A5EC36</td><td>PEC</td><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand solid state devices as logic switches, power controller switches.
2. Demonstrate an understanding of photo electronics, lasers,
3. Understand the working principles of various input devices (sensors, transducers etc.) and output devices (amplifiers, relays etc.) and signal
4. Understand control logix, data communications for industrial electronics and telemetry.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Demonstrate the characteristics of power semiconductor devices.
2. Analyse the operation of converters and to design firing circuit for Thyristors
3. Identify different processors for various applications.
4. Construct power semiconductor circuits for industrial applications
5. Analyse power semiconductor circuits for domestic applications

UNIT-I	**DC Amplifiers**	**Classes: 9**

DC Amplifiers: Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascade amplifier, Stabilization, Differential amplifiers - Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT-II	**Regulated Power Supplies:**	**Classes: 9**

Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques - Short Circuit, Over voltage and Thermal Protection. Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators - Current boosting .

UNIT-III	**SCR and Thyristor:**	**Classes: 9**

SCR and Thyristor: Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F, Ratings of SCR.

UNIT-IV	**Applications of SCR in Power Control**:	**Classes: 9**

Applications of SCR in Power Control: Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half wave and Full wave. DIAC, TRIAC and Thyristor Applications: Chopper circuits – Principle, methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation.

UNIT-V	**Industrial Applications**	**Classes: 9**

Industrial Applications : Industrial timers -Classification, types, Electronic Timers – Classification, RC timers, Time base Generators. Electric Welding Classification, types and methods of Resistance and AI Electronic DC Motor Control. Industrial Applications - II: High Frequency heating – principle, merits, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electro Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications.
Text Books:
1. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 20(2. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.
Reference Books: **REFERENCE BOOKS:** 1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003. 2. Thyristors and applications – M. Rammurthy, East-West Press, 1977.3. 3. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE
Web Link:
http://101science.com/eleclinks.htm#11.%20Tutorials
E Text books:
https://frank.pocnet.net/other/Philips/Kretzmann_IndustrialElectronicsHandbook_1964.pdf
Moocs: https://swayam.gov.in/explorer?searchText=Industrial+electronics

PROFESSIONAL ELECTIVE- II

DIGITAL IMAGE PROCESSING								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC37	**PEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the image fundamentals and mathematical transforms necessary for image processing.
2. Study the image enhancement techniques
3. Know the various image restoration procedures.
4. Learn the image compression procedures
5. Know about the Color image processing

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Review the fundamental concepts of a digital image processing system.
2 .Analyze the images in frequency domain using various transform.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques and associated enhancements
5. Interpret the Image compression standards.

UNIT-I	Digital Image Fundamentals	Classes: 9

Digital Image Fundamentals: Fundamentals of Digital Image Processing, Origins of Digital Image Processing Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

UNIT-II	Spatial & Frequency Domain	Classes: 9

Restoration: Noise models, Restoration in the Presence of Noise only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

UNIT-III	Restoration	Classes: 9

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Morphological processing- erosion and dilation.

UNIT-IV	Color Image Processing	Classes: 9
Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing. Wavelets: Background, Multi resolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.		
UNIT-V	**Segmentation**	**Classes: 9**
Segmentation: Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Morphological Watersheds. Representation and Description: Representation, Boundary descriptors.		

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition, 2010.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002.

Reference Books:

1.Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.

2.Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pears Education, Inc., 2011.

Weblink:

1. https://msoe.us/taylor/cs4802/

E Textbook

1. http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20 %20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf

MOOCs:

1. https://www.coursera.org/courses?languages=en&query=digital%20image%20processing

2.https://onlinecourses.nptel.ac.in/noc19_ee55/preview

TELECOMMUNICATION SWITCHING SYSTEMS AND NETWORKS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC38	**PEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

COURSE OBJECTIVE:

The Course objectives of this course are:

1. To introduce in details the concepts of Frequency and Time division multiplexing.
2. To introduce digital multiplexing and digital hierarchy namely SONET / SDH
3. To introduce the concepts of space switching, time switching and combination switching, example of a switch namely ESS Toll switch.
4. To introduce the need for network synchronization and study synchronization issues.
5. To study the enhanced local loop systems in digital environment.

COURSE OUTCOMES:

On successful completion of the course

1. The student can identify different areas of satellite communication.
2. Identify, analyse the applications of all the areas in day to day life.
3. Identify the operations, working, construction, material etc. aspects of link budget, losses, fading.
4. Analyse the ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.
5. Analyse the outline network control and management issues

UNIT-I	**Introduction to Telecommunication Networks**	**Classes 8**

Introduction to Telecommunication Networks: Evolution of Telecommunications, Basic of Switching System, Simple Telephone Communication, Manual Switching System, Major Telecommunication Networks

UNIT-II	Evolution of Switching System	**Classes 9**

Evolution of Switching System: Strowger, Rotary Dial Telephone, Signaling Tones, Step by Step Switching, Design Parameters, Crossbar Switching: Principal of Common Control, Touch Tone Dial Telephone and Principals of Crossbar Switching

UNIT-III	**Digital Switching**	**Classes 9**

Digital Switching: Switching Functions, Space Division Switching, Time Division Switching, two dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross- Connect Systems, Digital Switching in an Analog Environment. Elements of SS7 signaling.

UNIT-IV	**Traffic Engineering**	**Classes 9**

Traffic Engineering: Network Traffic Load And Parameters, Grade Of Service And Blocking Probability, Modeling Switching Systems, Incoming Traffic And Service Time Characterizations, Blocking Models And Loss Estimates, Delay Systems

UNIT-V	**Telephone Networks**	**Classes 10**

Telephone Networks: Subscriber Loop System, Switching Hierarchy And Routing, Transmission Plan, Transmission System Numbering Plan, Charging Plan, Signaling Techniques, In-channel Signaling,

Common Channel Signaling, Cellular Mobile Telephony.
TEXT BOOKS:
1. J. Bellamy, "Digital Telephony", John Wiley, 2003, 3rd Edition. 2. JE Flood, "Telecommunications Switching, Traffic and Networks", Pearson. 3. R.A.Thomson, "Telephone switching Systems", Artech House Publishers, 2000. 4. W. Stalling, " Data and Computer Communications", Prentice Hall, 1993. 5. T.N.Saadawi, M.H.Ammar, A.E.Hakeem, "Fundamentals of Telecommunication Networks", Wiley Interscience, 1994.
REFERENCE BOOKS:
1. W.D. Reeve, "Subscriber Loop Signaling and Transmission Hand book", IEEE Press (Telecomm Handbook Series), 1995. 2. Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 1994.
WEBLINKS: 1.https://www.tutorialspoint.com/telecommunication_switching_systems_and_networks/telecommunication_switching_systems_and_networks_switching_systems.htm
E TEXTBOOKS:
1. https://electronicsbookcafe.files.wordpress.com/2015/08/telecommunication-switching-systems-and-networks.pdf
MOOCS: 1. https://www.mooc-list.com/tags/switching

<table>
<tr><td colspan="10">INTRODUCTION TO MEMS</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5EC39</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
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COURSE OBJECTIVES:

The course should enable the students to:

1. To equip the students with the Finite Element Analysis fundamentals.
2. Understanding the basics of MEMS
3. Explain about various materials and technology of MEMS

4 Study about micro machine processing and fabrication techniques

5 Explore about MEMS sensors and accelerometers

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. To introduce the fundamental concept of MEMS & Micro system and their relevance to current industry/scientific needs
2. To introduce and demonstrate processes that are used in MEMS fabrication
3. Applying basic sensing principles of chem./bio systems to develop novel sensors
4. To discuss the Design limitations and challenges in the design and fabrication of micro sensors, sensing modalities to build the desired micro system
5. To introduce students to writing and evaluating research proposals enabling them to apply general micromachining principles to build novel devices.

UNIT-I	**INTRODUCTION TO MEMS AND MICRO FABRICATION**	**Classes: 9**

INTRODUCTION TO MEMS AND MICRO FABRICATION: History of MEMS Development, Characteristics of MEMS-miniaturization - microelectronics integration - Mass fabrication with precision. Micro fabrication - microelectronics fabrication process- silicon based MEMS processes- new material and fabrication processing- points of consideration for processing.

UNIT-II	**ELECTRICAL AND MECHANICAL PROPERTIES OF MEMS MATERIALS**	**Classes: 9**

ELECTRICAL AND MECHANICAL PROPERTIES OF MEMS MATERIALS: Conductivity of semiconductors, crystal plane and orientation, stress and strain – definition – relationship between tensile stress and stain mechanical properties of silicon and thin films, Flexural beam bending analysis under single loading condition - Types of beam- deflection of beam-longitudinal stain under pure bending spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

UNIT-III	SENSING AND ACTUATION:	Classes: 9
SENSING AND ACTUATION: Electrostatic sensing and actuation-parallel plate capacitor – Application-Inertial, pressure and tactile sensor parallel plate actuator- comb drive. Thermal sensing and Actuations-thermal sensors-Actuators- Applications- Inertial, Flow and Infrared sensors. Piezo resistive sensors piezo resistive sensor material- stress in flexural cantilever and membrane Application-Inertial, pressure, flow and tactile sensor.		
UNIT-IV	**BULK AND SURFACE MICROMACHINING**	**Classes: 9**
BULK AND SURFACE MICROMACHINING: Anisotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), Isotropic wet etching, Basic surface micro machining process-structural and sacrificial material, stiction and antistiction methods, Foundry process.		
UNIT-V	**POLYMER AND OPTICAL MEMS**	**Classes: 9**
POLYMER AND OPTICAL MEMS: Polymers in MEMS- polymide-SU-8 liquid crystal polymer (LCP)-PDMS-PMMA-Parylene- Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMS-passive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.		

Text Books:

1. Chang Liu, ―Foundations of MEMS‖, Pearson International Edition, 2006

Reference Books:

REFERENCE BOOKS:

1. Gaberiel M.Rebiz, ―RF MEMS Theory,Design and Technology‖, John Wiley & Sons,2003
2. Charles P.Poole, Frank J.Owens, ―Introduction to nanotechnology‖ John Wiley & sons, 2003.

Weblink:

https://www.sciencedaily.com/releases/2018/12/181220080013.htm

E Text book

http://www-bsac.eecs.berkeley.edu/projects/ee245/index.htm

MOOCs:

https://nptel.ac.in/courses/117/105/117105082/

INTRODUCTION TO DATA MINING TECHNIQUES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC66	PEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Recall important pattern discovery concepts, methods, and applications, in particular, the basic concepts of pattern discovery, such as frequent pattern, closed pattern, max-pattern, and association rules.
2. Identify efficient pattern mining methods.
3. Compare pattern evaluation issues, especially several popularly used measures and their comparative strengths.
4. Compare mining diverse patterns, including methods for mining multi-level, multi-dimensional patterns, qualitative patterns, negative correlations, compressed and redundancy-aware top-k patterns, and mining long (colossal) patterns.
5. Learn well-known sequential pattern mining methods, including methods for mining sequential patterns.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Analyse the basic concepts, methods, and applications of cluster analysis, including the concept of clustering, the requirements and challenges of cluster analysis.
2. Learn multiple distance or similarity measures for cluster analysis.
3. Learn popular distance-based partitioning algorithms for cluster analysis.
4. Learn hierarchical clustering algorithms, including basic agglomerative and divisive clustering algorithms.
5. Learn the density-based approach to cluster analysis, which can group dense regions of arbitrary shape.

UNIT-I	Introduction to Data Mining	Classes:8

Introduction to Data Mining: Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation, Data Transformation; Measures of Similarity and Dissimilarity- Basics

UNIT-II	Association Rules	Classes: 9

Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set

UNIT-III	Classifications	Classes: 10
Classification: Problem Definition, General Approaches to solving a classification problem , Evaluation of Classifiers , Classification techniques, Decision Trees-Decision tree Construction , Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction ; Naive-Bayes Classifier, Bayesian Belief Networks; K- Nearest neighbour classification-Algorithm and Characteristics.		
UNIT-IV	**Clustering**	**Classes: 10**
Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm; R16 B.TECH IT Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and Weakness; Outlier Detection.		
UNIT-V	**Web and Text Mining**	**Classes: 8**
Web and Text Mining: Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.		

Text Books:

1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers,
 Elsevier Edition, 2006.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
3. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing

Reference Books:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Mining Principles & Applications – T.V Sveresh Kumar, B. Esware Reddy, Jagadish S Kalimani, Elsevier.
3. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press

Weblinks

1.https://www.carritech.com/news/switching-systems-in-telecommunication-networks/

E Textbook

1.http://sirius.cs.put.poznan.pl/~inf89721/Seminarium/Web_Data_Mining__2nd_Edition__Exploring_Hyperlinks__Contents__and_Usage_Data.pdf
2.https://ccsuniversity.ac.in/bridge-library/pdf/EC_8th_Sem_Electronic%20Switching_P_Gnanasivam%20-%20Telecommunication%20Switching%20and%20Networks_2nd-Edition-2008.pdf

MOOCs

1. https://www.coursera.org/specializations/data-mining

PROFESSIONAL ELECTIVES -III

CONTROL SYSTEMS								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC40	PCC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Understand the transfer function model of a systems
2. Assess the system performance using time domain analysis
3. Know the system performance using frequency domain analysis
4. Know the various controllers and compensators
5. Learn the concept of State space analysis

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply different methods to determine the transfer function of both open and closed-loop systems.
2. Calculate the response of a system in the time domain.
3. Use various methods to evaluate the stability of a closed-loop system in the Frequency and S-domain.
4. Design controllers and compensators to enhance system performance.
5. Develop system models using state-space analysis to analyze dynamic system behavior.

UNIT-I	Introduction to control Systems	Classes: 11

Open loop and closed loop control systems. Feedback control systems. Transfer function. Mathematical models-differential equations, impulse response. Electrical systems-examples, Block diagram and signal flow graph with Mason's gain formula analysis.

UNIT-II	Time Response Analysis	Classes: 8

Standard test signals-time response of first order systems-characteristic equation of feedback control systems, transient response of second order systems-time domain specifications-steady state response-steady state errors and error constants-effects of proportional derivative, proportional integral systems.

UNIT-III	Stability Analysis In S-Domain	Classes: 8

The concept of stability-routh's stability criterion-qualitative stability and conditional stability-limitations of routh's stability.

Root Locus Technique: The root locus concept –construction of root loci, lead and lag compensation on root locus technique.

UNIT-IV	Frequency-response analysis	Classes: 10

Introduction, frequency domain specifications, Bode plot, Polar plot, stability in frequency domain. Nyquist plots, Nyquist stability criterion. Compensation techniques- Lead, Lag and lag-lead compensation & their realization in frequency domain.		
UNIT-V	**State variable Analysis for linear and Continuous Systems:**	**Classes: 8**
Concepts of state, state variable, state models, Eigen values and vectors, diagonalization-solving the time invariant state equations-state transition matrix and it's properties, concept of controllability &observability.		
Text Books:		
1. "I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009 2. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.		
Reference Books:		
1. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991. 2. Nagrath&Gopal, "Modern Control Engineering", New Age International, New Delhi		

ARTIFICIAL INTELLIGENCE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5EC41	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

To learn

1. The difference between optimal reasoning vs human like reasoning
2. Understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
3. Different knowledge representation techniques
4. Understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Possess the ability to formulate an efficient problem space for a problem expressed in English.
2. Possess the ability to select a search algorithm for a problem and characterize its time and space complexities.
3. Possess the skill for representing knowledge using the appropriate technique
4. Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing

UNIT-I	INTRODUCTION	Classes 9

Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications. Problem Solving – State-Space Search and Control Strategies: Introduction, General Problem Solving, 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-II	LOGIC CONCEPTS AND LOGIC PROGRAMMING	Classes 9

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.
Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III	EXPERT SYSTEM AND APPLICATIONS	Classes 8

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools.
Uncertainty Measure – Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster - Shafer Theory.

UNIT-IV	MACHINE-LEARNING PARADIGMS	Classes 8
Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering, Support Vector Machines. **Artificial Neural Networks:** Introduction, Artificial Neural Networks, Single-Layer Feed Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.		
UNIT-V	**ADVANCED KNOWLEDGE REPRESENTATION TECHNIQUES**	**Classes 7**
Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, and Universal Networking Knowledge.		

TEXT BOOKS:

1. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004

REFERENCE BOOKS:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Introduction to Artificial Intelligence by Eugene Charniak, Pearson.
3. Introduction to Artificial Intelligence and expert systems Dan W.Patterson. PHI.
4. Artificial Intelligence by George Fluger rearson fifth edition.

WEBLINKS:

https://www.icaew.com/technical/technology/artificial-intelligence/artificial-intelligence-links

E Textbook:

https://www.mygreatlearning.com/blog/artificial-intelligence-books/

MOOC Course:

https://www.simplilearn.com/artificial-intelligence-masters-program-training-course

ASIC DESIGN

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC42	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVE:

The course should enable the students to

1. Learn the ASIC flow
2. Know the basic difference between memories.
3. Learn the synthesis, placement and routing
4. Know the different process in designing ASIC design flow

COURSE OUTCOMES:

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

1. Identify different steps in ASIC flow
2. Synthesize a digital design
3. Do placement and routing of any digital circuits
4. Do entire ASIC flow for the design of digital ICs
5.

UNIT-I	**INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN**	**Classes 8**

Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.

UNIT-II	**PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS**	**Classes 8**

Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT-III	**PROGRAMMABLE ASIC ARCHITECUTRE**	**Classes 9**

Architecture and configuration of Spartan / Cyclone and Virtex / Stratix FPGAs – Micro-Blaze / Nios based embedded systems – Signal probing techniques

UNIT-IV	**LOGIC SYNTHESIS, PLACEMENT AND ROUTING**	**Classes 8**

Logic synthesis - ASIC floor planning- placement and routing – power and clocking strategies.

UNIT-V	**HIGH PERFORMANCE ALGORITHMS FOR ASICS/ SOCS**	**Classes 9**

DAA and computation of FFT and DCT. High performance filters using delta-sigma modulators. Case Studies: Digital camera, SDRAM, High speed data standards.

TEXT BOOKS:
M.J.S.Smith, " Application - Specific Integrated Circuits", Pearson,2003 2. Steve Kilts, "Advanced FPGA Design," Wiley Inter-Science. 3. Roger Woods, John McAllister, Dr. Ying Yi, Gaye Lightbod, "FPGA-based Implementation of Signal Processing Systems", Wiley, 2008 4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", Mc Graw Hill, 1994.
REFERENCE BOOKS:
1. Douglas J. Smith, HDL Chip Design, Madison, AL, USA: Doone Publications, 1996. 2. Jose E. France, Yannis Tsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.
Weblinks: http://www.asic.co.in/Index_files/link.htm **E Textbook:** https://www.intechopen.com/books/application-specific-integrated-circuits-technologies-digital-systems-and-design-methodologies/introductory-chapter-asic-technologies-and-design-techniques **MOOCS:** https://www.mooc-list.com/tags/asic-design

INTERNET OF THINGS AND APPLICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC46	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand the fundamentals of Internet of Things.
2. To learn about the basics of IOT protocols.
3. To build a small low cost embedded system using Raspberry Pi and Arduino board.
4. To apply the concept of Internet of Things in the real world scenario.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
2. Develop web services to access/control IoT devices.
3. Analyze various protocols for IoT
4. Deploy an IoT application.
5. Analyze the applications of IoT in real time scenario

UNIT-I	INTRODUCTION TO IoT	Classes 9

Introduction: Definition, Characteristics of IOT, IOT Architectural view, Physical design of IOT, Logical design of IOT, IOT Enabling technologies, Application of IOT.

UNIT-II	IoT ARCHITECTURE	Classes 9

Domain specific IOT's: Introduction, Home Automation, Cities, Environment, Energy, retail, Logistics, Agriculture, Industry, Health.
Machine-to-machine (M2M): Introduction, Difference between IOT and M2M, SDN (software defined networking) and NFV (network function virtualization) for IOT.

UNIT-III	IOT PROTOCOLS & BUILDING IoT WITH ARDUINO	Classes 9

Developing Internet of things: Introduction, IoT platforms design methodology, Need for IoT systems management

UNIT-IV	BUILDING IoT WITH RASPBERRY PI	Classes 9

IoT Physical devices & End points: Basic building blocks of IoT device, About Board, Raspberry Pi Interfaces, Other IoT devices.

UNIT-V	CASE STUDIES AND REAL – WORLD APPLICATIONS	Classes 9

Case Studies Illustrating IoT design: Home automation, Weather Monitoring, Agriculture, smart Cities

TEXT BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of things(A-Hand-on-Approach)" 1st Edition, Universal Press

REFERENCE BOOKS:

1. Rajkamal,"Internet of Things", Tata McGraw Hill publication
2. Hakima Chaouchi "The Internet of Things: Connecting Objects", Wiley pcation.
3. Charless Bell "MySQL for the Internet of things", Apress publications.
4. Francis dacosta "Rethinking the Internet of things:A scalable Approach to
5. Connecting everything", 1st edition, Apress publications 2013.
6. Donald Norris"The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", McGraw Hill publication.

Web links:

https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT

E-Textbook:

https://www.tableau.com/learn/articles/internet-of-things-books

MOOC Course:

https://mit-online.getsmarter.com/presentations/lp/mit-internet-of-things-online-short-course

PROFESSIONAL ELECTIVES- IV

SPEECH AND AUDIO PROCESSING								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC43	PEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand basic concepts and methodologies for the analysis and modeling of speech signals.
2. Characterize the speech signal as generated by a speech production model.
3. Understand the mechanism of speech and audio perception.
4. Understand the speech compression techniques
5. Perform the analysis of speech signal using STFT.

COURSE OUTCOMES:

Upon successful completion of the course, the student will able to

1. Demonstrate advanced Knowledge in Digital model representation of speech signal.
2. Design and implement algorithms for processing speech and audio signals considering the properties of acoustic signals and human hearing.
3. Analyze speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).
4. Develop a speech compression techniques/ algorithms
5. Analyze complex engineering problems critically for conducting research in speech signal

UNIT-I	BASIC CONCEPTS OF SPEECH PROCESSING	Classes: 9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT-II	SPEECH MODELING	Classes: 9

Speech modelling introduction**,** Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re estimation and Implementation issues.

UNIT-III	SPEECH RECOGNITION	Classes: 9

Speech recognition introduction, Large Vocabulary Continuous Speech Recognition: Architecture of large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT-IV	SPEECH COMPRESSION	Classes: 9

Sampling and Quantization of Speech (PCM) – Adaptive differential PCM – Delta Modulation -Vector Quantization- Linear predictive coding (LPC) – Code excited Linear predictive Coding (CELP)

UNIT-V	SPEECH SYNTHESIS	Classes: 9
Speech synthesis introduction, Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.		

Text Books:

1. Lawrence Rabiner and Biing-Hwang Juang, ―Fundamentals of Speech Recognition‖, Pearson Education, 20

2. Daniel Jurafsky and James H Martin, ―Speech and Language Processing – An Introduction to Natural Lang Processing, Computational Linguistics, and Speech Recognition‖, Pearson Education, 2002

3. Frederick Jelinek, ―Statistical Methods of Speech Recognition‖, MIT Press, 1997

4. Ben Gold and Nelson Morgan Speech and Audio signal processing- processing and perception of speech and John Wiley and sons 2006

Reference Books:

1. Steven W. Smith, ―The Scientist and Engineer‟s Guide to Digital Signal Processing‖, California Technical Publishing, 1997.

2. Thomas F Quatieri, ―Discrete-Time Speech Signal Processing – Principles and Practice‖, Pearson

Education, 2004.

Web links:

http://home.iitk.ac.in/~nnaik/pdf/PPT_AudioSpeech.pdf

E –Text books:

https://onlinelibrary.wiley.com/doi/book/10.1002/9781118142882

MOOCs

https://www.coursera.org/learn/audio-signal-processing

SATELLITE COMMUNICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC44	PEC	3	-	-	3	30	70	100

Course Overview:

This course presents the fundamentals of satellite communications link design and provides an overview of practical considerations. Existing systems are described and analyzed, including direct broadcast satellites, VSAT links, and Earth-orbiting and deep space spacecraft. Topics includes satellite orbits, link analysis, antenna and payload design, interference and propagation effects, modulation techniques, coding, multiple access and Earth station design.

