ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(Choice Based Credit System)

R20

Electronics and Communication Engineering

For

B.TECH. FOUR YEAR DEGREE COURSE
(Applicable for batches admitted from 2020-2021)

SWARNANDHRA
COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
SEETHARAMAPURAM, NARSAPUR-534 280, W.G.DT., A.P.

ACADEMIC REGULATIONS

1. INTRODUCTION

Swarnandhra College of Engineering & Technology (**Subsequently referred to as SCET**) will be followed the norms of Jawaharlal Nehru Technological University Kakinada and Govt. of Andhra Pradesh.

All Academic Programme rules and regulations are approved by the Academic Council, which is the highest Academic body of the Institute. It is applicable for all Bachelor of Technology (B. Tech) degree programme from academic year 2020-21.

2. ADMISSIONS

Regular Admission

(Join in first year B. Tech Programme)

Admissions in the Institution are classified into **CATEGORY – A,** through convener, EAMCET and **CATEGORY- B** filled by the college management.

Lateral Entry Admission
(Join in the Second year/third semester of B. Tech Programme)
Eligibility: Diploma in Engineering / B.Sc Degree with Mathematics as one course .
Based on the rank secured by the candidate at Engineering Common Entrance Test (ECET) conducted by APSCHE, Government of Andhra Pradesh.

Advance standing Admission
(Transfer from other Colleges/ Re-admission due to dis-continuation)
These may arise in the following cases:

a) When a student seeks transfer from other colleges to SCET and desirous to pursue the study at SCET in an eligible branch of study.
b) When students of SCET get transferred from one regulation to another regulation.

In all such cases, approval is mandatory from the statutory bodies

3. UNDER GRADUATE (UG) PROGRAMMES OFFERED

The College is offering the following programmes:

- Computer Science and Engineering (CSE)
- Electronics and communication Engineering (ECE)
- Electrical and Electronics Engineering (EEE)
- Information Technology (IT)
- Mechanical Engineering (ME)
- Civil Engineering (CE)
- Artificial Intelligence and Machine Learning (AI&ML)
- Robotics (ROBO)

Structure of the Programme:

i) Preamble:

It is emphasized in UGC Guidelines on Choice Based Credit System (CBCS), that the important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides

governance and other matters. It is adopted grading system in place of conventional system of marks and percentages.

CBCS provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The students can register any course of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach through open electives.

Key words CBCS, such as Course, credit, credit point, CGPA, SGPA, Grade Point, Letter Grades as given in the UGC guidelines are used the same definitions.

Each Programme consists of:

- Foundation courses in Basic Sciences, Engineering Sciences, Humanities and social science including management courses.
- Professional core Courses to impart broad knowledge.
- Professional Elective Courses from the discipline or interdisciplinary areas / industry related opted by the student based on their interest in specialization.
- Open Elective Courses from the interdisciplinary areas opted by the students based on their interest in specialization.
- Mandatory Courses, Internship, Seminar, Project work.
- Skill Oriented Courses to upskilling the graduates on the skills relevant to the need and demands of the industry.

Each Programme designed to have 35-40 theory courses, 20-25 laboratory courses and 05 Skill Oriented Courses. The categories of courses are indicated in the following table.

Athree-weekinductionprogramismandatoryforallfirstyear UGstudentsandshallbeconductedasper AICTE/UGC/APSCHE guidelines.

TABLE-1 CATEGORY OF COURSES

S.No	Category	Code
1	Humanitiesandsocialscienceincluding Managementcourses	HSMC
2	BasicSciencecourses	BSC
3	Engineeringcoursesscience	ESC
4	ProfessionalcoreCourses	PCC
5	OpenElectiveCourses	OEC
6	ProfessionalElective Courses	PEC
7	Internship,seminar,projectwork	PROJ
8	SkillOrientedCourses	SC
9	LaboratoryCourses	LC
10	Mandatorycourses	MC

Note: All components prescribed in the curriculum will be conducted and evaluated.

MOOCS: A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the Programme. Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

ii) **Contact hours:** Depending on the complexity and volume of the course, the number of contact hoursper week will be determined.

iii) Credits:

TABLE-2 CREDITS BASED ON CONTACT HOURS

Course type	No. of Contact Hours	No. of Credits
Theory	1	1
Practical	2	1

TABLE-3 CREDITS FOR DIFFERENT COURSES

Course type	Lecture method			Credits
	L	T	P	C
Theory/Elective	2	1	0	3
	3	0	0	3
	2	0	2	3
	2	0	0	2
Laboratory	0	0	2	1
	0	0	3	1.5
	0	0	4	2
Skill Oriented Courses	1	0	2	2

Curriculum for each Programme:

- All Four year B. Tech Programme of study is formulated based on the guidelines mentioned in 3.1 and recommended by the concerned Board of Studies (BoS) and approved by the Academic Council (AC).
- The same curriculum will be applicable for lateral entry students from 3 rd semester onwards.
- For advance standing admission, the equivalent curriculum will be prepared by BoS and approved by AC.