Prerequisite(s): A basic knowledge of analog and digital modulation, basics of random variables and probability distributions is required

Course Objectives:

1. Define the various orbital parameters of satellites, orbital Mechanics and Launchers
2. Know about tracking techniques of satellites and its sub systems
3. Learn about various multiple accessing techniques
4. Create link budgets for an uplink and a downlink for the specified carrier to noise ratio (C/N)
5. Design satellite communication systems using GEO or LEO satellites

Course Outcomes:

After going through this course the student will be able to:

1. Determine the orbital parameters of a satellites, azimuth, elevation angles and visibility of a geostationary satellite from earth stations.
2. Explain the orbital mechanisms, satellite monitoring systems
3. Evaluate and compare the various multiple accessing techniques used in satellite communications systems
4. Design the satellite links for specified C/N and apply the concepts of power test methods for satellite communications
5. Analyze the radio propagation channel, satellite navigation systems

SYLLABUS

UNIT-I Introduction **Classes 9**

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 and Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbital determination, Launches and Launch vehicles, Orbital effects in communication systems performance, Payload, Recent advancements in launch vehicles.

UNIT–II Satellite Subsystems **Classes 8**

Satellite Subsystems: Introduction-Attitude and Orbit control system, Telemetry, Tracking, Commanding and Monitoring, Power Systems, Communication Subsystems, Satellite antennas subsystems, propulsion subsystems Equipment reliability and Space qualification

UNIT-III **Multiple Access**	**Classes 8**
Multiple Accesses: Frequency Division Multiple Access (FDMA), Intermodulation, calculation of C/N. Time Division Multiple Access (TDMA), Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception, TDMA, CDMA.	
UNIT-IV **Satellite Link Design**	**Classes 9**
Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio, Design of downlinks, Uplink design, Design of satellite links for specified C/N, System design examples. Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial Interface, Primary Power test methods.	
UNIT-V **Low Earth Orbit and Geo-Stationary Satellite Systems:**	**Classes 9**
Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit considerations, Coverage and Frequency Consideration, Delay and Throughput considerations, Systems considerations, Operational NGSO Constellation Designs. Satellite Navigation and Global Positioning System: Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS, Signal Levels, GPS Receiver Operation, GPS C/A code accuracy, Differential GPS.	
TEXT BOOKS:	
1. Satellite Communications- Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.	
2. Satellite Communications Engineering- Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud,2nd Edition, Pearson Publications, 2003.	
REFERENCES:	
1. Satellite Communications: Design Principles- M. Richharia, B S publications, 2nd Edition, 2003. 2. Satellite Communication- D.C Agarwal, Khanna Publications, 5th Edition. 3. Fundamentals of Satellite Communications- K.N. Raja Rao, PHI, 2004 4. Satellite Communications- Dennis Roddy, McGraw Hill, 4th Edition, 2009 Weblinks: https://www.britannica.com/technology/satellite-communication E Textbook: https://bookauthority.org/books/best-satellite-communication-books MOOC Course: https://www.coursera.org/learn/satellite-communications	

<table>
<tr><td colspan="9">ROBOTICS PROCESS AUTOMATION</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5EC45</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
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COURSE OBJECTIVES:

1. Recognize what RPA is.
2. Identify processes suitable for RPA.
3. Recognize how RPA is transforming businesses.
4. Indicate the business value of RPA.
5. Identify key considerations in getting started with RPA.

COURSE OUTCOMES:

1. Become adept in automating Windows, web, and Java-based applications
2. Acquire knowledge of fundamental UI automation concepts
3. Gain ability to create and debug workflows using UiPath
4. Master installation of UiPath Studio on Windows
6. Gain ability to implement error exception handling

UNIT-I	**Programming Basics & Recap**	**Classes 7**

Programming Concepts Basics – Understanding the application, Basic Web Concepts, Protocols, Email Clients, Data Structures, Data Tables, Algorithms, Software process.
RPA Basics :History of Automation, What is RPA,RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots.

UNIT-II	**ARPA Advanced Concepts**	**Classes 9**

Standardization of processes, RPA Developemt methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team ,Process Design Document/Solution Design Document, Industries best suited for RPA ,Risks& Challenges with RPA,RPA and emerging ecosystem.

UNIT-III	**Control Flow**	**Classes 9**

Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, about Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity Data Manipulation :Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data.

UNIT-IV	**Advanced Automation concepts and techniques**	**Classes 9**

Image, Text & Advanced Citrix Automation :Introduction to Image & Text ,Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps.

UNIT-V	Introduction to Orchestrator	Classes 9
Tenants, Authentication, Users, Roles, Robots, Environments, Queues & Transactions, Schedules Emerging and Future Trends in IT: Emerging and Future Trends in IT: Artificial Intelligence, Machine Learning, Agent awareness, Natural Language Processing, Computer Vision		
TEXT BOOKS:		
1.Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition 2. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition		
REFERENCE BOOKS:		
1.Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant Paperback –by Richard Murdoch		
Web References: 1.https://www.oreilly.com/library/view/learning-robotic-process/9781788470940/ 2.https://www.ibm.com/cloud/learn/rpa EText books: 1.https://solutionsreview.com/business-process-management/the-top-best-robotic-process-automation-books-you-need-to-read/ MOOCS: 1.https://www.mooc-list.com/tags/rpa		

MACHINE LEARNING TECHNIQUES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5EC67	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To introduce the fundamental concepts of machine learning and its applications
2. To learn the classification, clustering and regression machine learning algorithms
3. To understand the methods of solving real life problems using the machine learning techniques

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Illustrate the basic concepts of machine learning
2. Implement the classification, clustering and regression algorithms
3. Design and implement a method for solving real life problem using a suitable machine learning technique
4. Combine the evidence from two or more models/methods for designing a system.

UNIT-I	INTRODUCTION AND BAYESIAN DECISION THEORY	Classes 10

Machine perception - feature extraction - classification, clustering and regression - design cycle - types of learning, Bayesian decision theory - classifiers, discriminant functions, and decision surfaces - univariate and multivariate normal densities - Bayesian belief networks.

UNIT-II	COMPONENT ANALYSIS AND HIDDEN MARKOV MODELS	Classes 9

Principal component analysis - Linear discriminant analysis - Independent component analysis. Expectation-maximization algorithm - hidden Markov models: Evaluation - decoding - learning.

UNIT-III	CLASSIFICATION ALGORITHMS	Classes 8

Perceptron and back propagation neural network - radial basis function neural network - probabilistic neural network - k-nearest-neighbour rule. Support vector machine: Training - multicategory generalizations. Decision trees: classification and regression tree - random forest.

UNIT-IV	CLUSTERING AND REGRESSION ALGORITHM	Classes 7

k-means clustering - fuzzy k-means clustering - Gaussian mixture models - auto associative neural network. Regression analysis - support vector regression.

UNIT-V	COMBINING MULTIPLE LEARNERS	Classes 8

Generating diverse learners - model combination schemes - voting - error-correcting output codes - bagging - boosting - mixture of experts revisited - stacked generalization - fine-tuning an ensemble - cascading.

TEXT BOOKS:

1. R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", Second edition, John Wiley & Sons, Singapore, 2003.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
3. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

REFERENCE BOOKS:

1. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

Weblinks:

1.https://toloka.ai/academy/coursera?utm_source=google&utm_medium=cpc&utm_campaign=Search_Worldwide_eng_Desktop_B2B_Practical-Crowdsourcing_toloka|12548924772&utm_term=%2Bnptel%20%2Bmachine%20%2Blearning&utm_con

E Textbook:

https://www.kdnuggets.com/2020/04/10-best-machine-learning-textbooks-data-scientists.html

MOOC Course:

https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course

PROFESSIONAL ELECTIVES- V

BIO-MEDICAL INSTRUMENTATION								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC47	PEC	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

PREREQUISITE: Knowledge on Electron devices and Electronic circuits

COURSE OBJECTIVES:

The students are able to:
- To gain knowledge about the various physiological parameters of recording.
- To acquire knowledge on Bio-chemical and non-electrical parameter measurement
- To study about the various assist devices used in the hospitals.
- To gain knowledge about equipment used for physical medicine
- To be familiar with the various recently developed diagnostic and therapeutic techniques.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:
- Discuss the application of electronics in diagnostic and therapeutic area.
- Measure biochemical and various physiological information.
- Describe the working of units which will help to restore normal functioning.
- Acquire knowledge about equipment used for microsurgery and non-invasive techniques

UNIT I — ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING — Classes: 09

The origin of Bio-potentials; bio potential electrodes, biological amplifiers, ECG, EEG, EMG, EOG, PCG, lead systems and recording methods, typical waveforms and signal characteristics

UNIT II — BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT — Classes: 09

pH, PO2, PCO2, colorimeter, Photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, pulse, Blood Cell Counters.

UNIT III — ASSIST DEVICES — Classes: 09

Cardiac pacemakers, DC Defibrillator, Dialyser, Heart lung machine, Tele-stimulators.

UNIT IV — PHYSICAL MEDICINE AND BIOTELEMETRY — Classes: 09

Diathermies-techniques and waveforms, Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Telemetry principles, frequency selection, biotelemetry, Radio-pill, Electrical safety.

UNIT V — IMAGING MODALITIES AND RECENT TRENDS IN MEDICAL INSTRUMENTATION — Classes: 09

Introduction to X-ray, CT, MRI and PET, Thermograph, Endoscopy unit, Laser in medicine, Cryogenic application, Introduction to telemedicine.

TEXTBOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007.

REFERENCES:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA McGraw-Hill, New Delhi, 2003.
2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004
3. L. A. Geddes, L. E. Baker., "Principles of Applied Biomedical Instrumentation", 3rd Edition, John Wiley & Sons Inc., ISBN: 978-0-471-60899-8.
4. Dr.M.Arumugam, "Bio medical Instrumentation", 2nd edition, Anuradha Publications.

Web References:

1. http://library.abes.ac.in/E-Books/BioMedical%20Book%20Full%20Text%20New.pdf
2. https://www.phindia.com/Books/BookDetail/9788120352155/biomedical-instrumentation-and-measurements-ananda

E Text Books

1. https://aip.scitation.org/doi/10.1063/1.1134672
2. http://fa.bme.sut.ac.ir/Downloads/AcademicStaff/3/Courses/4/Medical%20instrumentation%20application%20and%20design%204th.pdf

MOOC Course.

1. https://nptel.ac.in/courses/108/105/108105101/
2. https://nptel.ac.in/courses/108/105/108105091/

CELLULAR MOBILE COMMUNICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC48	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To know the evolution of Mobile communication and cellular concepts to improve capacity of the system.
2. To know the fading mechanism and types of fading and effect of fading on Mobile communication.
3. To know the different types of Equalizers and Diversity techniques.
4. To know the types of channel coding techniques, data transmission modes and services of GSM, CDMA.
5. To know the concepts of Advanced Cellular Systems like 4G, 5G Systems.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Apply the cellular concepts like frequency reuse, hand-off, and interference in practical mobile communication scenarios.
2. Analyze the propagation techniques to calculate link budget using path loss models.
3. Evaluate the different equalization and diversity techniques used in mobile communication systems.
4. Analyze the data transmission techniques used in GSM and CDMA systems.
5. Design the fundamentals of 4G and 5G mobile cellular systems and their implementation.

UNIT I	INTRODUCTION TO MOBILE COMMUNICATION	Classes: 09

Evolution of Mobile Radio Communication, Examples of Wireless Communication Systems. Paging system, Cordless telephones systems, Cellular telephone Systems, Cellular concept: Frequency reuse, Channel Assignment strategies, Hand off strategies. Interference and System capacity, Improving coverage and capacity in cellular systems.

UNIT II	MOBILE RADIO PROPAGATION	Classes: 09

Large Scale Fading : Free space propagation model, Three basic propagation mechanisms, Reflection, Ground Reflection(Two-Ray)Model, Diffraction, Scattering, Practical link budget using path loss models. Small Scale Fading : Multipath Propagation, Types of small scale fading, Parameters of Mobile Multipath channels, Fading effects due to multipath time delay Spread and Doppler spread.

UNIT III	EQUALIZATION AND DIVERSITY TECHNIQUES	Classes: 09

Fundamentals of Equalizers, Linear equalizers, Non-linear equalizers, Decision feedback equalizers, MLSE. Space diversity: MRC, EGC Selection diversity, Polarization diversity, Frequency diversity, Time diversity.

UNIT IV	MOBILE CELLULAR SYSTEMS: GSM, CDMA	Classes: 09

GSM: Historical overview, System overview, The air interface, Logical and physical channels, Synchronization, Coding, Equalizer, Circuit-switched data transmission, Handover.
CDMA: Historical overview, System overview, Air interface, Coding, Spreading and Modulation, Handover.

UNIT V	ADVANCED MOBILE CELLULAR SYSTEMS	Classes: 09

Overview of 4G and its features, 4G Architecture, Overview of 5G requirements, spectrum sharing for 5G, 5G System concepts, Single and multi user MIMO.
TEXT BOOKS: 1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003. 2. Andreas F.Molisch - Wireless Communications, John Wiley, 2nd Edition, 2006. 3. Wei Xiang, Kan Zheng, Xuemin Shen " 5G Mobile Communications" Springer publications-2016 4. AfifOsseiran, Jose F. Monserrat, Patrick Marsch. " 5G Mobile and Wireless Communication Technology" Cambridge University Press-2016
REFERENCE BOOKS: 1. Kamilo Feher - Wireless Digital Communications, PHI, 2003. 2. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995. 3. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.
Web References: 1. http://www.winlab.rutgers.edu/~narayan/Course/Wireless_Revolution/vts%20article.pdf 2. https://m.eet.com/media/1116127/mcclaning_3_pt2.pdf
E Text Books 1. https://www.pearson.com/us/higher-education/program/Rappaport-Wireless-Communications-Principles-and-Practice-2nd-Edition/PGM91547.html 2. https://www.wiley.com/en-in/Wireless+Communications%2C+2nd+Edition-p-9780470741863
MOOC Course 1.https://nptel.ac.in/courses/106/106/106106167/ 2. https://nptel.ac.in/courses/117/104/117104118/

CMOS ANALOG DESIGN								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC49	PEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Understand the fundamentals of analog circuits and MOS device models.
2. Apply the knowledge on various configurations of MOS transistors and feedback concepts
3. Know the different types of noise and different amplifier designs
4. Estimate the concepts of Op-Amp frequency compensation, capacitor switches and PLLs

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Design a simple current mirror.
2. Differentiate the basic difference in the design of amplifiers.
3. Analyze the characteristics of noise and frequency response of the amplifier
4. Design a op-amp and switched capacitor circuits.

UNIT-I	INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS	Classes: 09

Concepts of Analog Design – General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

UNIT-II	AMPLIFIERS AND FEEDBACK	Classes: 09

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response- Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

UNIT-III	FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE	Classes: 09

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascade stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

UNIT-IV	OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION	Classes: 09

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multipole system- Phase margin- Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.		
UNIT-V	**SWITCHED-CAPACITOR FILTERS AND PHASE LOCKED LOOPS**	**Classes: 09**
General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL- Charge pump PLLs – Non ideal Effects in PLLs- Delay locked loops- its Applications.		

TEXT BOOKS:

1. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003
2. Philli Allen and Douglas Holmberg ―CMOS Analog Circuit Design‖ Second Edition, Oxford University Press, 2004

REFERENCE BOOKS:

1. R. Jacob Baker, CMOS circuit design, layout and simulation, revised second edition, IEEE press, 2008.
2. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
3. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer editions).
4. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

Web References:

1.http://www-soc.lip6.fr/~hassan/lec5_freq_resp.pdf
2. https://user.eng.umd.edu/~neil/EE408D_02/Design_Ex/Mixer/mixer.html

E Text Books

1. https://xdevs.com/doc/_Books/ASIC_Design/design%20of%20analog%20cmos%20in egrated%20circuits%20%28razavi-2001%29.pdf
2. https://www.wiley.com/en-us/CMOS:+Circuit+Design,+Layout,+and+Simulation,+3rd+Edition-p-978047089117**9**

MOOC Course

1. https://nptel.ac.in/courses/117/101/117101105/
2. https://nptel.ac.in/courses/117/106/108106105/

ARTIFICIAL NEURAL NETWORKS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EC52	**PEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To organize synaptic connectivity as the basis of neural computation and learning
2. To learn the ideological basics of artificial neural networks
3. To know some application of artificial neural networks
4. Understand the concepts of Perceptron and dynamical theories of recurrent networks
5. To learn how to design and how to supervised and unsupervised artificial neural networks

COURSE OUTCOMES

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

1. Organize synaptic connectivity as the basis of neural computation and learning
2. Apply the ideological basics of artificial neural networks
3. Implement the real time application of artificial neural networks
4. Analyse the Perceptron and dynamical theories of recurrent networks
5. Design and how to supervised and unsupervised artificial neural networks

UNIT-I	INTRODUCTION TO ANN	Classes: 09
Introduction to ANN: Features , structure and working of Biological Neural Network , Trends in Computing Comparison of BNN and ANN. Basics of Artificial Neural Networks -History of neural network research, characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture.		
UNIT-II	**BACK PROPAGATION NETWORKS**	**Classes: 09**
Back propagation networks -Architecture of feed forward network, single layer ANN, multilayer perception, back propagation learning, input - hidden and output layer computation, back propagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.		
UNIT III	**ACTIVATION & SYNAPTIC DYNAMICS**	**Classes: 09**
Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks Basic functional units of ANN for pattern recognition tasks: Basic feed forward, Basic feedback and basic competitive learning neural network. Pattern association, pattern classification and pattern mapping tasks.		
UNIT-IV	**COMPETITIVE LEARNING NEURAL NETWORKS**	**Classes: 09**
Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.		

UNIT-V	APPLICATIONS OF ANN	Classes: 09
Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters. NET Talk: to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation.		

TEXT BOOKS

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. S. Raj sekaran, Vijayalakshmi Pari - Neural networks, Fuzzy logic and Genetic Algorithms
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005

REFERENCE BOOKS:

1.Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995
2. Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press, 1990
3. Journal of Artificial neural networks, Volume 1 – Ablex Publishing corporation , 1994

Web References:

1. https://www.investopedia.com/terms/n/neuralnetwork.asp
2. https://towardsdatascience.com/understanding-neural-networks-19020b75823

E Text Books

1. https://kupdf.net/download/ann-by-byegnanarayanapdf_5ab9885ae2b6f523273f5edb_pdf
2.https://www.spiedigitallibrary.org/ebooks/TT/Artificial-Neural-Networks-AnIntroduction/eISBN-9780819478726/10.1117/3.633187?SSO=1

MOOC Course

1. https://nptel.ac.in/courses/117/105/117105084/
2. https://nptel.ac.in/courses/108/108/108108148/

PROFESSIONAL ELECTIVES- VI

RADAR SYSTEMS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC50	PEC	3	-	-	3	30	70	100

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Analyze the block diagram of RADAR, radar frequency bands, and their applications.
2. Evaluate the concepts of False Alarm Time, Probability, Radar Cross Section, and system losses.
3. Interpret the Doppler Effect and the operation of Continuous Wave (CW) and Frequency Modulated (FM) radars.
4. Differentiate between FM-CW Radar and Multiple Frequency CW Radar systems.
5. Design the parameters and performance of MTI (Moving Target Indicator) and Pulse Doppler Radars.

UNIT-I	BASICS OF RADAR SYSTEMS	Classes: 09

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

UNIT-II	RADAR EQUATION	Classes: 09

SNR, Envelope Detector-False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.

UNIT-III	FM-CW RADAR	Classes: 09

Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar. MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with -Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. MTI versus Pulse Doppler Radar.

UNIT-IV	TRACKING RADAR	Classes: 09

Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar– Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers. Detection of Radar Signals in Noise : Introduction, Matched Filter Receiver –Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Nonmatched Filters, Matched Filter with Non-white Noise .

UNIT-V	RADAR RECEIVERS	Classes: 09
Noise Figure and Noise Temperature. Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.		

TEXT BOOKS:

1. Merrill I. Skolnik, Introduction to Radar Systems –TMH Special Indian Edition,2nd ed., 2007.

REFERENCE BOOKS:

1. Merrill I. Skolnik, Introduction to Radar Systems –Third Edition, Tata McGraw-Hill, 2001.
2. Radar: Principles, Technology, Applications-Byron Edde, Pearson Education.2004.
3. Levanon, N., Radar Principles, Wiley Interscience, 1988.

Web References:

1. https://fas.org/man/dod-101/navy/docs/es310/radarsys/radarsys.htm
2. https://www.jlab.org/ir/MITSeries/V1-1.pdf

E Text Books

1. https://www.jlab.org/ir/MITSeries/V1-1.pdf
2. https://deebak.files.wordpress.com/2009/05/skolnik.pdf
3. https://www.smartzworld.com/notes/radar-system-notes-rs/

MOOC Course

1. https://nptel.ac.in/courses/108/105/108105154/
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee58/

WIRELESS COMMUNICATIONS AND NETWORKS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC51	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To know the Overview and basics of Wireless channels and Communication.
2. To know the types of Multiplexing and Wi-Fi Technology.
3. To know the Concepts of Circuit switched Cellular Systems.
4. To know the Concepts of Packet switched Cellular Systems.
5. To know the Mobility in Cellular Systems and Wireless Personal Area Networks.

COURSE OUTCOMES

1. Understand the radio signal propagation issues and its impact on communication systems.
2. Understand the different multiple access schemes and Wi-Fi Technology.
3. Describe the fundamentals of cellular standards and services.
4. Distinguish the Circuit and Packet switched Cellular Systems.
5. Understand the concepts of different Wireless Networks and Security.

UNIT-I OVERVIEW AND BASICS OF WIRELESS CHANNELS AND COMMUNICATION — Classes: 09

Review of Digital Communications - Cellular Systems from 1G to 3G - Wireless 4G Systems -Components of a Wireless Transmitter and Receiver – Bandwidth, Duplexing, Licensed and Unlicensed Bands - Power, Rate and SNR - Shannon's Capacity, Bandwidth and Power-Limited Regimes - Radio Propagation and Propagation Path-Loss Model: Free-Space Attenuation, Multipath Channel Characteristics, Signal Fading Statistics, Path-Loss Models.

UNIT-II RANDOM ACCESS SYSTEMS AND Wi-Fi — Classes: 09

Types of Multiplexing: Fixed Assignment vs. Statistical Multiplexing - Aloha, Slotted Aloha - Review of Poisson Process and Analysis of Aloha - CSMA with Collision Avoidance and Collision Detection - Wi-Fi: History and Motivation, Architecture - DCF Mode, RTS-CTS, Hidden and Exposed Terminal Problem - 802.11n Enhancements

UNIT-III CIRCUIT-SWITCHED CELLULAR SYSTEMS — Classes: 09

Cellular Concept and Spatial Reuse - Interference-Limited and Coverage-Limited Systems - Frequency Reuse - Cellular vs. Wi-Fi - GSM: Architecture, Voice Support – UMTS: Basics of CDMA, Architecture and Key Channels.

UNIT-IV PACKET-SWITCHED CELLULAR SYSTEMS — Classes: 09

Packet-Switched vs. Circuit-Switched Communication - HSDPA (High Speed Downlink Packet Access) - HSUPA (High Speed Uplink Packet Access) - Introduction to LTE: History, Architecture - OFDM – Uplink and Downlink Communication in LTE

UNIT-V WIRELESS NETWORKS AND SEURITY — Classes: 09

WiMAX: Physical layer, Media access control, Mobility and Networking, Wireless Personal Area Networks (PANS): Bluetooth 802.15.1, Zigbee 802.15.4. , Security: Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.

TEXTBOOKS:

1.V. K. Garg, Wireless Communications and Networking, Morgan Kaufmann, 2007.
2. D. P. Agrawal and Q.A. Zeng, Introduction to Wireless and Mobile Systems, Third Edition, Cengage Learning, 2010.
3. W. Stallings, Wireless Communications & Networks, Second Edition, Prentice Hall, 2004.
4. T. S. Rappaport, Wireless Communications, Second Edition, Prentice Hall, 2002.
5. J. Schiller, Mobile Communications, Second Edition, Addison Wesley, 2003.

REFERENCE BOOKS:

1. Andreaws F. Molisch, Wireless Communications,–Wiley India, 2006.
2. Kamilo Feher ,Wireless Digital Communications, PHI, 1999.
3. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

Web References:

1. https://cis.temple.edu/~wu/teaching/spring2017_files/cell.pdf
2. https://www.electronicshub.org/wireless-transmitter-and-receiver-using-rf-modules/

E Text Books

1. https://www.sciencedirect.com/book/9780123735805/wireless-communications-and-networking
2. http://59.51.24.50:8000/wxwl/Wireless_Communications_&_Networking_Stallings_2nd.pdf

MOOC Course

1. https://nptel.ac.in/courses/117/102/117102062/
2. https://onlinecourses.nptel.ac.in/noc20_ee61/preview

DEEP LEARNING ALGORITHMS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC68	PEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To Understand basics of deep learning
2. To know the various deep learning models
3. To study the realign of high dimensional data using reduction techniques
4. To analyze optimization and generalization in deep learning
5. To know the various deep learning applications

COURSE OUTCOMES:

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

1. Estimate the basics of deep learning algorithms
2. Implement various deep learning models
3. Realign high dimensional data using reduction techniques
4. Analyze optimization and generalization in deep learning
5. Explore the deep learning applications

UNIT-I INTRODUCTION TO MACHINE LEARNING Classes: 09

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT-II DEEP NETWORKS Classes: 09

History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT-III DIMENTIONALITY REDUCTION Classes: 09

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization

UNIT-IV OPTIMIZATION AND GENERALIZATION Classes: 09

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning -Computational & Artificial Neuroscience

UNIT-V DEEP LEARNING APPLICATIONS Classes: 09

Deep Learning applications: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics

TEXT BOOKS:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. 1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.

REFERENCE BOOKS:

1. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Web References:

1. https://towardsdatascience.com/what-is-deep-learning-and-how-does-it-work-2ce44bb692ac
2. https://www.ibm.com/cloud/learn/deep-learning

E Text Books

1. https://www.stat.cmu.edu/~cshalizi/ADAfaEPoV/ADAfaEPoV.pdf
2. https://www.emerald.com/insight/content/doi/10.1108/03684920710743466/full/html

MOOC Course

1. https://nptel.ac.in/courses/106/106/106106184/
2. https://cdala14.com/atyfi9s/design-and-analysis-of-algorithms-nptel-2021

<table>
<tr><td colspan="10">OPTO ELECTRONICS</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5EC53</td><td rowspan="2">PEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
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COURSE OBJECTIVES:

The course should enable the students to:

1. Understanding basic laws and phenomena in the area of Optoelectronics and Lasers
2. Theoretical and practical preparation of students to acquire and apply knowledge and skills in Optoelectronics and Lasers
3. Conducting experiments in laboratory and industrial environment
4. Understand the optical fibre equipment, and data transfer using optical fiber
5. Know about the application of Optoelectronic Modulator.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Learn the fundamental physical and technical base of Optoelectronic systems,
2. Know the basic laws and phenomena that define behaviour of optoelectronic systems,
3. Analyse various premises, approaches procedures and results related to optoelectronic systems,
4. Use optical fibre equipment, and data transfer using optical fiber.
5. Analyse the real components, devices and equipment of optoelectronic systems.

UNIT-I	ELEMENTS OF LIGHT AND SOLID STATE PHYSICS	Classes: 9

ELEMENTS OF LIGHT AND SOLID STATE PHYSICS: Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.

UNIT-II	DISPLAY DEVICES AND LASERS	Classes: 9

DISPLAY DEVICES AND LASERS: Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.

UNIT-III	OPTICAL DETECTION DEVICES	Classes: 9

OPTICAL DETECTION DEVICES: Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.

UNIT-IV	OPTOELECTRONIC MODULATOR	Classes: 9
OPTOELECTRONIC MODULATOR: Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.		
UNIT-V	**OPTOELECTRONIC INTEGRATED CIRCUITS:**	**Classes: 9**
OPTOELECTRONIC INTEGRATED CIRCUITS: Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.		
Text Books: 1. Pallab Bhattacharya ―Semiconductor Opto Electronic Devices‖, Prentice Hall of India Pvt., Ltd., New Delhi, 2006. 2. Jasprit Singh, ―Opto Electronics – As Introduction to Materials and Devices‖, Mc Graw-Hill International Edition, 1998		
Reference Books: 1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005. 2. J. Wilson and J.Haukes, ―Opto Electronics – An Introduction‖, Prentice Hall, 1995		
Web Link: https://www.oe.phy.cam.ac.uk/		
E Text books: https://www.fulviofrisone.com/attachments/article/405/handbook%20of%20optpelecttronics%20vol%20I.pdf		
MOOCS: https://onlinecourses.nptel.ac.in/noc20_ph24/preview		

OPEN ELECTIVES-I

OFFERED BY
AERONAUTICAL DEPARTMENT

FUNDAMENTALS OF AVIONICS

V Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5AE62	**OEC**	L	T	P	C	CIE	SEE	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES

The purpose of this subject is to provide the students with the theoretical background and engineering applications.

1. Overview on Aviation using Electronics
2. Basic understanding about major electronics systems used for communication
3. Basic understanding about major devices, display and flight controls used in aircraft

COURSE OUTCOMES:

At the end of the course the students are able to:

1 To explain the instrumentation used in avionics.
2 To classify various ranges of the communication techniques used in aircraft.
3 To distinguish between network systems, controlling parts & surfaces
4 To compare various principles of navigation systems
To build phenomena of auto pilot control system

UNIT-I	BASICS & FLIGHT DECK AND DISPLAY SYSTEMS

BASICS:Basic principles of Avionics, Typical avionics sub system in civil/ military aircraft and space vehicles.
FLIGHT DECK AND DISPLAY SYSTEMS: Flight deck display technologies, CRT, LED, LCD, Touch screen, Head up display, electronic instrumentation systems.

UNIT-II	COMMUNICATION SYSTEMS

AUDIO AND COMMUNICATION SYSTEMS: Aircraft audio systems, basic audio transmitter and receiver principles, VHFcommunication system, UHF communication systems.

UNIT-III	FREQUENCY RANGING SYSTEM

RANGING AND LANDING SYSTEMS:VHF Omnirange, VOR receiver principles, distance maturity equipment, principles of operation, Instrument landing system, and localizer and glide slope.
POSITIONG SYSTEM: Global positioning system principles, triangulation, position accuracy, applications in aviation

UNIT-IV	NAVIGATION SYSTEM

INERTIAL NAVIGATION SYSTEM: Principle of Operation of INS, navigation over earth, components of inertial Navigation systems, accelerometers, gyros and stabilized platform.
SURVELLIENCE SYSTEM: ATC surveillance systems principles and operation interrogation and replay standards, Collision avoidance system, ground proximity warning system

UNIT-V	AUTO FLIGHT SYSTEM
AUTO FLIGHT SYSTEM: Automatic flight control systems fly by wire and fly by light technologies, flight directorsystems, flight management systems.	

Text Books:

1. N. S. Nagaraja(1996),Elements of electronic navigation, 2nd edition, Tata McGraw Hill, New Delhi.
2. Janes W. Wasson, Jeppesen Sandersen(1994), Avionic systems Operation and maintenance,

Reference Books:

1. Albert Hel Frick (2010), Principle of Avionics, 6th edition, Avionics Communications Inc, India.
2. H. J. Pallet (2010), Aircraft Instrumentation and Integrated systems, Pearson Education, New Delhi.
3. J. Powell (1998), Aircraft Radio Systems, Pitman publishers, London

Web References:

https://www.britannica.com/technology/avionics

https://www.pdc.com/aviation/

E-Text Books:

Advanced Avionics Handbook(FAA)
Digital Avionics: A Computing Perspective - Elisabeth A. Strunk John C. Knight

MOOC Course

https://www.canvas.net/browse/erau/courses/aviation-101

INTRODUCTION TO AEROSPACE TECHNOLOGY

V Semester: OPEN ELECTIVE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE63	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To introduce the basic concepts of Aerospace technology and the current developments in the field.
2. To provide knowledge on the basic principles on which the development of aerodynamics, Structures, propulsion and satellite systems.

UNIT-I HISTORY OF FLIGHT- THE AEROSPACE ENVIRONMENT

Balloons and dirigibles, heavier than air aircraft, commercial air transport, introduction of jet aircraft, helicopters, missiles, conquest of space, commercial use of space, exploring solar system and beyond. Earth's atmosphere, the temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity. The near earth radiative environment. The magnetosphere. Environmental impact on spacecraft. Meteoroids and micrometeoroids, space debris. Planetary environments

UNIT-II AERODYNAMICS AND FLIGHT VEHICLE PROPULSION

Anatomy of the airplane, helicopter, launch vehicles and missiles, space vehicles. Static forces and moments on the vehicle. Understanding engineering models. Aerodynamics of wings and bodies. Generation of lift. Sources of drag. Force and moment coefficients, centre of pressure. Thrust for flight, the propeller, the jet engine, rocket engines- description, principles of operation. Governing equations.

UNIT-III FLIGHT VEHICLE PERFORMANCE AND STABILITY

Performance parameters. Performance in steady flight, cruise, climb, range, endurance; accelerated flight- symmetric manoeuvres, turns, sideslips, take off and landing. Flight vehicle stability- longitudinal, lateral and directional- static, dynamic; trim, control. Handling qualities of airplanes

UNIT-IV SATELLITE SYSTEMS ENGINEERING- HUMAN SPACE EXPLORATION

Satellite missions, an operational satellite system, elements of satellite, satellite subsystems. Satellite structures, mechanisms and materials. Power systems. Communication and telemetry. Thermal control. Attitude determination and control. Propulsion and station keeping. Space missions. Mission objectives. Case studies. Human space flight missions- goals, historical background. The Soviet and US missions. The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle. International Space Station, extravehicular activity

UNIT-V INTRODUCTION TO ENGINEERING DESIGN, AIR TRANSPORTATION

Design as a critical component of engineering education- as a skill- the process, design thinking, design drawing. Design for mission, performance and safety requirements. Concurrent engineering. Computer aided engineering, design project. Example: the lighter-than – air vehicle student design project at MIT. Air Transportation Systems- civil, military- objectives- principal constituents- the vehicle, the ground facilities, the organization- role. Regulation- national and international. Indian effort- civil and military- in the field of Aerospace Engineering.

Text Books:

1. Newman, D., Interactive Aerospace Engineering and Design, (with software and reference material on CD),McGraw-Hill, 2002, ISBN 0-07-112254-0.
2. Anderson, J.D., Introduction to Flight, fifth edition, Tata McGraw-Hill, 2007, ISBN: 0-07-006082

Reference Books:

1. Russell Mikel, Aerospace and Aeronautical Engineering, Willford press, 2017.
2. Ajoykumar Kundu, Mark A Price and David Riordan, Conceptual Design: An Industrial Approach, Wiley-Blackwell, 2019.

COURSE OUTCOMES:

Students should able to

1. Compare the atmosphere conditions of different altitudes for spacecraft system
2. Analyze how lift, drag and thrust are generated and understand which components constitute them
3. Analyze the flight performance parameters with respective stability condition
4. Distinguish the different systems used in a satellite mission
5. Design lighter than air vehicle using Catia software

OPEN ELECTIVES-I

OFFERED BY

COMPUTER SCIENCE AND ENGINEERING

CORE JAVA PROGRAMMING

V SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS30	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce the object oriented programming concepts.
2. To understand object oriented programming concepts, and apply them in solving problems.
3. To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
4. To introduce the implementation of packages and interfaces
5. To introduce the concepts of exception handling and multithreading.
6. To introduce the design of Graphical User Interface using applets and swing controls.

COURSE OUTCOMES:

At the end of the course students are able to

1. Use object-oriented programming concepts to solve real world problems.
2. Demonstrate the user-defined exceptions by exception handling keywords (try, catch, throw, throws, and finally).
3. Use multithreading concepts to develop inter-process communication.
4. Create user-defined packages and use them in real world applications.
5. Build internet-based dynamic applications using the concept of applets.

UNIT-I OPEN CONCEPTS AND JAVA PROGRAMMING

Oops concepts- Procedural and objects oriented programming paradigms, classes and objects,Data abstraction, encapsulation, polymorphism, inheritance, benefits of inheritance.

Java Programming- History of java, data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expression, type conversion and casting , control flow- block scope, condition statements, loops, break, and continue statements, simple java stand alone programs, arrays, constructors, methods, parameter passing, static keyword, access control, this pointer, overloading methods and constructor, recursion, garbage collection, exploring string class

UNIT-II INHERITANCE AND POLYMORPHISM

Inheritance- Inheritance hierarchies super and sub classes, member access rules, super keyword, final keyword, the Object class.

Polymorphism- dynamic binding, method overriding, abstract classes and methods. Interface- Interfaces vs. Abstract classes, defining an interface, implementing interfaces, implementing multiple inheritance using interfaces, extending interfaces.

Inner classes- Uses of inner classes, local inner classes, anonymous inner classes, static inner classes.

UNIT-III PACKAGES, EXCEPTION HANDLING AND FILES

Packages- Defining, Creation and Accessing Packages, Understanding CLASSPATH, importing packages.
Exception handling- Types of errors, benefits of exception handling, classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception sub classes.
Files- streams- byte streams, character streams, text input/output, binary input/output, File management

UNIT-IV	MULTITHREADING AND AWT CONTROLS	

Multithreading- Difference between multiprocessing and multithreading, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, producer consumer problem.
AWT CONTROLS: The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, ScrollBar. Working with Frame class, Colour, Fonts and layout managers.

UNIT-V	GUI PROGRAMMING WITH JAVA AND EVENT HANDLING	

GUI Programming with Java-Introduction to Swing, Hierarchy for Swing components, Swing vs.AWT, Containers- JFrame, JApplet, JDialog, JPanel, JButton,JLabel, JTextField,JtextArea
Event Handling- Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Examples: handling a button click, handling mouse events, Adapter classes.

TEXT BOOKS:

1. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH
2. Java A Beginner's Guide Sixth Edition , Herbert Schildt

REFERENCE BOOKS:

1. Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M. Deitel, PHI.
2. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
3. Thinking in Java, Bruce Eckel, Peason Education
4. Programming in Java, S. Malhotra and S. Choudary, Oxford Univ. Press.

WEB REFERENCES:

1. http://www.math.hcmuns.edu.vn/~hvthao/courses/java_programming/lecture_notes/
2. http://people.alari.ch/derino/Teaching/Java/JavaLectureNotes-Derin.pdf

E-TEXT BOOKS:

1. https://books.google.co.in/books?id=pnwTLvCJKh0C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://books.google.co.in/books?id=8qFDDAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC COURSE

1. http://moocfi.github.io/courses/2013/programming-part-1/
2. https://www.edx.org/learn/java

INTRODUCTION TO DATA ANALYTICS

III B. TECH- I SEMESTER

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5CS22	OEC	L	T	P	C	CIE	SEE	Total
		3	1	-	4	30	70	100

COURSE OBJECTIVES

1. Understand different techniques of Data Analysis.
2. Be familiar with concepts of data streams.
3. Be exposed to data analytics Visualization tools and techniques.
4. Implement statistical and analytical tools and techniques.
5. To analyze the visualization with R-programming.

COURSE OUTCOMES

1. Demonstrate data analytics fundamentals.
2. Create data models and analyze using R Programming
3. Use python libraries as a tool to analyze data
4. Research and justify data wrangling, data integration, and database techniques as relevant to data analytics
5. Perform data visualizations and integrate tableau with python

UNIT - I	INTRODUCTION TO DATA ANALYTICS	CLASSES: 12

Introduction To Data Analytics: Overview, Types of Analysis And Key Steps, Components Of Modern Data Ecosystem, Role Of Data Analyst, Data Engineers, Data Scientist, Business Analyst And Business Intelligence Analyst.

Data Eco-System: Types of Data Structures, File Formats, Sources of Data, Data Professional Languages, Various Data Repositories, ETL Process, Introduction To Big Data, Big Data Ecosystem.

UNIT - II	R & DATA MODELLING	CLASSES: 12

Introduction to R-Programming: Overview, visualization using R, simulation, Code profiling, Statistical Analysis with R, data manipulation, visualization tools with R (Ggplot, Lattice,etc.,)

Data Modelling: SQL Best Practices, Advanced Excel, NoSQL Databases, / Visualization Using Tableau, Visualisation Using PowerBI, Visualization Using Plotly.

UNIT - III	DATA ANALYSIS USING SQL	CLASSES: 12
Data Analysis using SQL, Python for Data Science, Visualization in Python, Exploratory Data Analysis, Maths for Data Science, Inferential Statistics, Hypothesis Testing, Advanced SQL for Data Science.		
UNIT - IV	**GATHERING AND WRANGLING DATA**	**CLASSES: 12**
Gathering And Wrangling Data: Identifying, Gathering and Importing Data From Desperate Sources, Wrangling And Cleaning Data, Tools For Gathering, Importing, Wrangling And Cleaning, Characteristic, Applications And Limitations.		
UNIT - V	**DATA VISUALIZATION**	**CLASSES: 12**
Tableau: Introduction to Tableau, connecting to Excel, CSV Text Files, Product Overview, Connecting to Databases, Working with Data, Analyzing and Generating reports, TabPy: Combining Python and Tableau.		

TEXT BOOKS

1. Data Analytics Made Accessible by Dr. Anil Maheshwari
2. Principles of Data Wrangling, by Joseph M. Hellerstein, Tye Rattenbury, Jeffrey Heer, Sean Kandel, Connor Carreras, Released July 2017
3. Visual Analytics with Tableau by Alexander Loth , Nate Vogel, et al.

REFERENCE BOOKS

1. SQL QuickStart Guide: The Simplified Beginner's Guide to Managing, Analyzing, and Manipulating Data With SQL by Walter Shields
2. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic

OPEN ELECTIVES- I

OFFERED BY DEPARTMENT OF EEE

ELECTRICAL WIRING AND SAFETY MEASURES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE52	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To Study the wiring diagram of residential.
2. To understand the Safety measures of Electrical wiring
3. Apply the Different types of safety rules in Electrical Systems.
4. Design the Different types of Residential Electrification Methods.
5. Identifying Different types of Substations.

Course Outcomes:

The students should be able to

1. To Analyze the safety measures & state safety precautions.
2. To Understand the Different Methods of Earthlings.
3. Apply the Different types of safety rules in Electrical Systems.
4. Design the Different types of Residential Electrification Methods.
5. Identifying Different types of Substations.

SYLLABUS

UNIT-I	BASICS OF ELECTRICAL INSTALLATIONS	Classes: 12

Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, General requirements of electrical installations, testing of installations, Types of loads, Systems of wiring, Service connections, Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT-II	EARTHING	Classes: 08

Introduction & importance, Factors affecting Earth Resistance, Methods of earthling Substation and Transmission tower earthling, Neutral and Earth wire, Transformer Neutral Earthling.

UNIT-III	SAFETY & PREVENTION OF ACCIDENTS	Classes: 08

Definition of terminology used in safety, I.E. Act & statutory regulations for safety of persons &equipments working with electrical installation. Dos & don’ts for substation operators as listed in IS. Meaning & causes of electrical accidents factors on which severity of shock depends.

UNIT-IV	RESIDENTIAL BUILDING ELECTRIFICATION	Classes: 10

General rules guidelines for wiring of Residential Installation and positioning of equipments. Principles of circuit design in lighting and power circuits. Procedures for designing the circuits and deciding the number of sub-circuits. Method of drawing single line diagram & wiring diagram.

UNIT-V	RULES : SUBSTATION AND METERS	Classes: 12

Rule 28: Voltage level definitions. Rule 30: Service lines & apparatus on consumer premises.
Rule 31: Cut-out on consumer's premises.
Rule46: Periodical inspection & testing of consumer's installation.
Rule 47: Testing of consumer's installation.
Rule 54: Declared voltage of supply to consumer.
Rule 55: Declared frequency of supply to consumer.
Rule 56: Sealing of meters &cut-outs.
Rule 77: Clearances above ground of the lowest conductor.
Rule 79: Clearances between conductors & trolley wires.
Rule 87: Lines crossing or approaching each other.
Rule 88: Guarding.

Text Books:

1. K.B. Raina, S.K.Bhattacharya Electrical Design;Estimating and costing New Age International (p) Limited, New Delhi Surjit Singh.
2. Electrical Estimating and costing DhanpatRai and company, New Delhi .J.B.Gupta
3.A course in Electrical Installation, Estimating & costing S.K.Kataria&sons,S.L. Uappal .
4. Electrical wiringEstimating and costing Khanna Publication. ,A.K.Sawhney

Reference Books:

1. Electrical Machine Design DanpatRai& co.
2. The Electricity Rule 2005Universal Law Publishing Co. Pvt. Ltd. N. AlagapanS. Ekambaram
3. Electrical Estimating and costing Tata McGraw Hill Publication, New Delhi ,Surjit Singh
4. TarlokSibgh Installation, Commissioning & Maintenance of Electrical Equipment S.K.Kataria& Sons
5. B.V.S.Rao Operation & Maintenance of Electrical Machines Vol I & II Media Promoters & Publisher Ltd. Mumb

Web References:

1. https://electrical-engineering-portal.com › Technical Articles
2. https://www.st-andrews.ac.uk/staff/policy/healthandsafety/publications/electricalsafety/
3. https://www.cpwd.gov.in/Publication/Internal2013.pdf

E-Text Books:

1. https://books.google.co.in/books?isbn=0323170064
2. https://www.jove.com/science.../electrical-safety-precautions-and-basic-equipment

MOOC Course

1. https://nptel.ac.in/courses/103106071/5
2. https://nptel.ac.in/courses/108108099/28
3. https://nptel.ac.in/courses/124107001/

ELECTRICAL MATERIALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EE53	OEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

Course Objectives:

1. To Analyze the various Conducting materials.
2. To Explain the various Semi conducting materials.
3. To Explain The Dielectrics and Insulators.
4. To Explain the Different Magnetic Materials.
5. To Describe the Optical properties of Fibers

Course Outcomes:

The students should be able to

1. Analyze the various Conducting materials.
2. Explain the various Semi conducting materials.
3. Explain The Dielectrics and Insulators.
4. Explain the Different Magnetic Materials.
5. Describe the Optical properties of Fibers.

SYLLABUS

UNIT-I	CONDUCTORS	Classes: 10

Classification: High conductivity, high resistivity materials, fundamental requirements of high conductivity materials and high resistivity materials, mobility of electron in metals, commonly used high conducting materials, copper, aluminum, bronze brass, properties, characteristics, constantan, platinum, nichrome, properties, characteristics and applications, materials used for contacts.

UNIT-II	SEMICONDUCTORS	Classes: 08

General concepts, energy bands, types of semiconductors, Fermi Dirac distribution, intrinsic Semi-conductors, extrinsic Semi-conductors, hall effect, drift, mobility, diffusion in Semiconductors, and their applications, superconductors.