4 DURATION OF THE PROGRAMME:

The duration of the B. Tech. Programme is four academic years consisting of eight semesters. Students, who fail to fulfill all the academic requirements for the award of the degree within the prescribed duration as per article 4.1, will forfeit their admission in B. Tech**.**

Maximum duration of study.

Maximum duration permitted for completion of the B. Tech. Programme of study will be:

Regular Admission: Eight academic years in sequence from the year of admission for a student admitted into first year of any Programme.

Lateral Entry Admission: Six academic years in sequence from the year of admission for a student admitted into second year of any Programme.

Advanced standing Admission: The maximum time for completion of Programme of study, will be twice the period in terms of academic years in sequence, with prescribed curriculum.

TABLE- 4 MAXIMUM DURATION OF STUDY

Admitted year of study	Maximum duration
First year	8 Academic years in sequence
Second year (Lateral entry)	6 Academic years in sequence
Advanced standing	Twice the period in terms of academic years in sequence

Cancellation of Admission :
In case candidate fails the above conditions for the award of degree, admission stands cancelled.

5 MEDIUM OF INSTRUCTION :
The medium of instruction and examinations are in English.

6 MINIMUM INSTRUCTION DAYS: Each semester will consist of 22 weeks duration with minimum of 110 working days which includes instruction days, internal tests and End examinations.

7 TRANSITORY REGULATIONS (Admitted under advance standing**):**

The following regulations will be followed the operandi. At the time of such admission, based on the Programme pursued (case by case)

- Discontinued or detained candidates are eligible for re-admission in subsequent years in the same semester.
- The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

In case of transferred students from other colleges, credits shall be transferred to SCET as per the academic regulations and course structure of SCET.

8 DISTRIBUTION AND WEIGHTAGE OF MARKS:

Each semester consists of 4/5/6 theory courses and 4/3/2 Laboratory courses. However, in the 8th semester there will be only project work / internship in industry.

(a). Theory Courses:

- Each course consists of five units.
- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- The internal evaluation of 30 marks consists of Two Mids for 20 marks and Five class tests for 10 marks.
- Mid Examination: Each mid examination will be conducted for 20 marks with the duration of 75 Minutes. Internal test paper consists of three questions (8M+8M+4M) from two and half units and all are to be answered.
- **Weighted average of two Mids** performance will be considered, weightage of 80% for the best Mid marks and 20% for the second.
- **Class tests for 10 marks calculation**: There will be one class test conducted in each unit. Average of **Best three** will be considered.
- The **end semester** examination will be conducted for 70 marks which covers full syllabus. In end examination pattern, **Part – A** consists of five short questions from all units (Brainstorming/Thought provoking/Case study) for 10 marks. **Part – B** has **5 questions** with internal choice from each unit and valued for 60 marks.
- Internal Marks will be considered for three academic years only if the candidates will not completed the concern course because of less than 12 internal marks. Thereafter the candidate writes external examination for 70 which will be converted to 100 but the

candidate must get minimum 40 %.

(b). **Practical Courses:**

- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- End practical examination will be conducted by the internal and external examiner appointed by COE.
- Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

(c). **Design or Engineering Drawing Marks Distribution:**For the courses of design or drawing such as Engineering Graphics, etc., the distribution will be 30 marks for internal evaluation with 10 marks for day-to-day work, and 20 marks from two internal test (80% of first best + 20% of second best). End examination will be conducted for 70 marks.

(d) **SummerInternship:**It can be carried out with a minimum of Six weeks and maximum Eight weeks duration at end of 4^{th} semester and 6^{th} semester. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. It will be evaluated internally by an internal evaluation committee comprising of Head of the Department and two faculty of the department. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightage respectively. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits

(e) **Full Internship and Project Work:** The 8th Semester Project Work with full internship will be evaluated for 200 Marks. The project work is evaluated for internal assessment of 60 and external Examination for 140. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

i) **Internal Assessment:** Internal Assessment will be monitored by Project Review Committee consists of Head of the Department , Supervisor and Senior faculty member on the basis of two seminars and the internal marks will be awarded by Project Supervisor with recommendation of PRC.

ii) **External Examination**: External Examination will be conducted by Project external examination committee consists of Head of the Department, Supervisor and External examiner appointed by CoE , through presentation / viva - voce by the student.

9. Community Service Project (Experiential Learning through Community Engagement):

Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development. Community Service Project is meant to link the community with the college for mutualbenefit. Community Service Project is an integral part of the curriculum with 4 Credits and evaluated internally for 100 marks.