UNIT-III	DIELECTRICS AND INSULATORS	Classes: 12

Properties of gaseous, liquid and solid dielectric, dielectric as a field medium, electric conduction in gaseous, liquid and solid dielectric, breakdown in dielectric materials,

mechanical and electrical properties of dielectric materials, effect of temperature on dielectric materials, polarization, loss angle and dielectric loss, petroleum based insulating oils, transformer oil, capacitor oils, properties, solid electrical insulating materials, fibrous, paper boards, yarns, cloth tapes, sleeving wood, impregnation, plastics, filling and bounding materials, fibrous, film, mica, rubber, mica based materials, ceramic materials, classification of insulation (solid) and application in AC and DC machines.		
UNIT-IV	**MAGNETIC MATERIALS**	**Classes: 10**
Soft and hard magnetic materials, diamagnetic, paramagnetic and ferromagnetic materials, electric steel, sheet steel, cold rolled grain oriented silicon steel, hot rolled grain oriented silicon steel, hot rolled silicon steel sheet, hysteresis loop, hysteresis loss, magnetic susceptibility, coercive force, curie temperature, magneto-striction.		
UNIT-V	**OPTICAL PROPERTIES OF SOLIDS**	**Classes: 10**
Photo emission, photo emission materials, electro luminPCCence junction diode, photo emitters, photo transistor, photo resistors, injunction lasers, optical properties of semiconductors, application of photo sensitive materials (CRT, Tube light, photo panels etc.).		
Text Books:		
1. "Electrical Engineering Materials",Dekker,PHIPbs. 2. "Electrical Engineering Materials", Indulkar,S.Chand		
Reference Books:		
1. "Electrical Engineering Materials", Tareev 2. "Electrical Engineering Materials", Yu. Koritsky. 3. "Electrical Engineering Materials", R.K.Rajput, LaxmiPbs		
Web References: 1. https://physics.info/dielectrics/ 2. https://www.oxfordreference.com/view/10.1093/oi/authority.20110803095631265 3. *web.mit.edu/course/6/6.732/www/6.732-pt2.pdf*		
E-Text Books: 1. *https://easyengineering.net/electrical-engineering-materials-by-dekker/* 2. https://www.oreilly.com/library/view/dielectric-materials-for/9781118619780/		
MOOC Course 1. *1. https://nptel.ac.in/courses/108108076/* 2. https://nptel.ac.in/courses/112104203/3 3. https://onlinecourses.nptel.ac.in/noc18_ee14/		

OPEN ELECTIVES- I

OFFERED BY DEPARTMENT OF ECE

MICROPROCESSORS AND INTERFACING								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC54	OEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the basic of 8, 16 bit microprocessor architectures and its functionalities.
2. Develop an assembly language programming skills of various processors.
3. Interface different peripheral devices with microprocessors and microcontrollers.
4. Interface memory devices to 8086 processor.
5. Analyze Serial communication schemes of microprocessor based systems.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Understand the architecture of micro processor.
2. Understand the programming model of micro processors.
3. Interface different external peripherals with microprocessors.
4. Analyze a problem and formulate appropriate computing solution for processor based application.
5. Develop an assembly language program for specified application in communication.

UNIT-I	MICROPROCESSORS ARCHITECTURE	Classes: 09
Overview of 8085, 8086 architecture- functional diagram, Register organization, memory segmentation, Memory addresses, physical memory organization.		
UNIT-II	SIGNAL DESCRIPTION OF 8086	Classes: 09
Signal description of 8086, timing diagrams, Interrupt structure of 8086, Vector interrupt table, Interrupts of 8086 Processor, Interrupt service routine.		
UNIT-III	INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086	Classes: 09
Programming model, Addressing modes, Instruction set, Assembler directives, Programs involving logical, branch and call instructions, Sorting, evaluating arithmetic expressions, and string manipulations.		
UNIT-IV	I/O INTERFACE	Classes: 09
Introduction to 8255 PPI, various modes of operation of 8255 PPI, interfacing 8255 to 8086, Stepper motor interfacing, D/A &A/D converter, Memory interfacing to 8086.		
UNIT-V	SERIAL COMMUNICATION INTERFACE	Classes: 09
Serial communication standards, serial data transfer schemes, 8251 USART architecture, Interfacing of 8251/ USART to 8086 Processor.		

Text Books:

1. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006.
3. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.

3. R.S.Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.
Reference Books: 1. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers. 2.Micro computer system 8086/8088 family architecture, programming and design- By Liu and GA Gibson, PHI, 2nd Ed.,
Web References: 1.http://www.freebookcentre.net/electronics-ebooks-download/Microprocessor-and-Microcontroller.html 2.http://coen.boisestate.edu/smloo/smloo-courses/ece-332-microprocessors-fall07/lecture-notes/ 3.http://www.freebookcentre.net/electronics-ebooks-download/Introduction-to-Microcontrollers-Lecture-Notes.html
E-Text Books: 1.http://gen.lib.rus.ec/book/index.php?md5=67C5AC79DC8180A7F0641609D0C7800C 2.http://www.faadooengineers.com/threads/9039-8085-microprocessor-by-RAMESH-GANOKAR-ebook-pdf-download 3.https://e.edim.co/123389964/The_8051_Microcontroller_Architecture_Programming_And_Applications.pdf https://e.edim.co/123389964/A.K._Ray_and_K.M._BhurchandiAdvanced_Microprocessors_and_Peripherals_3e-Tata_Mcgraw_Hill.pdf
MOOC Course 1.https://www.mooc-list.com/tags/microprocessors 2.https://www.coursera.org/courses?query=microprocessor

PRINCIPLES OF COMMUNICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC55	OEC	3	-	-	3	30	70	100

PREREQUISITE: Knowledge on Electron devices and Electronic circuits

COURSE OBJECTIVES:

The students are able to:

1. Describe the basic concepts of analog communication
2. Significance of digital & analog communication
3. Compare the digital modulation techniques
4. Learn the various multiple access techniques
5. Understanding the Satellite and Optical fiber concepts.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

1. Understand the concepts of analog modulations
2. Illustrate the basic concepts of digital modulations.
3. Analyse the various digital modulation methodologies.
4. Distinguish the concepts of multiple access techniques.
5. Differentiate the various orbits and associated satellite launches.

UNIT I — FUNDAMENTALS OF ANALOG COMMUNICATION — Classes: 09

Modulation, Principles of Amplitude Modulation, AM modulator and Demodulator, Types of Amplitude modulation (DSBSC,SSBSC, VSB). Angle modulation FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation.

UNIT II — DIGITAL TRANSMISSION — Classes: 09

Introduction, Sampling theorem, Types of pulse modulations, PCM, companding, differential pulse code modulation, delta modulation, adaptive delta modulation, Inter symbol interference.

UNIT III — DIGITAL MODULATION TECHNIQUES — Classes: 09

Introductions, Shannon limit for information capacity, ASK FSK, BPSK QPSK and DPSK modulators and demodulators, comparison of digital modulation techniques.

UNIT IV — SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES — Classes: 09

Introduction, Pseudo noise sequence, DS spread spectrum with coherent binary PSK, FH spread spectrum, multiple access techniques-FDMA, TDMA and CDMA.

UNIT V — SATELLITE AND OPTICAL COMMUNICATION — Classes: 09

Satellite Communication Systems, Keplers Law, LEO, MEO and GEO Orbits, Link model Optical Communication Systems-Fiber losses-scattering, absorption attenuation and bending losses, types of optical Sources and Detectors.

TEXTBOOKS:

1. Wayne Tomasi, ―Advanced Electronic Communication Systems‖, 6/e, Pearson Education, 2007.
2. Simon Haykin, ―Communication Systems‖, 4th Edition, John Wiley & Sons., 2001.

REFERENCES:

1. H.Taub,D L Schilling, G Saha ,‖Principles of Communication‖3/e,2007.
2. B.P.Lathi,‖Modern Analog And Digital Communication systems‖, 3/e, Oxford University Press, 2007

3. Blake, ―Electronic Communication Systems‖, Thomson Delmar Publications, 2002.
4. Martin S.Roden, ―Analog and Digital Communication System‖, 3rd Edition, PHI, 2002.
5. B.Sklar,‖Digital Communication Fundamentals and Applications‖2/e Pearson Education 2007.

Web References:

1.https://personal.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf
2.Bricker G (2012) 2-D bar codes, Journal of Computing Sciences in Colleges, **28**:1, (25-32), Online publication date: 1-Oct-2012.

E-Text Books:

1. https://books.google.co.in/books/about/Principles_Of_Communication.html?id=6Zunu4Acfg8C

MOOC Course:

1.https://onlinecourses.nptel.ac.in/noc18_ee26/preview

OPEN ELECTIVE-I
OFFERED BY
IT DEPARTMENT

FUNDAMENTALS OF DATA STRUCTURES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT21	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. Impart the basic concepts of data structures and algorithms.
2. Understand concepts linked lists and their applications.
3. Understand basic concepts about stacks, queues and their applications.
4. Understand basic concepts of trees, graphs and their applications.
5. Enable them to write algorithms for sorting and searching and hashing.
6. Use advanced data structures like B-Trees, AVL-trees etc., for efficient problem solving.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Evaluate algorithms in terms of time and memory complexity.
2. Implement basic data structures such as arrays, linked lists, stacks and queues.
3. Solve problem involving graphs, trees and heaps
4. Apply Algorithms for solving problems like sorting and searching.
5. Implement advanced data structures such as B-Trees, Red-Black, and AVL-Trees

UNIT-I	INTRODUCTION TO DATA STRUCTURES	Classes: 12

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations

Introduction to Linear and Non Linear data structures-Singly Linked Lists- Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

UNIT-II	STACKS AND QUEUES	Classes: 10

Stacks-Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation.

Queues-Queue ADT, definition and operations, array and linked Implementations in C, Circular queues-Insertion and deletion operations, Dequeue (Double ended queue)ADT, array and linked implementations in C.

UNIT-III	TREESANDGRAPHS	Classes: 14
Trees – Terminology, Representation of Trees, binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals. Max Priority Queue-ADT- implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap. Graphs , Introduction, Definition, Terminology, Graph ADT, Graph Representations-Adjacency matrix, Adjacency lists, Graph traversals- DFS and BFS.		
UNIT-IV	**SEARCHINGAND SORTING**	**Classes: 12**
Searching- Linear Search, Binary Search, Comparison of search techniques. **Sorting-**Insertion Sort, Selection Sort, Radix Sort, Quick sort, Merge Sort, Heap Sort, Comparison of Sorting methods.		
UNIT-V	**BINARY SEARCH TREES**	**Classes: 12**
Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees- Definition and Examples, Insertion into an AVL Tree, B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Comparison of Search Trees. **Pattern matching algorithm**- The Knuth-Morris-Pratt algorithm, Tries (examples only)		
Text Books:		
1. Fundamentals of Data Structures ‖, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press. 2. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press		
Reference Books:		
1. Algorithms,DataStructures,andProblemSolvingwithC++‖,IllustratedEditionbyMarkAllenWeiss, Addison- Wesley Publishing Company 2. HowtoSolveitbyComputer‖,2ndImpressionbyR.G.Dromey,PearsonEducation		

INTRODUCTION TO MACHINE LEARNING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5IT22	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Understand Basic classification algorithms to classify multivariate data
2. Understand the Neural networks and genetic algorithm
3. Gain knowledge about reinforcement learning
4. Create new machine learning techniques.

COURSE OUTCOMES:

1. Develop and apply Basic classification algorithms to classify multivariate data.
2. Develop and apply regression algorithms for finding relationships between data variables.
3. Develop and apply reinforcement learning algorithms for learning to control complex systems.
4. Write scientific reports on computational machine learning methods, results and conclusions.

UNIT – I	INTRODUCTION	CLASSES: 12

Introduction: Basic Definitions, Types of Learning, Learning Problems Perspectives and Issues, Hypothesis, Concept Learning, Version Spaces and Candidate Eliminations, Inductive bias – Decision Tree learning – Representation – Algorithm, issues.

UNIT – II	ARTIFICIAL NEURAL NETWORKS AND GENETIC ALGORITHMS	CLASSES: 12

ARTIFICIAL NEURAL NETWORKS : Neural Network Representation Problems Perceptions Multilayer Networks and Back Propagation Algorithms-Remarks-Advanced Topics.

GENETIC ALGORITHMS : Genetic Algorithms Hypothesis Space Search

UNIT – III	BAYESIAN CONCEPTS	CLASSES: 12

BAYESIAN CONCEPTS: Bayes Theorem Concept Learning Maximum Likelihood Minimum Description Length Principle Bayes Optimal Classifier Gibbs Algorithm Naïve Bayes Classifier Bayesian Belief Network, EM Algorithm

UNIT – IV	INSTANCE BASED LEARNING	CLASSES: 14
K- Nearest Neighbor Learning-Remarks, Locally weighted Regression, Radial Bases Function-, Case Based Learning-Remarks.		
UNIT – V	**ADVACENED LEARNING CONCEPTS**	**CLASSES: 10**
Learning Sets of Rules Sequential Covering Algorithm Learning Rule Set First Order Rules Sets of First Order Rules, Reinforcement Learning Task Learning Temporal Difference Learning.		

TEXT BOOKS

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill, 2010

REFERENCE BOOKS:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition
2. Introduction to Machine Learning with Python-nora
3. INTRODUCTION TO MACHINE LEARNING
4. Introduction to Machine Learning The Wikipedia Guide

OPEN ELECTIVE-I

OFFERED BY

MECHANICAL ENGINEERING DEPARTMENT

FUNDAMENTALS OF ENGINEERING MATERIALS

V Semester: OPEN ELECTIVE - I

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5ME72	OEC	L	T	P	C	CIE	SEE	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

This course will enable students to understand basic structure and crystal arrangement of materials, the phase diagrams, advantages of heat treatment, various heat treatment processes, the need and application of composite materials.

COURSE OUTCOMES:

At the end of course students are able to

1. Explain basic concepts of crystal structure such as unit cells, crystal systems of metals etc.
2. Demonstrate the concept of alloying and formation of different types of phases in alloys.
3. Differentiate ferrous and non ferrous alloys.
4. Explain various heat treatment processes.
5. Classify and explain polymers, ceramics and composites.

UNIT-I CRYSTAL STRUCTURE

Unit cell, Crystal systems of metals and slip systems. Imperfection in solids: Point, line, surface and volume defects; dislocation movement, strengthening mechanisms.

Determination of grain size, effect of grain size on the properties of alloys.

UNIT-II ALLOYS & PHASE DIAGRAMS

Alloys- substitutional and interstitial solid solutions.
Phase diagrams: Interpretation of binary phase diagrams and microstructure development; Reactions involved in Phase diagrams: eutectic, peritectic, peritectoid and monotectic reactions. Iron and Iron-carbide phase diagram, microstructure development of steels and cast irons.

UNIT-III FERROUS AND NON FERROUS ALLOYS

Alloying of steel, properties of stainless steel and tool steels, maraging steels; cast irons-grey, white, malleable and spheroidal cast irons.
copper and copper alloys- brass, bronze and cupro-nickel; Aluminium and Aluminium alloys.

UNIT-IV HEAT TREATMENT OF STEEL

Annealing, Normalizing, Hardening: Case hardening, carburizing, Nitriding, Cyaniding, Carbo-nitriding, flame and induction hardening, vacuum and plasma hardening, Tempering, and spheroidising, austempering, martempering,

UNIT-V	POLYMERS, CERAMICS AND COMPOSITES
Classification, properties and applications of polymers, ceramics, composites and nano materials.	

Text Books:

1. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
2. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.
3. Sidney H. Avener (2007,) *Introduction to Physical Metallurgy*, 2nd edition, Tata McGraw hill education (P) Ltd, New Delhi, India.

Reference Books:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. D. Kodgire (2006), Material Science and Metallurgy for engineers, 1st Edition, Everest, Pune, India.

Web References:

1. ptel.ac.in/courses/113/102/113102080/
2. https://www.edx.org/course/materials-science-and-engineering

E-Text Books:

1.https://books.google.co.in/books?id=XXE8BAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2.https://books.google.co.in/books?id=kBM8BAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC Course:

1. https://ocw.mit.edu/courses/materials-science-and-engineering/
2. https://www.mooc-list.com/tags/materials-science

OPEN ELECTIVE I

OFFERED BY

DEPARTMENT OF SCIENCE AND HUMANTIES

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5HS06	**OEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

To enable the student to understand and appreciate, with a particular insight, the importance of certain basic issues governing the business operations namely; demand and supply, production function, cost analysis, markets, forms of business organizations, capital budgeting and financial accounting and financial analysis.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Understand the market dynamics namely, demand and supply, demand forecasting, elasticity of demand and supply, pricing methods and pricing in different market structures.
2. Gain an insight into how production function is carried out to achieve least cost combination of inputs and cost analysis.
3. Develop and understanding of Analyze how capital budgeting decisions are carried out.
4. Understanding the framework for both manual and computerized accounting process
5. Know how to analyze and interpret the financial statements through ratio analysis.

UNIT-I **Classes: 09**

Introduction & Demand Analysis: Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

UNIT-II **Classes: 09**

Production & Cost Analysis: Production Function - Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT-III **Classes: 09**

Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect

Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, New Economic Environment: Changing Business Environment in Post-liberalization scenario.

UNIT-IV		Classes: 09

Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of return (ARR) and Net Present Value Method (simple problems).

UNIT-V		Classes: 09

Introduction to Financial Accounting & Financial Analysis: Accounting concepts and Conventions - Introduction IFRS - Double - Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trasing Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios. Du Pont Chart.

Text Books:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age international Publishers, Hyderabad 2013.
3. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, 2012.

Reference Books:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi, 2012.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, Pearson, 2012.
3. Lipsey & Chrystel, Economics, Oxford University Press, 2012.
4. Domnick Salvatore: Managerial Economics In a Global Economy, Thomson, 2012.
5. Narayanaswamy: Financial Accounting - A Managerial Perspective, Pearson, 2012.
6. S.N. Maheswari & S.K. Maheswari, Financial Accounting, Vikas, 2012.
7. Truet and Truet: Managerial Economics: Analysis, Problems and Cases, Wiley, 2012.
8. Dwivedi: Managerial Economics, Vikas, 2012.
9. Shailaja & Usha: MEFA, University Press, 2012.
10. Aryasri: Managerial Economics and Financial Analysis, TMH, 2012.
11. Vijay Kumar & Appa Rao, Managerial Economics & Financial Analysis, Cengage 2011.
12. J.V. Prabhakar Rao & P.V. Rao, Managerial Economics & Financial Analysis, Maruthi Publishers, 2011.

BASIC OF ENTREPRENEURHIP

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5HS07	OEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	25	75	100

COURSE OBJECTIVES:

The course should enable the students to:

The curriculum helps students

1. Understand and **discover** entrepreneurship
2. Build a strong foundation for students to **start**, **build**, and **grow** a viable and sustainable venture
3. Develop an entrepreneurial outlook and **mindset**, critical **skills** and **knowledge**
4. Mitigate three types of **risks:** Customer, Business Model, and Product/Technical

UNIT-I	DISCOVER YOURSELF AND IDENTIFY PROBLEMS WORTH SOLVING	Classes: 10

Discover Yourself: Find your flow, Effectuation, Case Study: Tristan Walker: The extroverted introvert, Identify your entrepreneurial style.

Identify Problems Worth Solving: What is a business opportunity and how to identify it, Find problems around you that are worth solving, Methods for finding and understanding problems - (Observation, Questioning, DT, Jobs to be done (JTBD), How to run problem interviews to understand the customer's worldview, Introduction to Design Thinking – Process and Examples,

Generate ideas that are potential solutions to the problem identified – DISRUPT, Class Presentation: Present the problem you "love"

UNIT-II	CUSTOMER, BUSINESS MODEL, VALIDATION	Classes: 10

CUSTOMER :Identify Your Customer Segments and Early Adopters - The difference between a consumer and a customer (decision maker), Market Types, Segmentation and Targeting, Defining the personas; Understanding Early Adopters and Customer Adoption Patterns, Identify the innovators and early adopters for your startup; Craft Your Value Proposition - Come up with creative solutions for the identified problems, Deep dive into Gains, Pains and “Jobs-To- Be-Done” (using Value Proposition Canvas, or VPC), Identify the UVP of your solution using the Value Proposition section of the VPC, Outcome-Driven Innovation, Class Presentation: Communicating the Value Proposition- 1 min Customer Pitch .

BUSINESS MODEL: Get Started with Lean Canvas.

VALIDATION: Develop the Solution, Sizing the Opportunity, Building an MVP.

UNIT-III	MONEY AND TEAM	Classes: 12
MONEY: Revenue Streams - Basics of how companies make money, Understand income, costs, gross and net margins, Identify primary and secondary revenue, streams ; Pricing and Costs - Value, price, and costs; Different pricing, Understand product costs and operations costs; Basics of unit costing strategies; Financing Your New Venture - How to finance business ideas, Various sources of funds available to an entrepreneur and pros and cons of each, What investors expect from you, Practice Pitching to Investors and Corporates. **TEAM:** Team Building - Shared Leadership, Role of a good team in a venture's success; What to look for in a team; How do you ensure there is a good fit? Defining clear roles and responsibilities, How to pitch to candidates to join your startup, Explore collaboration tools and techniques - Brainstorming, Mind mapping, Kanban Board, Slack.		
UNIT-IV	**MARKETING & SALES**	**Classes: 10**
MARKETING & SALES: Positioning - Understand the difference between product and brand and the link between them, Define the positioning statement for your product/service and how it should translate into what your customers should see about that brand in the market place. **Channels & Strategy:** Building Digital Presence and leveraging Social media, Creating your company profile page, Measuring the effectiveness of selected channels, Budgeting and planning.		
UNIT-V	**PLANNING & TRACKING**	**Classes: 08**
Sales Planning : Understanding why customers buy and how buying decisions are made; Listening, Sales planning, setting targets, Unique Sales Proposition (USP); Art of the sales pitch (focus on customers' needs, not on product features, Follow-up and closing a sale; Asking for the sale **Planning & Tracking:** Importance of project management to launch and track progress, Understanding time management, workflow, and delegation of tasks. **Business Regulation:** Basics of business regulations of starting and operating a business; Importance of being compliant and keeping proper documentation, How to find help to get started.		
Text Books:		
Reference Books:		

OPEN ELECTIVE -II

OFFERED BY
AERONAUTICAL DEPARTMENT

INTRODUCTION TO JETS AND ROCKETS

VI Semester: OPEN ELECTIVE -II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE64	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The course is intended to serve as an introduction to air breathing propulsion systems and Rocket Propulsion Systems.

1. Illustrate an overview of aerospace propulsion system.
2. Identify the foundation in fundamentals of thermodynamics.
3. Compare the ideal components and characteristics of jet engine
4. Interpret the performance of nozzles
5. Simplify the ideal performance analysis of rocket engines.
6. Select appropriate fuel for aerospace application.

UNIT-I — INTRODUCTION TO AEROSPACE PROPULSION

Propulsion system, Propulsive Systems – Evolution, Development, Growth and Challenges. Fundamentals of Thermodynamics – Variables, Thermodynamic Process, Introduction to IC Engines and Reciprocating Engines, Propellers and Working of Propellers.

UNIT-II — PRINCIPLES OF JET PROPULSION

Fundamentals of jet propulsion, Working Principle, Analysis of Ideal Jet Engine cycle, Engine components- merit-significance- ideal component characteristics, Classification – turbo jet, turbo fan, turbo prop and Ramjet engines. Basic Problems based on Engine Cycle.

UNIT-III — RAMJET, SCRAMJET ENGINES AND NOZZLES

Speed limitations of gas turbines, Basics of Ramjets, Combustors for liquid fuel ramjet engines, Combustion Instability and its Suppression, Solid fuel Ramjet Engines, SCRAM jet engines, Applications of RAM Jet and SCRAM Jet Engines to Missiles with Examples, Nozzles- Types of Nozzles, Converging-Diverging Nozzle, Variable Nozzle and Effects of Pressure Ratios on Engine Performance.

UNIT-IV — ROCKET THEORY

Applications of Rockets, Types of Rockets, Basics of Thermal Rocket Engine-Thermodynamics and Ideal Performance Analysis, Equations of motion-Rocket Motion in free space, Tsiokovsky's equation, Rocket Parameters, Burnout range, Burnout Velocity. Practical Problems

UNIT-V — PROPELLANT ROCKETS

Solid Propulsion-Solid Propellant Rockets, Basic Configuration and Performance, Propellant Grain and Configuration, Propellant Characteristics Combustion Chamber, Ignition Process Liquid Propulsion - Design consideration of liquid rocket combustion chamber, injector, and propellant feed lines, valves, propellant tank outlet and helium pressurized and turbine feed systems-.BIO Fuels and Impact on the Atmosphere, Aviation turbine fuels - Requirements of aviation fuels of kerosene type.

Text Books:

1. Mechanics and Thermodynamics of Propulsion – Philip G Hill & Carl R Peterson , Pearson Publication – 2ndEdt
2. Rocket Propulsion Elements, Sutton, G.P., John Wiley, 1993.

Reference Books:

1.The Jet Engine – Rolls Royce
2. Gas Turbines and Jet and Rocket Propulsion, M. L. Mathur, R. P. Sharma, Standard Publishers Distributors.

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Explain the complexity in working of various engines
2. Interpret the elementary principles of thermodynamic cycles as applied to propulsion analysis
3. Analyze the process involved in individual components
4. Compare the nozzles with various operating conditions.
5. Determine Equations of motion in free space, Tsiokovsky's equation.
6. Classify the types of fuel in aviation and aerospace engineering.

NON-DESTRUCTIVE TESTING METHODS

VI Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE65	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

1.To impart knowledge about the non-destructive testing methods.
2. To provide knowledge on the selection of NDT methods for application in engineering industries.
3. Classify the various NDT methods for detecting defects in the structural components.
4. Judge defects basing on data representation of testing

UNIT-I SURFACE TECHNIQUES

Introduction to non-destructive testing (NDT) - importance of NDT techniques - types of NDTtechniques - ASME, ASTM, AWS, BIS, SAE standard sample specifications - visual testing (directand remote visual inspection) - principle and types of liquid penetrant tests (LPT) - properties ofliquid penetrants and developers - advantages and limitations of LPT - applications of LPT.

UNIT-II MAGNETIC PARTICLE TESTING

Introduction to magnetic particle testing (MPT) - magnetization methods - dry particle and wetfluorescent particle techniques - demagnetization - advantages and limitations of MPT - magnetic fluxleakage testing - principle, instrumentation and applications of electromagnetic induction techniquesand eddy current testing (ECT) method.

UNIT-III ULTRASONIC TESTING

Introduction to ultrasonic testing (UT) - characteristics of ultrasonic waves - principle of UT –UTprobes - UT inspection methods (pulse echo, transmission and phased array techniques, PAUT) -types of scanning and displays - application of UT for welded parts.

UNIT-IV RADIOGRAPHY TESTING

Introduction to radiography testing (RT) - sources of X-rays and Gamma rays - characteristics of Xraysand Gamma rays (absorption, scattering) - filters and screens - film radiography and digitalradiography (shadow formation, exposure factors, film handling and storage) - inverse square law -exposure charts - penetrameters - safety issues.

UNIT-V SPECIAL TECHNIQUES

Acoustic emission testing (AET) principle, advantages, limitations - instrumentation and application of AET - infra red thermography (IRT) - contact and non-contact inspection methods - pressure and leak detection - LASER shearography - acoustic holography.

Text Books:

1. Baldev Raj, T. Jayakumar, M. Thavasimuthu, "Practical Non-Destructive Testing", Narosa Publishing, London, 2012.
2. Paul E. Mix, "Introduction to Non Destructive Testing", A Training Guide, Wiley- Interscience, New Jersey, USA, June 2005.

Reference Books:

1. ASM Metals Handbook, V-17, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 2001
2. W.T. Mc Gonnagle, "Non-Destructive Testing", McGraw Hill Book Co., USA, 2013.
3. Louis Cartz, "Non-Destructive Testing", ASM International, Metals Park Ohio, US, 2007.
4. Barry Hull and Vernon John, "Non Destructive Testing", ELBS/Macmillan, Hampshire, UK, 2015.

Web References:

https://inspectioneering.com/tag/nondestructive+testing
https://www.element.com/materials-testing-services/non-destructive-testing-and-inspection
https://www.twi-global.com/technical-knowledge/faqs/what-is-non-destructive-testing

E-Text Books:

1. Nondestructive Testing Methods and New Applications by Mohammed Omar, Intech, 2012.
2. Non-Destructive Testing by S Ramachandran, A Anderson and T Rajasanthosh Kumar, Airwalk Publications, 2017, Kindle Edition.

MOOC Course

https://nptel.ac.in/courses/113106070/

COURSE OUTCOMES:

1. Recognize various non-destructive techniques for engineering industries.
2. Select appropriate non-destructive technique for defects detection in manufactured/operating parts.
3. Perform inspection using major non-destructive testing methods.
4. Understand the importance and application of NDT in Aerospace structural analysis
5. Determine the defects basing on the principal of radiography

OPEN ELECTIVES-II
OFFERED BY
COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><th colspan="9">FUNDAMENTALS OF DBMS</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">A5CS31</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIE</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
</table>

COURSE OVERVIEW:

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business, scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

COURSE OBJECTIVES:

The course should enable the students to:

1. **Discuss** the basic database concepts, applications, data models, schemas and instances.
2. **Design** Entity Relationship model for a database.
3. **Demonstrate** the use of constraints and relational algebra operations.
4. **Describe** the basics of SQL and construct queries using SQL
5. **Understand** the importance of normalization in databases.
6. **Demonstrate** the basic concepts of transaction processing and concurrency control.
7. **Understand** the concepts of database storage structures and identify the access techniques.

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Use the basic concepts of Database Systems in Database design
2. Apply SQL queries to interact with Database
3. Apply normalization on database design to eliminate anomalies
4. Analyze database transactions and can control them by applying ACID properties
5. Analyze physical database storage system of database.

GROUP OF INSTITUTIONS

UNIT-I

Introduction: Database system applications, Database system Vs file systems, Advantage of a DBMS, Describing and storing data in a DBMS, Structure of a DBMS, People who work with databases.

Entity Relationship Model (ER Model): Database Design and ER Diagrams, Entities Attributes and Entity sets, Features of ER Model, Conceptual design with the ER model.

UNIT-II

Introduction to relational model: Structure of Relational Databases, Database Schema,Types of Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition language, Basic Structure of SQL Queries, Basic operations, Set Operations, NULL Values, Aggregate Functions, Nested Sub Queries, JOIN Expressions, Views, Transactions, Integrity Constraints, SQL Data types and Schemas, Functions , Triggers.

UNIT-III

Relational Algebra and Calculus: Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus.

Schema Refinement and Normal Forms:

Introduction to schema refinement, Functional Dependencies, Reasoning about FDs, Normal Forms: 1NF, 2NF, 3NF, Boyce Codd Normal Form, Properties of decompositions, Multi valued Dependencies, Fourth Normal Form, Join Dependencies and Fifth Normal Form.		
UNIT-IV		
Transaction Management: Transaction Concept, A simple transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation. **Concurrency Control and Recovery System:** Lock based protocols, Deadlock handling, Multiple granularity, Time stamp based protocols, Validation based protocols. Failure Classification, Storage, Recovery and Atomicity, Failure with Non-volatile Storage, Remote backup systems.		
UNIT-V		
Storage and File Structure: Overview of Physical Storage Media, Magnetic Disk and Flash Storage, RAID, Tertiary Storage, File Organization, Organization of Records in Files, Data Dictionary storage. **Indexing and Hashing:** Basic Concepts, Ordered Indices, B+ Tree Index Files, Multiple Key access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.		

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.
2. Raghurama Krishnan, Johannes Gehrke, “Data base Management Systems”, TATA McGraw Hill, 3rd Edition, 2007.
3. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2013.

REFERENCE BOOKS:

1. Peter Rob, Carlos Coronel, Database Systems Design Implementation and Management, 7th edition, 2009.
2. Scott Urman, Michael McLaughlin, Ron Hardman, “Oracle database 10g PL/SQL programming “, 6th edition, Tata McGraw Hill,2010
3. .K.Singh, “Database Systems Concepts, Design and Applications”, First edition, Pearson Education, 2006.
4. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson / Addision wesley, 2007.

WEB REFERENCES:

1. http://www.learndb.com/databases/how-to-convert-er-diagram-to-relational-database
2. https://www.w3schools.com/sql/sql_create_table.asp
3. http://www.edugrabs.com/conversion-of-er-model-to-relational-model/?upm_export=print
4. http://ssyu.im.ncnu.edu.tw/course/CSDB/chap14.pdf
5. http://web.cs.ucdavis.edu/~green/courses/ecs165a-w11/8-query.pdf

E-TEXT BOOKS:

1. http://www.freebookcentre.net/Database/Free-Database-Systems-Books-Download.html
2. http://www.ddegjust.ac.in/studymaterial/mca-3/ms-11.pdf

MOOC Course

1. https://www.mooc-list.com/tags/dbms-extensions
2. https://onlinecourses.nptel.ac.in/noc18_cs15/preview

Introduction to Design & Analysis of Algorithms

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5CS07	OEC	L	T	P	C	CIE	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. To demonstrate performance of algorithms with respect to time and space complexity.
2. To explain graph and tree traversals.
3. To explain the concepts greedy method and dynamic programming. Applying for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP and so on respectively.
4. To illustrate the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively.

COURSE OUTCOMES:

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

1. Identify various Time and Space complexities of various algorithms
2. Apply Divide and conquer and Greedy Algorithms to solve various problems
3. Understand Tree Traversal method and Apply Dynamic Programming concept to solve various problems
4. Apply Backtracking concept to solve various problems
5. Apply Branch and Bound concept to solve various problems

UNIT-I	INTRODUCTION	CLASSES: 10

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis ofcomplexity bounds – best, average and worst-case behavior; Performance measurements ofAlgorithm, Time and space trade-offs, Analysis of recursive algorithms throughrecurrence relations: Substitution methodand Masters' theorem.

UNIT-II	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part I	CLASSES: 10

DIVIDE AND CONQUER: General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs.

GREEDY METHOD: Heuristics –characteristics, Applications-job sequencing with deadlines, 0/1 knapsack problem, minimum cost spanning trees, Single source shortest path problem.

UNIT-III	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part II	CLASSES: 10

GRAPHS (Algorithm and Analysis): Breadth first search and traversal, Depth first search and traversal, Spanning trees, connected components and bi-connected components, Articulation points.

DYNAMIC PROGRAMMING: General method, applications - 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem.

UNIT-IV	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part III	CLASSES: 10

BACKTRACKING: Heuristics –characteristics, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles.

UNIT- V	FUNDAMENTAL ALGORITHMIC STRATEGIES – Part IV	CLASSES: 10

BRANCH AND BOUND: General method, applications - travelling sales person problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution.

TEXT BOOKS:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

REFERENCE BOOKS:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,Reading, MA.

WEB REFERENCES:

1. https://www.hackerrank.com/domains/algorithms
2. https://discuss.codechef.com/questions/48877/data-structures-and-algorithms
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algo rithms_tutorial.pdf
4. http://nptel.ac.in/courses/106101060/

E-TEXT BOOKS:

1. http://www.trips-to-morocco.com/introduction-to-algorithms-3rd-edition-mit-press-english.pdf
2. https://comsciers.files.wordpress.com/2015/12/horowitz-and-sahani-fundamentals-of-computer-algorithms-2nd-edition.pdf
3. https://doc.lagout.org/science/0_Computer%20Science/2_Algorithms/Algorithm%20Design_%20Foundations%2C%20Analysis%2C%20and%20Internet%20Examples%20%5BGoodrich%20%26%20Tamassia%202001%5D.pdf

MOOC COURSE:

1. https://onlinecourses.nptel.ac.in/noc17_cs27/preview
2. https://www.coursera.org/courses?languages=en&query=Algorithm+design+and+analysis

OPEN ELECTIVES- II

OFFERED BY DEPARTMENT OF EEE

ANALYSIS OF LINEAR SYSTEMS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5EE56	**OEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**

Course Objectives:

1. To develop ability to analyze linear systems and signals
2. To develop critical understanding of mathematical methods to analyze linear systems and signals.
3. To Explain the Laplace Transformation techniques
4. To Explain the Sampling of Signals.
5. To Analyze the Z-Transforms.

Course Outcomes:

1. Explain the State Space Analysis of Simple Networks.
2. Analyze the Fourier series and Transformation.
3. Explain the Laplace Transformation techniques.
4. Explain the Sampling of Signals.
5. Analyze the Z-Transforms.

SYLLABUS

UNIT-I	STATE VARIABLE ANALYSIS	Classes: 08

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

UNIT-II	FOURIER SERIES AND FOURIER TRANSFORM REPRESENTATION	Classes: 12

Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Fourier integrals and transforms, Fourier transform of a periodic function , Properties of Fourier Transform , Parseval's theorem , Fourier transform of some common signals, Fourier transform relationship with Laplace Transform. Applications of Fourier series and Fourier Transform Representation: Introduction, Effective value, and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.

UNIT-III	LAPLACE TRANSFORM APPLICATIONS	Classes: 10

Application of Laplace transform Methods of Ananlysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications Testing of Polynomials: Elements of realisability – Hurwitz polynomials-positive real functions-Properties-Testing-Sturm's Test, examples. Network Synthesis: Network synthesis: Synthesis of one port LC networks-Foster and Cauer methods-Synthesis of RL and RC one port networks-Foster and Cauer methods

UNIT-IV	SAMPLING	Classes: 10
Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.		
UNIT-V	Z-TRANSFORMS	Classes: 10
Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z Transform of a discrete sequence. Distinction between Laplace, Fourier, and Z-Transforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.		

Text Books:

1. B. P. Lathi”, “Signals, Systems and Communications”, BS Publications 2003.
2. “UmeshSinha” “Network Analysis and Synthesis”, SatyaPrakashan Publications, 2013.

Reference Books:

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

Web References:

1. https://archive.org/details/introductiontoli00brow
2. https://ieeexplore.ieee.org/iel5/9/24171/01101971.pdf

E-Text Books:

1. www.cds.caltech.edu/~murray/books/AM08/pdf/am08-complete_04Mar10.pdf
2. https://www.springer.com/gp/book/9780387975733

MOOC Course:

1. www.nptelvideos.in/2012/11/estimation-of-signals-and-systems.html
2. https://nptel.ac.in/courses/108104100/6

NEURAL NETWORKS AND FUZZY LOGIC

III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE57	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To understand the fundamental theory and concepts of neural networks, neuro-modeling, several neural network paradigms and its applications.
2. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.
3. To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.

Course Outcomes:

The students should be able to

1. Comprehend the concepts of feed forward neural networks
2. Analyze the various feedback networks.
3. Understand the concept of fuzziness involved in various systems and fuzzy set theory.
4. Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
5. Analyze the application of fuzzy logic control to real time systems.

UNIT-I	INTRODUCTION & ESSENTIALS TO NEURAL NETWORKS	Classes: 12

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCullochPiUs Model, Historical Developments, Potential Applications of ANN. Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN — Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

UNIT-II	SINGLE & MULTI LAYER FEED FORWARD NEURAL NETWORKS	Classes: 10

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training.**Algorithms:** Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. Credit Assignment Problem, Generalized Delta Rule, and Derivation of Back-propagation (BP) Training, Summary of Back-propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT-III	ASSOCIATIVE MEMORIES-I	Classes: 08

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory).

UNIT-IV	ASSOCIATIVE MEMORIES-II	Classes: 10

Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of HoptieldNetwork: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications

UNIT-V	FUZZY LOGIC	Classes: 10

Classical & Fuzzy Sets: Introduction to classical sets – properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components:Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, De—fuzzification methods.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications, Rajasekharan and Pal, PHI.
2. Neural Networks and Fuzzy Logic, C. Naga Bhaskar, G. Vijay Kumar, BS Publicatior-is.

Reference Books:

1. Artificial Neural Networks, B. Yegnanarayana, PHI.
2. Artificial Neural Networks, Zaruda, PHI.
3. Neural Networks and Fuzzy Logic System, Bail Kosko, PHI.
4. Fuzzy Logic and Neural Networks, M. Amirthavalli, Scitech Publications India Pvt. Ltd.
5. Neural Networks, James A Freeman and Davis Skapura, Pearson Education.
6. Neural networks by satish Kumar, TIVIH, 2004
7. Neural Networks, Simon Hakins , Pearson Education.
8. Neural Engineering, C.Eliasmith and CH.Anderson, PHI.

Web References:

1. *users.monash.edu/~app/CSE5301/Lnts/LaD.pdf*
2. https://engineering.purdue.edu/~tsoukala/rational.html
3. https://pdfs.semanticscholar.org/5e31/c55a00eb3945e3e483caa2e146a95c12f5aa.pdf

E-Text Books:

1. https://www.mheducation.co.in/computer.../neural-networks-fuzzy-systems/text-book
2. www.crectirupati.com/sites/default/files/lecture_notes/NNFL.pdf
3. www.vssut.ac.in/lecture_notes/lecture1423723637.pdf

MOOC Course:

1. https://nptel.ac.in/noc/individual_course.php?id=noc19-ge07
2. https://nptel.ac.in/courses/108104049/16
3. https://nptel.ac.in/courses/117105084/
4. https://nptel.ac.in/syllabus/127105006/

OPEN ELECTIVES- II

OFFERED BY

DEPARTMENT OF ECE

MICROCONTROLLER & APPLICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC58	OEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

1.To introduce the students about architectural features of microcontrollers and its registers
2. To introduce about the instruction set of 8051
3. To know about the I/O Ports and Interrupts of 8051
4. To know about Timers/Counters of 8051
5. To introduce Arduino programming and interfacing of sensors

COURSE OUTCOMES:

Upon completion of the course, students will be able to:
1. Understand the architectural features of MCS-51 and select a suitable microcontroller to suit the application.
2. Develop programs for control applications using assembly language and embedded C
3. Use timers and counters for delay generation and event counting and Illustrate the use of interrupts and service routines
4. Write algorithms and develop programs for serial data communication applications.
5. Design microcontroller based-applications for simple real-world applications

UNIT I	8051 ARCHITECTURE	Classes: 9

Introduction to microcontrollers, RISC, CISC, Harvard and Von Neumann architectures. Architecture of 8051, Signal descriptions of 8051, General purpose registers of 8051, register banks, Memory organization.

UNIT II	INSTRUCTION SET OF 8051	Classes: 9

Assembly language Instruction format, 8051 Addressing modes, Instruction set of 8051: Classification, syntax and function of instructions, Simple programs.

UNIT III	I/O PORT AND INTERRUPT PROGRAMMING	Classes: 9

I/O Ports of 8051,Features of I/O ports, configuring I/O ports, interface I/O devices such as LED, buzzer, push-button switch, example programs with assembly & C. Interrupts of 8051 and its priorities, IE and IP registers, Interrupt enabling/disabling and priority setting, example programs in assembly and C.

UNIT IV	TIMERS /COUNTERS AND SERIAL I/O	Classes: 9
Bit structure and function of TMOD and TCON registers, Timer/Counter modes of operations, Timer/Counter programs in assembly and C. Bit structure and function of SCON, PCON registers, SBUF register, Serial Communication modes in 8051, programs on serial communication.		
UNIT V	**INTRODUCTION TO ARDUINO**	**Classes: 9**
Introduction to Arduino-uno board, Analog and Digital pins, programming structure of Arduino, introduction to sensors and actuators , Sensor interfacing, programming to sensors, Motor interfacing, LCD interfacing.		
TEXTBOOKS: 1. The 8051 Microcontroller(3rd edition) - Kenneth J Ayala 2. The 8051 Microcontroller & Embedded systems using assembly and C (2ndEdition) –M.A.Mazidi , J.C. Mazidi & R.D.McKinlay ISBN: 81-317-1026-2		
REFERENCES: 1. The 8051 Microcontroller(4th Edition)- MacKenzie , ISBN:81-317-2018-7 2. The 8051 Microcontroller(1st Edition) – Dr.Uma Rao & Andhe Paallavi, ISBN: 81-317-3252-5 3. Microcontrollers & applications, Ramani Kalpathi, & Ganesh Raja , ISBN: 81-888-4918-9 4. Programming Arduino: Getting Started with Sketches, Second Edition (Tab) 2nd Edition – Simon Monk		
Web References:https://www.the8051microcontroller.com/web-references		
E-Text Books: 1. https://www.freebookcentre.net/Electronics/Microcontroller-Books.html 2. https://www.freebookcentre.net/Electronics/Microcontroller-Application-Books.html		
MOOC Course 1.https://nptel.ac.in/courses/117/104/117104072/		

FUNDAMENTALS OF IMAGE PROCESSING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC61	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The students are able to:

1. To become familiar with digital image fundamentals
2. To get exposed to image enhancement techniques in Spatial and Frequency domain.
3. To learn concepts of degradation function and restoration techniques.
4. To study the image segmentation and representation techniques.
5. To become familiar with image compression and recognition methods

COURSE OUTCOMES:

1. Know and understand the basics and fundamentals of digital image processing.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Apply the restoration concepts and filtering techniques on digital images.
4. Learn the basics of segmentation and features extraction.
5. Analyze the compression and recognition methods for color images.

UNIT I	INTRODUCTION OF IMAGE PROCESSING	Classes: 09

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures.

UNIT II	IMAGE ENHANCEMENT	Classes: 09

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Image Enhancement in Frequency Domain: Low Pass and High Pass Filters in Frequency Domain, Homomorphic filtering

UNIT III	IMAGE TRANSFORMS	Classes: 09

Image Transforms: 2 D- Discrete Fourier Transform and its properties, Discrete Cosine Transform (DCT), Haar Transform, Hadmard Transform, Hotelling Transform and Slant transform.

UNIT IV	IMAGE SEGMENTATION	Classes: 09

Introduction-Edge detection, Edge linking and boundary detection – Thresholding – Region based segmentation – Region growing – Region splitting and merging- Watershed segmentation algorithm.

UNIT V	IMAGE COMPRESSION	Classes: 09

Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXTBOOKS: 1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008 2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- Mc Graw Hill Edn., 2010.
REFERENCES: 1. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004 2.Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015. 3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.
Web References: 1. http://homepages.inf.ed.ac.uk/rbf/BOOKS/VERNON/Chap004.pdf
E-Text Books: 1. https://books.google.co.in/books/about/Digital_Image_Processing.html?id=a62xQ2r_f8wC
MOOC Course: 1. https://nptel.ac.in/courses/117105079/

OPEN ELECTIVES- II
OFFERED BY
DEPARTMENT OF IT

BASICS OF PYTHON PROGRAMMING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5IT23	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To Describe the basic elements of the Python language and the Python interpreter and discuss the differences between Python and other modern languages.
2. To Describe Python dictionaries and demonstrate the use of dictionary methods.
3. Define, analyze and code the basic Python conditional and iterative control structures and explain how they can be nested and how exceptions can be used.
4. To Explain and demonstrate methods of error handling and Python exceptions.
5. To demonstrate the understanding of —magic methods‖ through use of these in the context of a Python application.

COURSE OUTCOMES:

Up on successful completion of the course, the student is able to

1. Write and debug Python programs which make use of the fundamental control structures and method-building techniques.
2. Use data types, input, output, iterative, conditional, and functional components of the language in his or her programs.
3. Use object-oriented programming techniques to design and implement a clear, well-structured Python program.
4. Use and design classes and objects in his or her programs.
5. Outline the specific features of Python which made it more powerful programming language.

UNIT-I	INTRODUCTION TO PYTHON	Classes: 08

Overview, Basic. Python Installation, Comments in Python, Concept of Indentation in python.

UNIT-II	DATA TYPES	Classes: 08

Tuples, Lists More advanced data types (dictionary, string), Python operators, control flows, Loops, Functions.

UNIT-III	MODULES AND PACKAGES	Classes: 08

File handling in python, Module and Packages, Object oriented programming.

UNIT-IV	ADVANCED FUNCTIONS	Classes: 08
Exceptions, sorting, advanced function: map, filter, and reduce.		
UNIT-V	**INTRODUCTION TO STANDARD LIBRARIES**	**Classes: 08**
Multi-Processing And Multi-Threading, Introduction To Standard Libraries(pandas,Turtle, numpy, os).		
Text Books:		
1. Learning Python, by Shroff Pub& Dist., O‘relly publications, Publication Year: 2013.		
Reference Books:		
1. Python Programming for Beginners: Python Programming Languageby Joseph Joyner		

HUMAN COMPUTER INTERACTION

III Year II Semester: OPEN ELECTIVE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5IT11	OEC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. The human components functions.
2. The Computer components functions.
3. The Interaction between the human and computer components.
4. Interaction design basics
5. HCI in the software process
6. Design rules and Evaluation techniques

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Explain the human components functions regarding interaction with computer
2. Explain Computer components functions regarding interaction with human
3. Demonstrate Understanding of Interaction between the human and computer components.
4. Implement Interaction design basics
5. Use HCI in the software process

UNIT-I	INTRODUCTION	Classes: 12

Importance of user Interface – definition, importance of good design, Benefits of good design. A brief history of Screen design, The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT-II	DESIGN PROCESS	Classes: 15

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions. Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT-III	WINDOWS	Classes: 12

New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT-IV	SOFTWARE TOOLS	Classes: 08
Specification methods, interface – Building Tools.		
UNIT-V	INTERACTION DEVICES	Classes: 08
Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.		
Text Books:		
1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dreamtech. 2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.		
Reference Books:		
1. Human – Computer Interaction. ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL BEAL,PEARSON. 2. Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech, 3. User Interface Design, Soren Lauesen , Pearson Education.		

OPEN ELECTIVES- II

OFFERED BY

DEPARTMENT OF MECHANICAL ENGINEERING

FUNDAMENTALS OF MECHATRONICS

VI Semester: OPEN ELECTIVE - II

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME73	OEC	3	-	-	3	30	70	100

COURSEOVERVIEW:

The aim is to introduce students to the fundamental concepts and principles mechatronics. It builds upon the awareness and necessity of interdisciplinary dependency of 21st century. It aim is also to engage students to understand the introduction to mechatronics with emphasis on analog electronics, digital electronics, sensors and transducers, actuators, and microprocessors. Lectures are intended to provide the student with foundational concepts in mechatronics and practical familiarity with common elements making up mechatronic systems.

COURSEOUTCOMES:

At the end of the course students are able to

1) Demonstrate various elements underlying mechatronic systems, electronics, control systems and differentiate the purpose in the system.
2) Analyze and select sensors, actuators, electro-mechanical components needed for an application.
3) To evaluate microprocessor and micro controller interfacing to mechanical application.
4) To choose PLC to a mechanical application.
5) To design mechatronic systems for mechanical applications.

UNIT-I INTRODUCTION

Introduction to Mechatronics – Mechatronics systems - Mechatronics design process - Mechatronics in Manufacturing– Adoptive and distributed control systems – Modelling and simulation of mechatronics systems.

UNIT-II SENSORS AND ACTUATORS

Sensors and actuators: Overview of sensors and transducers – Microsensors - Signal conditioning –Operational amplifiers – Protection–Filtering - Analog and Digital converters. Electro–pneumatics and

Electro – hydraulics - Solenoids – Direct Current motors – Servomotors – Stepper motors- Micro actuators; Drives selection and application.

UNIT-III INTERFACING

Interfacing: Microprocessor based Controllers, Architecture of microprocessor and microcontroller – System interfacing for a sensor, keyboard, display and motors - Application cases for temperature control, Warning and process control systems

UNIT-IV PLCs

PLCs: Programmable Logic Controllers, Architecture of Programmable Logic Controllers –Input /Output modules – programming methods– Timers and counters – Master control–Branching– Data Handling – Analog input /output–Selection of PLC and trouble shooting.

UNIT-V	ARTIFICIAL INTELLIGENCE
AI: Intelligent Mechatronics and Case Studies, Fuzzy logic control and Artificial Neural Networks in mechatronics – Algorithms – Computer– based instrumentation - Real time Data Acquisition and Control –Software integration –Man Machine interface-Vision system–Mechatronics system case studies.	
TextBooks:	
1. Introduction to Mechatronics and Measurement Systems, Tata Mc Graw Hill	
ReferenceBooks:	
1. Designing Intelligent Machines, Michel B.Histand and David G.Alciatore, Open University London 2. Control Sensors and Actuators, ICW. Desiha, Prentice Hall	
WebReferences:	
1. https://lecturenotes.in/subject/137/mechatronics-mech 2. https://sites.google.com/site/profnarendralakal/Home/presentations/mtrx	
E-TextBooks:	
1. https://books.google.co.in/books?id=NCEeONKWzX4C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false 2. https://books.google.co.in/books?id=z8yEUou06cEC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false	
MOOCCourse:	
1. https://ocw.mit.edu/courses/mechanical-engineering/2-737-mechatronics-fall-2014/ 2. https://nptel.ac.in/courses/112103174/ 3. https://www.igi-global.com/chapter/massive-online-open-course-assisted-mechatronics-learning/137327	

OPEN ELECTIVE- II

OFFERED BY DEPARTMENT OF SCIENCE AND HUMANITIES SCIENCE AND HUMANITIES

<table>
<tr><td colspan="11">ADVANCED ENTREPRENEURHIP</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3" rowspan="2">Hours / Week</td><td rowspan="2">Credits</td><td colspan="3" rowspan="2">Maximum Marks</td></tr>
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<tr><td rowspan="2">A5HS09</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>25</td><td>75</td><td>100</td></tr>
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OBJECTIVES:

The course should enable the students to:

The curriculum helps students

1. Understand and **discover** entrepreneurship
2. Build a strong foundation for students to **start**, **build**, and **grow** a viable and sustainable venture
3. Develop an entrepreneurial outlook and **mindset**, critical **skills** and **knowledge**
4. Mitigate three types of **risks:** Customer, Business Model, and Product/Technical

UNIT-I	**ORIENTATION TO GROWTH**	**Classes: 10**

ORIENTATION TO GROWTH: Getting Ready for Growth-Why growth stage is different compared to startup phase, Why Product-Market fit is not enough, Case study, To assess readiness for growth, To chart a growth path.

UNIT-II	**CUSTOMER, BUSINESS MODEL, VALIDATION**	**Classes: 10**

CUSTOMERS : Expanding Customer Base-Revisit your business model and develop few variants (more business model types),Identify additional customer segments that your Solution can address, Evaluate business models for the new customer segments, Relook at the Problem Statement (can you expand the scope and scalability of your business by repositioning your problem statement?), Explore additional ways to monetize.

BUSINESS MODEL: Get Started with Lean Canvas.

VALIDATION: Develop the Solution, Sizing the Opportunity, Building an MVP.

UNIT-III	**TRACTION AND TEAM**	**Classes: 12**

TRACTION : Scaling **-** How to gain traction beyond early customers, Defining traction (in quantifiable terms) and identifying the most important metrics to measure traction, Calculate cost of new customer acquisition, Estimate your customer lifetime value(LTV),Identifying waste in your operations and

focusing your team on what is important for traction. Channels and Strategy - The Bulls eye frame work, Identify Channels using Bulls Eye Framework, Measuring the effectiveness of selected channels, Budgeting and planning.		
UNIT-IV	**MONEY & SALES**	**Classes: 10**
MONEY: Growing Revenues - Stabilizing key revenue streams, Developing additional revenue streams (licensing, franchising),Exploring new channels and partnerships, Sales Planning - Understanding why customers buy and how buying decisions are made; Listening skills, Sales planning, setting targets, Unique Sales Proposition (USP); Art of the sales pitch (focus on customers' needs, not on product features, Follow-up and closing a sale; Asking for the sale. Strengthening Sales - Follow-up and closing a sale; Asking for the sale, Building a professional sales team ,Sales compensation and incentives, Sales planning, setting targets. Improving Margins - Testing price elasticity, Optimizing costs and operational expenses, Advanced concepts of unit costing. Financial Modeling - Financial modeling of your venture's growth, Analyzing competitor and peer's financial models.		
UNIT-V	**SUPPORT**	**Classes: 08**
SUPPORT: Legal - Overview of legal issues and their impact on entrepreneurs, Importance of getting professional help (legal and accounting), Importance of being compliant and keeping proper documentation, Patents and Intellectual property, Trademarks. Mentors, Advisors, and Experts - The importance of a Mentor and how to find one, Role of business advisors and experts for specific targets in your growth plan		
Text Books:		
Reference Books:		

OPEN ELECTIVE III

OFFERED BY
AERONAUTICAL DEPARTMENT

VII Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE67	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To understand the evolution and applications of unmanned aerial vehicles.
2. To illustrate the subsystems of UAVs.
3. To explain the process involved in design of UAVs.

UNIT-I INTRODUCTION TO UAV

Historical Development, Overview of UAV Systems and sub-systems, Classification, Informal Categories, The Tier System, Classification Change.

UNIT-II BASIC AERODYNAMICS AND PERFORMANCE of UAV

Basic Aerodynamic Equations, Air foils, lift, drag, moments, Aircraft Polar, The Real Wing and Airplane, Induced Drag, Total Air-Vehicle Drag, Flapping Wings, Rotary wings. Climbing Flight, Range, Endurance, Gliding Flight

UNIT-III PROPULSIVE SYSTEMS, STRUCTURES AND LOADS, PAYLOAD

Thrust Generation and basic thrust equation, Sources of Power, Loads, types of loads, Materials, construction techniques. Payloads-Reconnaissance/Surveillance Payloads, Weapon Payloads, Other payloads

UNIT-IV UAV SUBSYSTEMS

Mission Planning and Control Station- Types, Physical Configuration, Planning and Navigation, MPCS Interfaces, Modes of control, piloting and controlling mission, Autopilot system Launch Systems- Basic Considerations, launch Methods for Fixed, rotary wing UAV Recovery Systems

UNIT-V BASICS DESIGN AND CASE

Introduction to Design and Selection of the System - Conceptual Phase, Preliminary Design, Detail Design, Selection of the System Case study on Indian UAVs(Rustom, Lakshya, AURA) Case study on Israeli-Heron, US- MQ9 Reaper

Text Books:

1. Paul Fahlstrom, Thomas Gleason - Introduction to UAV Systems-Wiley (2012)
2. Reg Austin, "Unmanned Air Systems: UAV Design, Development and Deployment", First Edition, Wiley Publishers, 2015.

Reference Books:

1. Mirosaw Adamski, "Power units and power supply systems in UAV", New Edition, Taylor and Francis Group publishers, 2014.
2. Skafidas, "Microcontroller Systems for a UAV", KTH, TRITA-FYS 2002:51 ISSN 0280-316X. 34, 2002.

COURSE OUTCOMES

1. Classify the Unmanned Aerial Vehicles.
2. Calculate the basic performance parameters for aircraft.
3. Identify and illustrate various payloads and propulsive systems.
4. Explain the functioning of subsystems in UAVs.
5. Illustrate the design process for a UAV..

UNMANNED AERIAL VEHICLES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE67	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To understand the evolution and applications of unmanned aerial vehicles.
2. To illustrate the subsystems of UAVs.
3. To explain the process involved in design of UAVs.

UNIT-I INTRODUCTION TO UAV

Historical Development, Overview of UAV Systems and sub-systems, Classification, Informal Categories, The Tier System, Classification Change.

UNIT-II BASIC AERODYNAMICS AND PERFORMANCE of UAV

Basic Aerodynamic Equations, Air foils, lift, drag, moments, Aircraft Polar, The Real Wing and Airplane, Induced Drag, Total Air-Vehicle Drag, Flapping Wings, Rotary wings. Climbing Flight, Range, Endurance, Gliding Flight

UNIT-III PROPULSIVE SYSTEMS, STRUCTURES AND LOADS, PAYLOAD

Thrust Generation and basic thrust equation, Sources of Power, Loads, types of loads, Materials, construction techniques. Payloads-Reconnaissance/Surveillance Payloads, Weapon Payloads, Other payloads

UNIT-IV UAV SUBSYSTEMS

Mission Planning and Control Station- Types, Physical Configuration, Planning and Navigation, MPCS Interfaces, Modes of control, piloting and controlling mission, Autopilot system Launch Systems- Basic Considerations, launch Methods for Fixed, rotary wing UAV Recovery Systems

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Text Books:

1. Paul Fahlstrom, Thomas Gleason - Introduction to UAV Systems-Wiley (2012)
2. Reg Austin, "Unmanned Air Systems: UAV Design, Development and Deployment", First Edition, Wiley Publishers, 2015.

Reference Books:

1. Mirosaw Adamski, "Power units and power supply systems in UAV", New Edition, Taylor and Francis Group publishers, 2014.
2. Skafidas, "Microcontroller Systems for a UAV", KTH, TRITA-FYS 2002:51 ISSN 0280-316X. 34, 2002.
3. Droneprep, "Unmanned Aircraft Systems Logbook for Drone Pilots & Operators", Create Space Independent Publishing Platform, Latest Edition, 2015.

Web References:

https://nptel.ac.in/courses/101/104/101104083/
https://nptel.ac.in/courses/101/104/101104073/

E-Text Books:

https://www.wiley.com/en-in/Unmanned+Aircraft+Systems%3A+UAVS+Design%2C+Development+and+Deployment-p-9780470058190
https://www.springer.com/gp/book/9789048197064
https://onlinelibrary.wiley.com/doi/book/10.1002/9781119508618

MOOC Course

https://nptel.ac.in/courses/101/104/101104073/
https://nptel.ac.in/courses/101/104/101104083/

COURSE OUTCOMES

1. Classify the Unmanned Aerial Vehicles.
2. Calculate the basic performance parameters for aircraft.
3. Identify and illustrate various payloads and propulsive systems.
4. Explain the functioning of subsystems in UAVs.
5. Illustrate the design process for a UAV..

OPEN ELECTIVES-III

OFFERED BY

COMPUTER SCIENCE AND ENGINEERING

INTRODUCTION TO CLOUD COMPUTING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS33	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To inculcate the concepts of distributed computing
2. To familiarize the concepts of cloud computing and services
3. To explain cloud platform and types of cloud
4. To explain resource management in cloud

COURSE OUTCOMES

1. Analyze the principles of distributed computing
2. Create virtual machines and virtual templates.
3. Create Cloud platform using Virtual machines
4. Apply suitable business models of cloud computing
5. Analyze various case studies on cloud computing.

UNIT-I	INTRODUCTION TO VIRTUALIZATION AND TECHNOLOGIES	CLASSES: 12

INTRODUCTION TO VIRTUALIZATION AND TECHNOLOGIES: Introduction to Virtualization: Definition, Objectives, Characteristics, Benefits of virtualization, Taxonomy of virtualization technologies, Pros and cons of virtualization. Virtualization Technologies: VMware, Hyper-V, Zen and virtual iron.

UNIT-II	FUNDAMENTAL CLOUD COMPUTING AND MODELS	CLASSES: 12

FUNDAMENTAL CLOUD COMPUTING AND MODELS: Cloud Computing: Origin and influences, Basic concepts and terminology, Goals and benefits, Risks and challenges. Cloud Models, roles and boundaries, Cloud characteristics, Cloud delivery models, Cloud deployment models.

UNIT-III	CLOUD COMPUTING MECHANISMS AND ARCHITECTURE	CLASSES: 14

CLOUD COMPUTING MECHANISMS AND ARCHITECTURE: Cloud-Enabling Technology: Broadband networks and internet architecture, Data center technology, Virtualization technology, Web technology, Multitenant technology, Service technology. Cloud Architectures: Architecture - Workload distribution, Resource pooling, Dynamic scalability, Elastic resource capacity, Service load balancing, Cloud bursting, Elastic disk provisioning, Redundant storage.

UNIT-IV	CLOUD SECURITY AND DISASTER RECOVERY	CLASSES: 12

CLOUD SECURITY AND DISASTER RECOVERY: Cloud Security: Data, Network and host security, Cloud security services and cloud security possible solutions. Cloud Disaster Recovery: Disaster recovery planning, Disasters in the cloud, Disaster management, Capacity planning and cloud scale.

UNIT-V	CLOUD CASE STUDIES	CLASSES: 10

CLOUD CASE STUDIES: Case Studies: Software-as-a-Service (SaaS) - Salesforce.com, Facebook; Platform–as-a-Service (PaaS) - Google App Engine, MS-Azure and IBM Bluemix; Infrastructure-as-a-Service (IaaS) - Amazon EC2, Amazon S3 and Netflix.

TEXT BOOKS

1. Cloud ComputingConcepts, Technology and Architecture, Thomas Erl and RicardoPuttini Pearson, 2013.
2. Cloud Computing Virtualization Specialist Complete Certification Kit-Study Guide Book, Ivanka Menken and Gerard Blokdijk, Lightning Source, 2009

REFERENCE BOOKS

1. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt Ltd, 2011.
2. Cloud Computing Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej Goscinski, John Wiley and Sons, 2011.
3. Cloud Computing Implementation, John W. Rittinghouse and James F. Ransome, Management and Security, CRC Press, Taylor & Francis Group, 2010.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.ibm.com/in-en/cloud/learn/cloud-computing

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5CS34	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To understand the basic structure and operation of a digital computer.
2. To discuss in detail the operation of the arithmetic unit including the algorithms & Implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
3. To study different ways of communicating with I/O devices and standard I/O interfaces.
4. To study hierarchical memory system including cache memories and virtual memory.
5. To demonstrate the knowledge of functions of operating system memory management Scheduling, file system and interface, distributed systems, security and dead locks.
6. To implement a significant portion of an Operating System

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Describe the fundamental organisation of a computer system.
2. Identify addressing modes, instruction formats and program control statements and Input-Output Organization.
3. Identify and analyse the different structures and services of operating system.
4. Analyse the memory management approaches of operating systems.
5. Assess different methods to solve Deadlock and learn concepts of File system Interface.

UNIT-I	BASIC STRUCTURE OF COMPUTERS	15 classes

Computer Types, Functional UNIT, 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 Transfers, 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, STACK Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation.

UNIT-II	MICRO PROGRAMMED CONTROL	10 classes

Control Memory, Address Sequencing, Micro Program Examples, Design of Control Unit, Hard Wired Control, Micro Programmed Control. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP).

UNIT-III	OPERATING SYSTEMS OVERVIEW	10 classes

Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating System Generation. Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

UNIT-IV	MEMORY MANAGEMENT	10 classes
Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows.		
UNIT-V	**PRINCIPLES OF DEADLOCK**	**15 classes**
System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock. File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. Allocation Methods, Free-Space Management.		

TEXT BOOKS:

1. Computer Organization - Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.
2. Computer System Architecture - M. morismano, 3rd edition, Pearson
3. Operating System Concepts - AbrehamSilberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

REFERENCE BOOKS:

1. Computer Organization and Architecture - William Stallings 6th Edition, Pearson
2. Structured Computer Organization - Andrew S. Tanenbaum, 4th Edition, PHI
3. Fundamentals of Computer Organization and Design - SivaraamaDandamudi, Springer Int. Edition
4. Operating Systems - Internals and Design Principles, Stallings, 6th Edition - 2009, Pearson Education.
5. Modern Operating Systems, Andrew S Tanenbaum 2nd Edition, PHI
6. 6. Principles of Operating System, B. L. Stuart, Cengage Learning, India Edition

WEB REFERENCES:

6. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
7. https://www.tutorialspoint.com/operating_system/os_overview.htm

E-TEXT BOOKS:

1. https://www.academia.edu/7727578/Operating_System_Concepts_5th_ed_BY_GALVIN
2. http://www.gpkhutri.in/BOOK/COMPUTER/Computer%20Organization%20and%20Architecture%20Designing%20for%20Performance%20(8th%20Edition)%20-%20William%20Stallings.pdf

MOOC Course

1. https://nptel.ac.in/courses/106/105/106105163/
2. https://nptel.ac.in/courses/106/106/106106144/
3. https://www.coursera.org/learn/comparch
4. https://www.coursera.org/learn/os-pku

OPEN ELECTIVE –III
OFFERED BY
DEPARTMENT OF EEE

SOLAR ENERGY AND APPLICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EE60	OEC	3	-	-	3	30	70	100

Course Objectives:

1. To Study about solar modules and PV system design and their applications
2. To Deal with grid connected PV systems
3. To Discuss about different energy storage systems

Course Outcomes:

The students should be able to

1. understanding of principles and technologies for solar thermal energy collection, conversion and utilization
2. Understanding of solar heating systems, liquid based solar heating systems for buildings.
3. Identify, formulate and solve simple to complex problems of solar thermal energy conversion and storage.
4. Identify and understand solar thermal systems 'components and their function.
5. Analyze hot water load and solar resource data and use this information to properly size a solar thermal system

SYLLABUS

UNIT-I	INTRODUCTION	Classes: 10
Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection		
UNIT-II	**STAND ALONE PV SYSTEM**	**Classes: 10**
Solar modules – storage systems – power conditioning and regulation - MPPT- protection – stand alone PV systems design – sizing		
UNIT-III	**GRID CONNECTED PV SYSTEMS**	**Classes: 10**
PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs		
UNIT-IV	**ENERGY STORAGE SYSTEMS**	**Classes: 10**
Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage		
UNIT-V	**APPLICATIONS**	**Classes: 10**
Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.		

Text Books:

1. Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies And Applications", PHI Learning Pvt. Ltd.,2015.
2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, "Applied Photovoltaics", 2007,Earthscan, UK. Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa,1994

Reference Books:

1. Frank S. Barnes & Jonah G. Levine, "Large Energy storage Systems Handbook", CRC Press, 2011.
2. McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990 5 S.P. Sukhatme , "Solar Energy", Tata McGraw Hill,1987.

Web References:

1. https://www.loc.gov/rr/scitech/tracer-bullets/solar-updatetb.html
2. https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100516798
3. https://link.springer.com/journal/11949

E-Text Books:

1. https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
2. *bookstore.teri.res.in/books/9788179935736*

MOOC Course:

1. https://nptel.ac.in/courses/112105051/
2. https://nptel.ac.in/courses/121106014/18
3. https://nptel.ac.in/courses/112105050/
4. https://nptel.ac.in/syllabus/112105051/

OPEN ELECTIVE –III

OFFERED BY

DEPARTMENT OF ECE

INTRODUCTION TO SENSORS AND ACTUATORS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC62	OEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understanding basic laws and phenomena on which operation of sensors and actuators- transformation of energy.
2. Create analytical design and development solutions for sensors and actuators.
3. To know the basic laws of behaviour of sensors and actuators.
4. To able to know about the Standards for Smart Sensor Interface
5. Analyse the development and application of sensors and actuators.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Apply the fundamental physical and technical base of sensors and actuators,
2. Analyse various premises, approaches, procedures and results related to sensors and actuators
3. Analyse basic laws and phenomena that define behaviour of sensors and actuators.
4. Apply the Smart Sensor Interface in various applications
5. Develop the application of sensors and actuators

UNIT-I	SENSORS & TRANSDUCERS	Classes: 9

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Resistance Strain Gauge, Semiconductor Strain Gauges, Capacitive Sensors, Electrostatic Transducer, Ultrasonic Sensors.

UNIT-II	THERMAL SENSORS	Classes: 9

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Nuclear Thermometer, Thermo-EMF Sensors, Thermal Radiation Sensors, Quartz Crystal Thermo-electric Sensors, Spectroscopic Thermometry, Noise Thermometry..

UNIT-III	RADIATION SENSORS	Classes: 9

Introduction – Basic Characteristics – Types of Photosensistors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors. Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Sensor Electrodes.

UNIT-IV	SMART SENSORS	Classes: 9
Introduction, Primary Sensors, Excitation, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors.		
UNIT-V	**ACTUATORS**	**Classes: 9**
Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves.		
Text Books: 1.D. Patranabis, “Sensors and Transducers”, PHI Learning Private Limited. 2.W. Bolton, “Mechatronics”, Pearson Education Limited.		
Reference Books: 1. Patranabis, “Sensors and Actuators”, 2nd Edition, PHI, 2013.		
Web Link: 1.https://www.journals.elsevier.com/sensors-and-actuators		
E Text books: 1.https://www.sciencedirect.com/handbook/handbook-of-sensors-and-actuators		
Moocs: 1.https://www.classcentral.com/course/swayam-sensors-and-actuators-14285		

INTRODUCTION TO COMPUTER VISION									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC63	OEC	3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. To review image processing techniques for computer vision.
2. To understand the concepts of Image Enhancement.
3. To understand the basics of segmentation and its applications.
4. To know about the feature extraction and Hough Transform.
5. To understand three-dimensional image analysis techniques.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Implement fundamental image processing techniques required for computer vision.
2. Analyze the various spatial and frequency domain filtering.
3. Understand the idea about segmentation
4. Apply Hough Transform for line, circle, and ellipse detections.
5. Apply 3D vision techniques and motion related techniques.

UNIT-I	IMAGE PROCESSING FOUNDATIONS	Classes: 09
Fundamental steps in Digital Image Processing, Components of Digital Image Processing Image sensing and acquisition, Image formation model, Pixels, Basic relationship between pixels, Sampling and Quantization in Digital Image Processing		
UNIT-II	**IMAGE ENHANCEMENT**	**Classes: 09**
Intensity transformations, contrast stretching, histogram equalization, Spatial filtering: Smoothing filters, sharpening filters, Frequency domain filtering, Homomorphic filtering,		
UNIT-III	**BAICS OF SEGMENTATION**	**Classes: 09**
Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour models, Texture feature based segmentation, Graph based segmentation, Wavelet based Segmentation - Applications of image segmentation.		
UNIT-IV	**FEATURE EXTRACTION**	**Classes: 09**
First and second order edge detection operators, Phase congruency, Localized feature extraction -detecting image curvature, shape features, Introduction to Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors.		
UNIT-V	**3D IMAGE VISUALIZATION**	**Classes: 09**
Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiple connected surfaces, Image processing in 3D, Measurements on 3D images.		

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing',Pearson,Education, Inc.,Second Edition, 2004.
2. Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press,2008.
3. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.

Reference Books:

1. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.
2. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012.
3. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
4. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

Web References:

1.https://machinelearningmastery.com/what-is-computer-vision/

E-Text Books:

1..https://machinelearningmastery.com/computer-vision-books/

MOOC Course

1.https://onlinecourses.nptel.ac.in/noc21_ee23/preview

OPEN ELECTIVES- III
OFFERED BY
DEPARTMENT OF IT

INTRODUCTION TO ARTIFICIAL INTELLIGENCE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIE**	**SEE**	**Total**
A5IT24	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

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 along with the time and space complexities
3. To learn different knowledge representation techniques
4. To understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

COURSE OUTCOMES:

1. Possess the ability to formulate an efficient problem space for a problem expressed in English.
2. Possess the ability to select a search algorithm for a problem and characterize its time and space complexities.
3. Possess the skill for representing knowledge using the appropriate technique
4. Possess the ability to apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing
5. Apply advanced knowledge representation techniques.

UNIT-I	Introduction	Classes:10

Introduction, History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications. Problem Solving – State-Space Search and Control Strategies: Introduction, General Problem Solving, 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-II	Logic Concepts and Logic Programming & Knowledge Representation	Classes:12

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III	Expert System and Applications & Uncertainty Measure – Probability Theory	Classes:13
Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools. Uncertainty Measure – Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.		
UNIT-IV	**Machine-Learning Paradigms & Artificial Neural Networks**	**Classes:13**
. Machine-Learning Paradigms: Introduction. Machine Learning Systems. Supervised and Unsupervised Learning. Inductive Learning. Learning Decision Trees, Deductive Learning. Clustering, Support Vector Machines. Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.		
UNIT-V	**Advanced Knowledge Representation Techniques**	**Classes: 12**
Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.		

TEXT BOOKS:

1. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004

REFERENCE BOOKS:

1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Introduction to Artificial Intelligence by Eugene Charniak, Pearson.
3. Introduction to Artificial Intelligence and expert systems Dan W.Patterson. PHI.
4. Artificial Intelligence by George Fluger rearson fifth edition.

Web References:

1. http://zsi.tech.us.edu.pl/~nowak/bien/BIEN_introduction.pdf
2. https://epub.uni-regensburg.de/13629/1/ubr06078_ocr.pdf
3. https://lecturenotes.in/subject/128/artificial-intelligence-ai

E-Textbooks:

1. https://books.google.co.in/books?id=DDNHzcN6jasC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://books.google.co.in/books?id=YmH1tXFA14MC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC Course

1. https://www.edx.org/course/artificial-intelligence-1
2. https://www.appliedaicourse.com/

SOFTWARE TESTING FUNDAMENTALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5IT25	OEC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

Software Testing has different goals and objectives.

1. Finding defects which may get created by the programmer while developing the software.
2. Gaining **confidence** in and providing information about the level of quality.
3. To prevent defects.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Understand software testing methods
2. apply various software testing techniques
3. Design and conduct a software test process for a software testing project
4. Designing solutions for various software testing problems by selecting appropriate software test model
5. Implement various practice oriented software testing projects

UNIT-I INTRODUCTION Classes: 08

Basics of software testing, Testing objectives, Principles of testing, Test Life Cycle, Types of testing, Software defect tracking.

UNIT-II TESTING METHODOLOGIES Classes: 12

White Box And Black Box Testing, Static Testing, Static Analysis Tools, Structural Testing, Unit/Code functional, testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing.

UNIT-III INTEGRATION TESTING Classes: 10

Integration, System, and Acceptance Testing Top down and Bottom up integration, Functional versus Non-functional testing, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing, Acceptance testing

UNIT-IV TEST SELECTION & MINIMIZATION FOR REGRESSION TESTING Classes: 10

Test Selection & Minimization for Regression Testing Regression testing, Regression test process, Initial Smoke or Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.

UNIT-V	TEST MANAGEMENT AND AUTOMATION TEST PLANNING	Classes: 10
Test Management and Automation Test Planning, Management, Execution and Reporting, Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection.		
Text Books:		
1. S. Desikan and G. Ramesh, "Software Testing: Principles and Practices", Pearson Education. 2. Aditya P. Mathur, "Fundamentals of Software Testing", Pearson Education.		
Reference Books:		
1. Naik and Tripathy, "Software Testing and Quality Assurance", Wiley 2. K. K. Aggarwal and Yogesh Singh, "Software Engineering", New Age International Publication.		

OPEN ELECTIVE-III

OFFERED BY

DEPARTMENT OF MECHANICAL ENGINEERING

BASICS OF ROBOTICS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME75	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

Today robot finds applications in industries, medical and other fields. For example, in eye surgery (replacement of retina), where a cylindrical portion needs to be replaced, the operation is best done by robots. Mobile robots like walking machines, hopping machines are examples of robots, Nuclear and power plants uses fish like robots which move inside pipes for purpose of inspection. This course focuses on b various types of industrial robots, their kinematic and kinetic aspects, different types of grippers, mechanics of grippers, trajectory planning etc.

COURSE OUTCOMES:

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

1. Demonstrate different types of robots, specifications of robots and different end effectors used in robots.
2. Explain various types of end effectors and actuators.
3. Evaluate rotation matrices, forward kinematics of RR, RP and 3R Manipulators.
4. Explain inverse kinematics of RR manipulator, RP manipulator and trajectory planning techniques.
5. Explain feedback components used in robots and industrial applications.

UNIT-I INTRODUCTION

Introduction: Automation and Robotics, Asimov's laws, Robot Architecture, Components, , Anatomy of robot, Factors to be considered in the selection of robot, present and future applications, Specifications-Degree of freedom, Pay load, Parts per hour, Accuracy, Repeatability, Speed, Work space, Work volume, Work envelope, classification of robots based on configuration and control systems

UNIT-II END EFFECTORS & ACTUATORS

End effectors: Mechanical and Non-mechanical grippers, requirements for the design of grippers, considerations for the selection of grippers, Types of actuation mechanisms.

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators

UNIT-III MOTION ANALYSIS & DIRECT KINEMATICS

Motion Analysis: Basic Rotation Matrices, Composite Rotation Matrices. Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: D-H notation, D-H method of Assignment of frames, D-H Transformation Matrix, joint coordinates and world coordinates, Forward kinematics of 2R, RP and 3R manipulators

UNIT-IV	INVERSE KINEMATICS & TRAJECTORY PLANNING
Inverse kinematics : Inverse kinematics of 2R and RP manipulators. Trajectory Planning: Definition of Trajectory planning, Path, Trajectory, Knot points, Steps involved in trajectory planning, Trajectory planning techniques-Joint space and Cartesian space techniques, Cubic polynomial trajectory	
UNIT-V	**FEEDBACK COMPONENTS & APPLICATIONS**
Feedback Components: Position sensors – potentiometers, resolvers, optical encoders, Velocity sensor, Contact Sensors-Touch sensors, Tactile and Range sensors, Force and Torque sensors, Proximity sensor, Inductive sensor. Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.	

Text Books:

1. Industrial Robotics by Groover M P, Pearson Edu.
2. Robotics by Fu K S, McGraw Hill.
3. Theory of Applied Robotics (kinematics, Dynamics and Control-Jazar,Springer.

Reference Books:

1. Robotics and Control by Mittal R K & Nagrath I J, TMH.
2. Robot Dynamics and Controls by Spony and Vidyasagar, John Wiley
3. Robot Analysis and control by Asada and Slotine, Wiley Inter-Science
4. Introduction to Robotics by John J Craig, Pearson Education

Web References:

1. https://www.sciencedaily.com/terms/industrial_robot.htm
2. https://www.robotics.org/robotics/industrial-robot-industry-and-all-it-entails

E-Text Books:

1. https://books.google.co.in/books?id=dr9IAI7wucUC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://books.google.co.in/books?id=rESVUHwMcvYC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC Course:

1. https://www.classcentral.com/tag/robotics
2. https://www.mooc-list.com/tags/robotics

FUNDAMENTALS OF OPERATIONS RESEARCH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME76	OEC	3	-	-	3	30	70	100

COURSE DESCRIPTION:

An operation research (OR) is an analytical method of problem-solving and decision-making that is useful in the management of organizations. In operations research, problems are broken down into basic components and then solved in defined steps by mathematical analysis. This course gives insight of Linear Programming, Transportation, assignment problems, sequencing etc.

COURSE OUTCOMES:

At the end of course students will be able to

1. Describe types of models and solve linear programming problem.
2. Solve transportation and assignment problems.
3. Analyze sequencing and replacement models and apply them for optimization.
4. Apply gaming theory for optimal decision making.
5. Analyze inventory models to optimize the cost

UNIT-I INTRODUCTION & ALLOCATION

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

ALLOCATION: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

UNIT-II TRANSPORTATION & ASSIGNMENT PROBLEMS

TRANSPORTATION PROBLEM: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

ASSIGNMENT PROBLEM: Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT-III SEQUENCING & REPLACEMENT

SEQUENCING: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines

REPLACEMENT: Introduction – Replacement of items that deteriorate with time – when money value is notcounted and counted – Replacement of items that fail completely.

UNIT-IV	THEORY OF GAMES
THEORY OF GAMES: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games –m x 2 & 2 x n games - graphical method – m x n games - dominance principle.	
UNIT-V	**INVENTORY**
INVENTORY: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.	

Text Books:

1. Operation Research by J.K.Sharma, MacMilan.
2. Operations Research by ACS Kumar, Yesdee

Reference Books:

1. Operations Research: Methods and Problems by Maurice Saseini, Arhur Yaspan and Lawrence Friedman
2. Operations Research by A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi, Pearson Education.
3. Operations Research by Wagner, PHI Publications.
4. Introduction to O.Rby Hillier & Libermann,TMH.

Web References:

1. http://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
2. http://www.mathcity.org/msc/notes/operation_research
3. http://biobharati.com/admin/img/gall/1467763196_BCA-504.pdf

E-Text Books:

1. https://books.google.co.in/books?id=6khDDAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://books.google.co.in/books?id=cwoWJrgCrP8C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. https://books.google.co.in/books?id=rj6bBMVzfPsC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

OPEN ELECTIVES-III

OFFERED BY DEPARTMENT SCIENCE AND HUMANITIES

INDIAN ETHOS AND BUSINESS ETHICS							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5HS10	**OEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1)To understand the importance of ethics in business

2) To acquire knowledge and capability to develop ethical practices for effective management

3) To understand the Business Ethics and to provide best practices of business ethics.

4) To learn the values and implement in their careers to become a good managers.

5) To develop various ethical Responsibilities and practice in their professional life

6) To imbibe the ethical issues and to adhere to the ethical codes.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

Understand the dynamics of morality

2. Identify the constant in morality
3. Recognize the variable values in morality
4. Students will be able to understand the business ethics.
5. The student will be able to analyze various ethical codes in corporate governance
6. Student will be able to analyze the Employees conditions and Business Ethics

UNIT-I		**Classes: 09**

Introduction to Indian Ethos: History & Relevance, Principles Practiced by Indian Companies, Role of Indian Ethos in Managerial Practices, Management Lessons from Vedas, Mahabharata, Bible and Quran.

UNIT-II		**Classes: 09**

Understanding Values in Business: Kautilya's Arthashastra, Indian Heritage in Business, Management-Production and Consumption. Ethics v/s Ethos , Indian v/s Western Management, Work Ethos and Values for Indian Managers- Relevance of Value Based Management in Global Change- Impact of Values on Stakeholders, Trans-Cultural Human Values, Secular v/s Spiritual Values , Value System in Work Culture, Stress Management-Meditation for mental health, Yoga.

UNIT-III		Classes: 09
Contemporary Approaches to Indian Ethos: Contemporary Approaches to Leadership- Joint Hindu Family Business–Leadership Qualities of Karta, Indian Systems of Learning-Gurukul System of Learning, Advantages- Disadvantages of Karma, importance of Karma to Managers-Nishkama Karma-Laws of Karma, Law of Creation- Law of Humility- Law of Growth- Law of Responsibility- Law of Connection- Corporate Karma Leadership.		
UNIT-IV		Classes: 09
Understanding the Business Ethics : Understanding the need for ethics, Ethical values, myths and ambiguity, ethical codes, Ethical Principles in Business; Theories of Ethics, Absolutism verses Relativism, Teleological approach, the Deontological approach, Kohlberg's six stages of moral development (CMD)		
UNIT-V		Classes: 09
Ethical Culture in Organization: Ethical Culture in Organization, Developing codes of Ethics and conduct, Ethical and value based leadership. Role of scriptures in understanding ethics, Indian wisdom & Indian approaches towards business ethics.		
Text Books: 1.M.G. Velasquez, Business Ethics, Prentice Hall India Limited, New Delhi, 2. R.C. Sekhar, Ethical Choices in Business, Response Books, New Delhi, 2007		
Reference Books: 1. Chakraborty S.K., ―Management Transformation by Values‖, New Delhi, Sage Publication, 1990. 2. Chakraborty, S.K., Ethics in Management-Vedantic Approach, New Delhi, Oxford India Ltd. 1995. 3. Fernando A.C., Business Ethics: An Indian Perspective, Pearson, 2009. 4. Kautilya's Arthasastra, King, Governance, and Law in Ancient India, Oxford University Press, 2016. 5. Murthy, C.S.R. Business Ethics, Himalaya Publishing House, Mumbai, 2009. 6. Narayana G., ―The Responsible Leader: A Journey through Gita‖, Ahmedabad, AMA 2000.		
E Resources 1. http://lsib.co.uk/lms/wp-content/uploads/2015/02/Indian-Ethos-and-Management.pdf 2. www.vikaspublishing.com/books/business-economics/management/ethics		

OPEN ELECTIVES-IV

OFFERED BY

DEPARTMENT AERONAUTICAL ENGINEERING

FUNDAMENTALS OF WIND POWER TECHNOLOGY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE68	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To learn how wind is generated and possible ways of extracting the same.
2. To estimate the resource potential.
3. To learn the operation of a wind electric generator and wind turbine.

UNIT-I **INTRODUCTION TO WIND ENERGY**

Background, Motivations, and Constraints, Historical perspective, Wind speed variation -Modern wind turbines, Components and geometry.

UNIT-II **WIND CHARACTERISTICS AND RESOURCES**

General characteristics of the wind resource, Atmospheric boundary layer characteristics, Wind data analysis and resource estimation.

UNIT-III **AERODYNAMICS OF WIND TURBINES**

Forces from wind, Lift and drag forces - Airfoils, 1-D Momentum theory, Ideal horizontal axis wind turbine with wake rotation, Blade element theory -General rotor blade shape performance prediction.

UNIT-IV **WIND TURBINE DESIGN AND CONTROL**

Brief design overview - Introduction - Wind turbine control systems -Typical grid-connected turbine operation -Basic concepts of electric power- Power transformers.

UNIT-V **ENVIRONENTAL AND SITE ASPECTS**

Overview- Wind turbine siting - Installation and operation- Wind farms- Overview of wind energy Economics-Electromagnetic interference-noise.

Text Books:

1. Emil Simiu& Robert H Scanlan, "Wind effects on structures - Fundamentals and Applications to Design", John Wiley & Sons Inc New York, 2019.
2. Ahmad Hemami, "Wind Turbine Technology", Cengage learning,Cananda, 2012.

Reference Books:

1. Tom Lawson, "Building Aerodynamics", Imperial College Press London, 2001.
2. G P Russo, "Aerodynamic Measurements: From Physical Principles to Turnkey Instrumentation", Woodhead publishing, 2011.
3. N J Cook, "Design Guides to wind loading of buildings structures - Part I & II", Butterworths London, 1985.
4. "IS: 875 (1987) Part III Wind loads, Indian Standards for Building codes",1987.

Web References:

https://nptel.ac.in/courses/108/105/108105058/
http://web.mit.edu/windenergy/windweek/Presentations/Wind%20Energy%20101.pdf

E-Text Books:

http://ee.tlu.edu.vn/Portals/0/2018/NLG/Sach_Tieng_Anh.pdf
https://www.engineeringbookspdf.com/wind-energy-engineering-pramod-jain/
http://library.uniteddiversity.coop/Energy/Wind/wind_power_in_power_systems.pdf

MOOC Course

https://www.coursera.org/learn/wind-energy
https://nptel.ac.in/courses/108/105/108105058/

COURSE OUTCOMES

1. Exemplify the historical development of wind turbine, its components and classifications
2. Interpolate the characteristics of winds and atmospheric boundary layers.
3. Outline the methods to measure the performance of wind turbines using different theories.
4. Demonstrate the wind turbine and its sub system design required for the operation of wind turbine
5. Evaluate the environmental factors which infer the operation of wind farms and methods for sustainable operations.

GUIDANCE AND CONTROL OF AEROSPACE VEHICLES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5AE69	OEC	3	0	0	3	30	70	100

COURSE OBJECTIVES

The purpose of this subject is to provide the students with the theoretical background and engineering applications.

1. To introduce the concepts of Navigation, guidance and control
2. To familiarize with various ways in which aerospace vehicles are guided and controlled
3. The dynamic objectives which students also learn to achieve by designing flight control systems.
4. Familiarize with the control principles of rockets and missiles
5. To give Insight into the manoeuvres of the space craft

COURSE OUTCOMES:

At the end of the course the students are able to:

1 Formulate the navigational equations of the space vehicle
2 Describe the guidance of the vehicle with state feed back
3 Explain the automatic control and guidance of the aircraft
4 Evaluate the control techniques of the rockets and missiles
Describe major manoeuvres of the space aircraft.

UNIT-I NAVIGATION

Introduction, Basic Principles and Definitions; Dead reckoning and Position Fixing, Celestial, Radio, Inertial Navigation; Principle and Construction of Accelerometers, Mechanical Gyros and Ring Laser Gyros, Inertial Measurement Units, Navigation Equations, Sensor Error Models, Kalman Filter, Attitude Heading Reference System, GPS, Terrain Reference Navigation.

UNIT-II GUIDANCE

Optimal Terminal Guidance of Interceptors, Optimal Terminal Guidance - planar and non-planar, Robust and Adaptive Guidance, Guidance with State Feedback , Guidance with Normal Acceleration Input , Minimum Energy Orbital Transfer.

UNIT-III GUIDANCE AND CONTROL OF AIRCRAFT

Powered Flying Controls, Helicopter Flight Controls, Fly-by-Wire Flight Control, Control laws, Redundancy and Failure Survival, Digital Implementation, Fly-by-Light Flight Control, Auto Pilot, Flight Management Systems, Unmanned Aerial Vehicle.

UNIT-IV CONTROL TECHNIQUES/ CONTROL OF ROCKETS AND MISSILES

Open-loop and Closed Loop Control Systems, Multi-variable Optimization, Optimal Control of Dynamic

Systems, Hamiltonian and Minimum Principle and Jacobi-Bellman Equation, Linear Time-Varying System with Quadratic Performance Index..	
UNIT-V	**CONTROL OF SPACECRAFT**
Launch of Satellite/ Spacecraft, Terminal Control of Spacecraft Attitude, Optimal Single-Axis Rotation of Spacecraft, Multi-axis Rotational Manoeuvres of Spacecraft, Spacecraft Control Torques, Rocket Thrusters, Reaction Wheels, Momentum Wheels and Control Moment Gyros, Torque.	

Text Books:

1. Tewari, A.—Advanced Control of Aircraft, Spacecraft and Rockets‖, John Wiley & Sons, Ltd, Chichester, UK, 2011
2. Nelson R. C - Flight Stability and Automatic Control, SIE edition, McGraw Hill, New York, 2007.

Reference Books:

1. Noton,M. —Spacecraft navigation and Guidance‖, Springer-Verlag, Germany, 1998
2. Mc. Cormic 2. B. W - Aerodynamics, Aeronautics and Flight Mechanics, Wiley India Pvt. Ltd, USA, 2010.

OPEN ELECTIVES -IV

OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DISTRIBUTED DATABASES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5CS20	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To understand the theoretical and practical aspects of the database technologies.
2. To understand the need for distributed database technology to tackle deficiencies of the centralized database systems.
3. To introduce the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application.
4. To familiarize the emerging database technology

COURSE OUTCOMES

1. Analyze database with distributed database concepts and its structures.
2. Apply methods and techniques for Distributed query processing and Optimization
3. Apply the concepts of Distributed Transaction process and concurrency control.
4. Illustrate reliability and providing security in the distributed databases
5. Summarize the concepts of Distributed Object Database Management Systems

UNIT – I	INTRODUCTION	CLASSES : 10

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design

UNIT – II	QUERY PROCESSING	CLASSES : 12

Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries

UNIT – III	TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL	CLASSES : 14

The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions

Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks,

Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.Control.		
UNIT – IV	**RELIABILITY AND SECURITY IN THE DISTRIBUTED DATABASES**	**CLASSES : 14**
Reliability, Basic Concepts, Non blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection		
UNIT – V	**DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS**	**CLASSES : 12**
Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects		

TEXT BOOKS:

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri & Navathe; Pearson Education; Asia Database System Concepts; Korth & Sudarshan; TMH

REFERENCE BOOKS:

1. Data Base Management System; Leon & Leon; Vikas Publications
2. Introduction to Database Systems; Bipin C Desai; Galgotia
3. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall

WEB LINKS

1. https://www.digimat.in/nptel/courses/video/106106168/L01.html
2. https://nptel.ac.in/courses/106/106/106106168/

SOFTWARE PROJECT MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5CS29	OEC	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. The main goal of software development projects is to create a software system with a predetermined functionality and quality in a given time frame and with given costs.
2. For achieving this goal. models are required for determining target values and for continuously controlling these values.
3. This course focuses on principles, techniques, methods & tools for model-based engagement of software projects.
4. Assurance of product quality and process adherence (quality assurance), as well as experience-based creation & improvement of models (process management).

COURSE OUTCOMES

1. Apply the specific roles within a software organization as related to project and process management
2. Analyze the basic infrastructure competences (e.g., process modeling and measurement)
3. Apply the steps of project planning, project management. Quality assurance, and process management and their relationships
4. Determine the importance of project management from the perspectives of planning, tracking and completion of project.
5. Compare and differentiate organization structures and project structures.
6. Implement a project to manage project schedule, expenses and resources with the application of suitable protect management tools.

UNIT-I	CONVENTIONAL SOFTWARE MANAGEMENT	CLASSES: 12

CONVENTIONAL SOFTWARE MANAGEMENT: The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics. Pragmatic software cost estimation.
IMPROVING SOFTWARE ECONOMICS: Reducing Software product size, Improving software processes, improving team effectiveness. Improving automation, Achieving required quality, peer inspections.

UNIT-II	THE OLD WAY AND THE NEWWAY	CLASSES: 12

THE OLD WAY AND THE NEWWAY - The principles of conventional software engineering. Principles of modem software management, transitioning to an iterative process.
ARTIFACTS OF THE PROCESS: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT-III	WORK FLOWS OF THE PROCESS	CLASSES: 12

WORK FLOWS OF THE PROCESS: Software Process Workflow, Inter Trans Workflows.
CHECKPOINTS OF THE PROCESS: Major Mile Stones, Minor Milestones, Periodic status assessments.
ITERATIVE PROCESS PLANNING: Work breakdown structures, planning guidelines, cost and scheduled estimating, Interaction, planning process, Pragmatic planning.

UNIT-IV	PROCESS AUTOMATION	CLASSES: 12

PROCESS AUTOMATION: Automation Building blocks, Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation, Tailoring the Process: Process discriminants.

UNIT-V	PROJECT CONTROL AND PROCESS INSTRUMENTATION	CLASSES: 12

PROJECT CONTROL AND PROCESS INSTRUMENTATION: The server care Metrics, Management indicators, and quality indicators. life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates, Example.
FUTURE SOFTWARE PROJECT MANAGEMENT: Modem Project Profiles Next generation Software economics modem Process transitions.
Case Study: The Command Centre Processing and Display System, Replacement (CCPDS. R).

TEXT BOOKS

1. Software Project Management. Walker Royce, Pearson Education.
2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, Tate McGraw Hd.

REFERENCE BOOKS

1. Applied Software Project Management, Andrew Stelbian 8 Jennifer Greene, O'Reilly. 2006
2. Head First PMP, Jennifer Greene & Andrew Steliman, ORoiHy.2007
3. Software Engineering Project Managent. Richard H. Thayer & Edward Yourdon, second edition, Wiley India, 2004.
4. Ale Project Management, Jim Highsniith. Pearson education, 2004
5. The art of Project management. Scott Berkun. O'Reilly, 2005.
6. Software Project Management in Practice. Pankaj Jalote. Pearson Educabon,2002.

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview
2. https://www.smartzworld.com/notes/software-project-management-pdf-notes-spm-pdf-notes/

OPEN ELECTIVES-IV

OFFERED BY DEPARTMENT OF EEE

INSTRUMENTATION AND CONTROL								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EE61	OEC	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100

Course Objectives:

1. To introduce the basic principles of all measuring instruments
2. To deal with the measurement of voltage, current measurements
3. To understand students how different types of meters work and their construction
4. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
5. To assess the system performance using time domain analysis and methods for improving it

Course Outcomes:

The students should be able to

1. Identify the instruments suitable for typical measurements.
2. Apply the knowledge about transducers and instrument transformers to use them effectively.
3. Improve the system performance by selecting a suitable controller for a specific application
4. Apply various time domain techniques to assess the system performance

SYLLABUS

UNIT-I	INTRODUCTION TO MEASURING INSTRUMENTS	Classes: 10

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

UNIT-II	POTENTIOMETERS & INSTRUMENT TRANSFORMERS	Classes: 08

Principle and operation of D.C. Crompton's potentiometer—standardisation — Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types standardisation — applications. CT and PT — Ratio and phase angle errors.

UNIT-III	TRANSDUCERS & OSCILLOSCOPES	Classes: 12

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

CRO: Cathode ray oscilloscope-Cathode ray tube-time base generator- horizontal and vertical

amplifiers-CRO probes-applications of CRO- Measurement of phase and frequency-lissajous patterns.		
UNIT-IV	**CLASSIFICATION OF CONTROL SYSTEMS**	**Classes: 10**
Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations – Impulse Response and transfer functions .Block diagram algebra – Representation by Signal flow graph – Reduction using mason's gain formula.		
UNIT-V	**TIME RESPONSE ANALYSIS**	**Classes: 10**
Standard test signals – Time response of first order systems –Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications .Effects of proportional derivative, proportional integral systems.		

Text Books:

1. Electrical and Electronic Measurements and Instrumentation, R. K. Rajput, S. Chand & Company Ltd.
2. Electrical Measuring Instruments and Measurements, S. C. Bhargava, BS Publications.
3. I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009
4. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

Reference Books:

1. Electrical & Electronic Measurement & Instruments, A.K.Sawhney DhanpatRai& Co. Publications.
2. Electrical and Electronic Measurements, G. K. Banerjee, PHI Learning Pvt. Ltd.
3. Electrical Measurements and Measuring Instruments, Golding and Widdis, Reem Publications.
4. N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rdEdition, 1998.
5. "NISE", "Control Systems Engineering", John wiley, 6th Edition, 2011.
6. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

Web References:

1. home.mit.bme.hu/~virosztek/docs/mt.../Principles_of_electrical_measurement.pdf
2. https://www.mccdaq.com/handbook/chapt_4.aspx

E-Text Books:

1. *www.vssut.ac.in/lecture_notes/lecture1423813026.pdf*
2. www.vssut.ac.in/lecture_notes/lecture1423904331.pdf
3. www.ent.mrt.ac.lk/~rohan/teaching/EN5001/Reading/DORFCH1.pdf

MOOC Course:

1. https://nptel.ac.in/syllabus/108106070/
2. https://nptel.ac.in/courses/108105064/
3. https://nptel.ac.in/courses/108101037/

<table>
<tr><td colspan="10">ENERGY STORAGE SYSTEMS</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">A5EE63</td><td rowspan="2">OEC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
</table>

Course Objectives:

1. To enable the student to understand the need for energy storage, devices and technologies available and their applications.
2. To Analyze the characteristics of energy from various sources and need for storage
3. To Classify various types of energy storage and various devices used for the purpose
4. To Explain the Pumped hydro Storage System.

Course Outcomes:

The students should be able to

1. Analyze the characteristics of energy from various sources and need for storage
2. Classify various types of energy storage and various devices used for the purpose
3. Explain the Pumped hydro Storage System.
4. Identify various real time applications.

SYLLABUS

UNIT-I	ELECTRICAL ENERGY STORAGE TECHNOLOGIES	Classes: 12

Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT-II	NEEDS FOR ELECTRICAL ENERGY STORAGE	Classes: 08

Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.

UNIT-III	FEATURES OF ENERGY STORAGE SYSTEMS	Classes: 08

Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).

UNIT-IV	TYPES OF ELECTRICAL ENERGY STORAGE SYSTEMS	Classes: 10
Electrical storage systems, Double-layer capacitors (DLC) ,Superconducting magnetic energy storage (SMES),Thermal storage systems, Standards for EES,Technical comparison of EES technologies.		
UNIT-V	**APPLICATIONS**	**Classes: 12**
Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems , Aggregating EES systems and distributed generation (Virtual Power Plant), Battery SCADA– aggregation of many dispersed batteries.		

Text Books:

1. "James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.

Reference Books:

1. "Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

Web References:

1. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118991978.hces212

E-Text Books:

1. https://www.pewtrusts.org/~/media/.../energy_storage-backs_up_power_supply.pdf
2. https://energy.mit.edu/wp-content/uploads/2018/04/Energy-Storage-for-the-Grid.pdf
3. https://www.adb.org/sites/default/files/.../handbook-battery-energy-storage-system.pdf

MOOC Course:

1. *nptel.ac.in/courses/112105221/56*
2. *nptel.ac.in/courses/108108036/9*
3. https://nptel.ac.in/courses/108102047/7

OPEN ELECTIVES-IV

OFFERED BY DEPARTMENT OF ECE

INTRODUCTION TO MOBILE COMMUNICATIONS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5EC64	OEC	L	T	P	C	CIA	SEE	Total
		3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.
2. To fill the skill gap in the domain of Cellular Technology.
3. Get hands on practice in the field of cellular technology and related disciplines.
4. To appreciate the contribution of wireless Communication networks to overall technological growth.
5. To provide an overview of wireless Communication networks area and its applications in communication engineering.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Explain the basics of mobile telecommunication system
2. Illustrate the generations of telecommunication systems in wireless network
3. Demonstrate knowledge on : cellular concepts like frequency reuse, fading, equalization, and handoff strategies
4. Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks
5. Implement the functionality of Transport and Application layer

UNIT-I	INTRODUCTION TO MOBILE COMPUTING	Classes: 9
Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA		
UNIT-II	**MOBILE TELECOMMUNICATION SYSTEM**	**Classes: 9**
GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture		
UNIT-III	**CELLULAR CONCEPT**	**Classes: 9**
Limitations of conventional mobile system, concept of frequency reuse, cluster size, cellular system architecture, channel assignment strategies, call handoff strategies - hard handoff and soft handoff, prioritizing handoff.		

UNIT-IV	WIRELESS NETWORKS	Classes: 9
Wireless networks – Advantages and applications of Wireless LAN, WLAN technology – RF and IR wireless LAN, diffuse, IEEE802.11 architecture, Physical layer, MAC layer, Introduction to WI-FI, Bluetooth architecture.		
UNIT-V	**MOBILE NETWORK AND TRANSPORT LAYER**	**Classes: 9**
Introduction to Mobile IP, requirements, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimization, Reverse tunneling; Mobile adhoc networks – Routing, Destination sequence distance vector, Dynamic source routing.		

Text Books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andreas F.MOlisch - Wireless Communications,J ohn Wiley, 2nd Edition, 2006.

Reference Books:

1. Kamilo Feher - Wireless Digital Communications, PHI, 2003
2. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
3. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.

Web References:

1.https://ptolemy.berkeley.edu/books/leeseshia/releases/LeeSeshia_DigitalV2_2.pdf

E-Text Books:

1.https://ptolemy.berkeley.edu/books/leeseshia/

MOOC Course

1.https://onlinecourses.nptel.ac.in/noc20_ee98/preview

BASICS OF EMBEDDED SYSTEMS DESIGN

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5EC65	OEC	3		-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Explains about the basic functions, structure, concepts and applications of embedded systems.
2. Describes the Core of the Embedded System
3. Explains about the tools used to develop in an embedded environment
4. Gives the knowledge about the development of embedded software using RTOS.
5. Gives the knowledge about the Advance Architectures

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1 Understand the selection procedure of Processors in the Embedded domain.
2. Design Procedure for Embedded Firmware.
3. Implement the Real time Operating Systems applications in Embedded Systems
4. Analyze the Correlation between task synchronization and latency issues
5. Understand the concepts of Advance architecture

UNIT-I	INTRODUCTIONTO EMBEDDED SYSTEMS	Classes: 09

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems

UNIT-II	TYPICAL EMBEDDED SYSTEM	Classes: 09

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Sensors and Actuators.

UNIT-III	EMBEDDED SOFTWARE DEVELOPMENT TOOLS	Classes: 09

Host and target machines, linker/locators for embedded software, getting embedded software into the target system, debugging techniques: Testing on host machine, using laboratory tools.

UNIT-IV	RTOS BASED EMBEDDED SYSTEM DESIGN	Classes: 09

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Message queues, mailboxes and pipes.

UNIT-V	INTRODUCTION TO ADVANCED ARCHITECTURES	Classes: 09
ARM and SHARC, processor and memory organization and instruction level parallelism; networked embedded systems: bus protocols, I2C bus and CAN bus.		

Text Books:
1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Reference Books:
1. Embedded Systems - Raj Kamal, TMH.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013
4. An Embedded Software Primer - David E. Simon, Pearson Education.

Web References:
1. https://www.elprocus.com/embedded-system-design/

E-Text Books:
1. https://www.phindia.com/Books/BookDetail/9788120347304/embedded-system-design-chattopadhyay

MOOC Course
1.https://onlinecourses.nptel.ac.in/noc20_ee98/preview

OPEN ELECTIVES-IV

OFFERED BY

DEPARTMENT OF IT

INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5IT26	OEC	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. Produce apps for Android platform devices
2. Gain a basic understanding of computer architecture and object-oriented programming
3. Develop a working knowledge of Apple's Xcode app development tool
4. Understand mobile design principles
5. Identify need and opportunity in app markets

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Describe those aspects of mobile programming that make it unique from programming for other platforms,
2. Critique mobile applications on their design pros and cons,
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
4. Program mobile applications for the Android operating system that use basic and advanced phone features, and
5. Deploy applications to the Android marketplace for distribution.

UNIT-I	INTRODUCTION TO ANDROID	Classes: 10
The Android Platform, Android SDK, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.		
UNIT-II	**ANDROID APPLICATION DESIGN ESSENTIALS**	**Classes: 08**
Android terminologies, Application Context, Activities.		
UNIT-III	**ANDROID USER INTERFACE DESIGN ESSENTIALS**	**Classes: 08**
User Interface Screen elements, Designing User Interfaces with Layouts.		

UNIT-IV	TESTING ANDROID APPLICATIONS	Classes: 08
Testing Android applications, Publishing Android application, Using Android preferences, managing Application resources in a hierarchy, working with different types of resources.		
UNIT-V	**USING COMMON ANDROID APIS**	**Classes: 10**
Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers.		

Text Books:

1. Lauren Darcey and Shane Conder, ―Android Wireless Application Development‖, Pearson Education,2nd ed. (2011)

Reference Books:

1. R1. Reto Meier, ―Professional Android 2 Application Development‖, Wiley India Pvt Ltd
2. R2. Mark L Murphy, ―Beginning Android‖, Wiley India Pvt Ltd.
3. R3. Android Application Development All in one for Dummies by Barry Burd, Edition.

BIG DATA									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5IT27	**OEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100

COURSE OBJECTIVES:

To learn

1. To introduce the terminology, technology and its applications
2. To introduce the concept of Analytics and Visualization
3. To demonstrate the usage of various Big Data tools and Data Visualization tools

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. **Compare** various file systems and **use** an appropriate file system for storing different types of data.
2. **Demonstrate** the concepts of Hadoop ecosystem for storing and processing of unstructured data.
3. **Apply** the knowledge of programming to process the stored data using Hadoop tools and generate reports.
4. **Connect** to web data sources for data gathering, **Integrate** data sources with hadoop components to process streaming data.
5. **Tabulate** and **examine** the results generated using hadoop components.

UNIT-I	INTRODUCATION TO BIG DATA	Classes: 12

Data and its importance, Big Data- Definition, V's of Big Data, Hadoop Ecosystem

HADOOP ARCHITECTURE

Hadoop Storage **:** HDFS, Hadoop

Processing **:** MapReduce Framework

Hadoop Server Roles **:** Name Node, Secondary Name Node and Data Node, Job Tracker, Task Tracker

HDFS-HADOOP DISTRIBUTED FILE SYSTEM

Design of HDFS, HDFS Concepts, HDFS Daemons, HDFS High Availability, Block Abstraction, FUSE-File System in User Space. HDFS Command Line Interface (CLI), Concept of File Reading and Writing in HDFS.

UNIT-II	MAPREDUCE PROGRAMMING MODEL	Classes: 12

Introduction to Map Reduce Programming model to process Big Data, key features of Map Reduce, Map Reduce Job skeleton, Introduction to Map Reduce API, Hadoop Data Types, Develop Map Reduce Job using Eclipse, build a MapReduce Job export it as a java archive (.jar file).

MAPREDUCE JOB LIFE CYCLE: How Map reduces Works? Understanding Mapper, Combiner, Partitioner ,Shuffle & Sort and Reduce phases of MapReduce Application, Developing Map Reduce Jobs based on the requirement using given datasets like weather dataset.

MAPREDUCE API: Understanding new MapReduce API from org.apache.hadoop.mapreduce and its sub packages to develop MapReduce applications ,key difference between old MapReduce API and the new MapReduce API.

UNIT-III	INTRODUCTION TO PIG	Classes: 12

Understanding pig and pig Platform, introduction to Pig Latin Language and Execution engine, running pig in different modes, Pig Grunt Shell and its usage.

PIG LATIN LANGUAGE–DATA TYPES IN PIG

Pig Latin Basics, Key words, Pig Data types, Understanding Pig relation, bag, tuple and writing pig relations or statements using Grunt Shell ,expressions, Data processing operators, using Built in functions.

WRITING PIG SCRIPTS USING PIG LATIN: Writing pig scripts and saving them in text editor, running pig scripts from command line.

UNIT-IV	INTRODUCATION TO HIVE	Classes: 12

Understanding Hive Shell, Running Hive, Understanding Schema on read and Schema on write.

HIVE QL DATA TYPES, SEMANTICS: Introduction to Hive QL (Query Language), Language semantics, Hive Data Types.

HIVE DDL, DML AND HIVE SCRIPTS: Hive Statements, Understanding and working with Hive Data Definition Languages and Manipulation Language statements, Creating Hive Scripts and running them from hive terminal and commands line.

UNIT-V	SQOOP, FLUME, OOZIE	Classes: 12

SQOOP: Introduction to Sqoop tool, commands to connect databases and list databases and tables, command to import data from RDBMS into HDFS, Command to export data from HDFS into required tables of RDBMS.

FLUME: Introduction to Flume agent, understanding Flume components Source, Channel and Sink, Writing flume configuration file, running flume configuration file to ingest the data into HDFS.

OOZIE: Introduction to Oozie, Understanding work flow and how to create Work flow using Work Flow definition language in XML, running a basic Oozie workflow to run a MapReduce job.

Text Books:

1. Hadoop: The Definitive Guide, 4th Edition - O'Reilly Media
2. Big Data and Hadoop- Learn by Example, Mayank Bhushan

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

OPEN ELECTIVES-IV

OFFERED BY

DEPARTMENT OF MECHANICAL ENGINEERING

RENEWABLE ENERGY SOURCES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
A5ME78	OEC	3	-	-	3	30	70	100

COURSE OVERVIEW:

Renewable energy is the energy produced from sources that donot deplete or can be replenished with ahumans life time. This course focuses on various renewable energy sources such as solar energy, wind energy, geothermal energy etc.

COURSE OUTCOMES:

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

1. Classify renewable energy sources and explain environmental impact of solar energy, solarradiation, their measurement and instruments.
2. Classify concentrating collectors and explain in detail about various solar gadgets.
3. Explain about wind mill, types of wind mills, its construction, wind energy conversion systems and principles of bio mass.
4. Explain in detail geothermal and ocean energies.
5. Demonstrate the concepts of direct energy conversion.

UNIT-I INTRODUCTION

Introduction – Renewable energy sources – Limitations – Classifications – Comparison – Global and Indian Energy scenario. Solar Energy: Introduction – Environmental impact of solar power – extraterrestrial andterrestrial solar radiation – solar radiation on titled surface – Solar Radiation Measurement and Instruments –Data and estimation.

UNIT-II SOLAR ENERGY

Flat plate and concentrating collectors – classification of concentrating collectors – orientation and thermal analysis – advanced collectors. Solar Gadgets: Solar furnace, Solar air heater, Solar water heater, Soarcooker, solar still, solar pond, solar pump, solar dryer, solar cell. Solar space heating and cooling system – Storage of solar energy.

UNIT-III WIND ENERGY & BIO MASS

Wind energy utilization: Introduction – Origin and nature of winds – Types of wind mills and its construction – Wind energy conversion systems – performance characteristics.

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters,combustion characteristics of bio-gas, applications and economic aspects.

UNIT-IV	GEOTHERMAL ENERGY & OCEAN ENERGY
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and waveenergy: Potential and conversion techniques, mini-hydel power plants, and their economics.	
UNIT-V	**DIRECT ENERGY CONVERSION**
Direct Energy Conversion: Need, limitations, principles of DEC. Thermo-electric generators, seebeck, peltier and Joule-Thomson effects – applications, MHD generator principle, Fuel cells: Overview; Classification of fuel cells; Operating principles. Bio-fuels, Urban waste to energy conversion	

Text Books:

1. Rai G.D, *Non-Conventional Energy Sources*, Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., *Renewable Energy Sources*, EFN Spon Ltd., UK, 2006

Reference Books:

1. Ashok V Desai, *Non-Conventional Energy*, Wiley Eastern Ltd, New Delhi, 2003.
2. Mittal K M, *Non-Conventional Energy Systems*, Wheeler Publishing Co. Ltd, New Delhi, 2003.
3. Khan B H, *Non-Conventional Energy Resources*, Tata McGraw Hill, 2nd Edn. New Delhi, 2009.
4. Ramesh R & Kumar K U, *Renewable Energy Technologies*, Narosa Publishing House, New Delhi, 2004
5. Tiwari. G.N., *Solar Energy – Fundamentals Design, Modelling & Applications*, Narosa Publishing House, New Delhi, 2002.

Web References:

1. http://www.afdc.energy.gov/fuels/natural_gas.html
2. https://cleancities.energy.gov/
3. http://www.firmgreen.com/
4. https://www.renewableresourcescoalition.org/alternative-energy-sources/
5. https://www.edx.org/learn/renewable-energy

E-Text Books:

1. https://www.sciencedirect.com/book/9780126561531/renewable-energy
2. https://www.pdfdrive.com/renewable-energy-resources-e14705840.html
3. https://www.pdfdrive.com/search?q=renewable&pagecount=&pubyear=&searchin=

MOOC Course:

1. https://www.coursera.org/learn/renewable-energy-entrepreneurship
2. https://www.coursera.org/learn/wind-for-renewable-energies
3. https://online-learning.tudelft.nl/courses/sustainable-energy-design-a-renewable-future/

OPEN ELECTIVES-IV

OFFERED BY
DEPARTMENT OF SCIENCE AND HUMANITIES

MANAGEMENT SCIENCE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
A5HS11	**OEC**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Familiarize & obtain Knowledge with the process of management and to provide basic insights into management practices.
2. Understand the structure & Designing of an Organization.
3. Knowledge on the aspects of Production.
4. Analyze the market and the strategies involved in Marketing.
5. Knowledge on concepts related to Human Resources.
6. Understand the techniques used in Project Management.
7. Familiarize with strategies used for analysis of an Organization.
8. Understand the Contemporary Management Issues.
9. Familiarize with the management skills which can be applied in the Organizational context to achieve Organizational goals.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Knowledge on management theories and practices.
2. Understanding designing organizational structure.
3. Understanding on the methods and charts used in operations management.
4. Ability to understand the market and its environment.
5. Understand the processes, functions, etc., in Human Resources Management.

UNIT-I	**INTRODUCTION TO MANAGEMENT AND ORGANIZATION**	**Classes: 09**

Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management-Taylor's Scientific Management Theory- Fayal's Principles of Management- Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory Y - Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management, Designing Organizational Structures: Basic concepts related to Organization - Departmentation and Decentralization, Types and Evaluation of mechanistic and organic structures of organization and suitability.

UNIT-II	**OPERATIONS AND MARKETING MANAGEMENT:**	**Classes: 09**

Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass Production), Work Study - Basic procedure involved in Method Study and Work Measurement - Business Process Reengineering(BPR) - Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality, Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Store Records - JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.		
UNIT-III	**HUMAN RESOURCES MANAGEMENT(HRM):**	**Classes: 09**
Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating - Capability Maturity Model (CMM) Levels - Performance Management System.		
UNIT-IV	**PROJECT MANAGEMENT (PERT/ CPM):**	**Classes: 09**
Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).		
UNIT-V	**STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES:**	**Classes: 09**
Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced Score Card as Contemporary Business Strategies.		
Text Books: 1. *A.R.Aryasri* : Management Science, TMH, (Latest edition) 2. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004.		
Reference Books:		

INTELLECTUAL PROPERTY RIGHTS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
A5HS12	OEC	L	T	P	C	CIA	SEE	Total

		3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Familiarize & obtain Knowledge with the process of management and to provide basic insights into management practices.
2. Understand the structure & Designing of an Organization.
3. Knowledge on the aspects of Production.
4. Analyze the market and the strategies involved in Marketing.
5. Knowledge on concepts related to Human Resources.
6. Understand the techniques used in Project Management.
7. Familiarize with strategies used for analysis of an Organization.
8. Understand the Contemporary Management Issues.
9. Familiarize with the management skills which can be applied in the Organizational context to achieve Organizational goals.

COURSE OUTCOMES:

Upon successful completion of the course, the student is able to

1. Knowledge on management theories and practices.
2. Understanding designing organizational structure.
3. Understanding on the methods & charts used in operations management.
4. Ability to understand the market and its environment.
5. Understand the processes, functions etc in Human Resources Management.
6. Ability to solve problems in managing the Project.
7. Knowledge on Strategic alternatives.
8. Familiar with the practices implemented in management.
9. Understand the social responsibilities of Management.
10. Understand the basic concepts of Management.

UNIT-I	INTRODUCTION TO INTELLECTUAL PROPERTY:	Classes: 09
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.		
UNIT-II	TRADE MARKS:	Classes: 09
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.		
UNIT-III	LAW OF COPY RIGHTS:& LAW OF PATENTS:	Classes: 09

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Foundation of patent law, patent searching process, ownership rights and transfer		
UNIT-IV	**TRADE SECRETS & UNFAIR COMPETITION:**	**Classes: 09**
Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade screte litigation. Misappropriation right of publicity, False advertising.		
UNIT-V	**NEW DEVELOPMENT OF INTELLECTUAL PROPERTY:**	**Classes: 09**
new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international - trade mark law, copy right law, international patent law and international development in trade secrets law.		
Text Books: 1. Intellectual property right, Deborah, E. Bouchoux, cengage learning. 2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing Company Ltd.		
Reference Books:		