Objectives:

- To sensitize the students to the living conditions of the people who are around them,
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project:

1. Every student should put in a minimum of 180 hours for the Community Service Project during the summer/ Semester vacation.
2. Each class/section should be assigned with a mentor
3. Specific Departments could concentrate on their major areas of concern.
4. A log book has to be maintained by each of the student, where the activities undertaken / involved to be recorded.
5. The log book has to be countersigned by the concerned mentor/faculty incharge.
6. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
7. The final evaluation to be reflected in the grade memo of the student.
8. The Community Service Project should be different from the regular programmes of NSS / NCC / Green Corps / Red Ribbon Club, etc.
9. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
10. The Project Log-, Project Implementation, Project report and Presentation shall carry 20%, 30%, 25% and 25% weightage respectively. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

TABLE- 5 MARKS ALLOCATION

Course type	Marks Allocation			
	Internal		End Semester	Total
	Internal test	Class Test/ Day to day work		
Theory course	20	10	70	100
Laboratory course	15	15	70	100
Design or Drawing course	20	10	70	100
Skill Oriented Courses	15	15	70	100
Summer Internship	50		-	50
Community Service Project	100		-	100
Project Work	60		140	200

(f) **Mandatory Courses**:
These courses are compulsory with zero credits. Only internal examination will be conducted and student has to secure minimum 40% of the marks in the evaluation for passing the course. The minimum attendance requirement is 75 %.

(g) **Open Electives:** Students are to choose Open Elective – I during 5th Semester, Open Elective– II during 6th Semester and Open Elective – III and IV during 7th Semester from the list of Open Electives given in the Course Structure. However, students cannot opt for an Open Elective Subject offered by their own (parent) Department, if it is already listed under any category of the courses offered by the parent Department in any Semester.

(h) Skill Oriented Courses:

i) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering.

ii) For these courses, one theory and two practical hours may be allotted as approved by the concerned BOS.

iii) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS.

iv) Every year the concerned BoS review the skill oriented courses based on industrial demand which are offered by the eligible external agencies and college.

v) Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination. End examination will be conducted by the internal and external examiner appointed by COE. Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

vi) If a student chooses a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded depends on the Course Completion Certificate.

vii) College academic committee evaluates the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

viii) Therearefive(05)skill-oriented coursesshallbeofferedduring IIIto VIIsemesters.

ix) Out of the five skill courses two shall be skill-oriented courses from the same domainand shall be completed in second year. Of the remaining 3 skill courses, one shall benecessarily be a soft skill course and the remaining 2 shall be skill-advanced courseseither from the same domain or Job oriented skill courses, which can be of interdisciplinary nature.

10. ATTENDANCE REQUIREMENTS

(i) A student will be eligible to appear for end semester examinations, if he/she acquired a minimum of 75% of attendance in aggregate of all the courses.

(ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (Above 65% and below 75%) in any semester may be granted by the College Academic Committee.

(iii) Shortage of Attendance below 65% in aggregate shall not be condoned.

(iv) Students with less than 65% of attendance in any semester are not eligible to take up their end examination of that particular semester and their registration for previous semesters examinations shall be allowed.

(v) Attendance may also be condoned for those who participate in Inter Collegiate/university sports, co- and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose (>65%) and recommended by the concerned authority. He/ She shall pay the prescribed Condonation fee.

(vi) Prescribed Condonation fee shall be payable by the student to appear for the end examination.

(vii) A Student will not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered consecutively.

(viii) A student will be condoned only four times for regular student and three times for lateral entry students during entire course of study.

(ix) Forinductionprogrammeattendanceshall bemaintainedasperAICTEnorms.

TABLE-6 ATTENDANCE REQUIREMENT

Attendance Percentage	Condonation fee	Appear End Exams
Above 75 %	Nil	Eligible
65 % -75%	Yes (on medical grounds)	Eligible
Below 65 %	Nil	Not Eligible (Seek re-admission to that semester when offered)

11. MINIMUM ACADEMIC REQUIREMENTS:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in **S.No.10.**

(i) A student will be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or drawing subject or project if he/she secures not less than a minimum of 35% of marks exclusively in the end semester examinations in each of the courses, for which the candidate had appeared. However, the candidate should have secured a minimum of 40% marks in both external and internal components put together to declare eligible for pass..

(ii) A student will be promoted from first semester to second semester, second semester to third and third to fourth semester, if he/she satisfies the minimum attendance requirement.

(iii) A student will be promoted from 4^{th} to 5^{th} Semester (2^{nd} year to 3^{rd} year), if he/she fulfills the academic requirements of 40% of the credits up to either 3^{rd} or 4^{th} Semester from all the examinations (Regular and supplementary) whether or not the candidate takes the examinations.

(iv) A student will be promoted from 6^{th} to 7^{th} Semester (3^{rd} year to 4^{th} year), only if he/she fulfills the academic requirements of 40% of the credits up toeither 5^{th} or6^{th} Semester from, all the examinations (regular and supply) whether or not the candidate takes the examinations.

(v) When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into thesame semester/year in which he has been detained. However, the academic regulations under whichhewasfirstadmitted shall continueto beapplicabletohim.

TABLE-7 PROMOTION IN TO NEXT HIGHER CLASS

Promotion		Promotion Criteria
From	To	
1^{ST} Semester	2^{nd} Semester	Minimum Attendance requirement
2^{nd} Semester	3^{rd} Semester	
3^{rd} Semester	4^{th} Semester	
4^{th} Semester	5^{th} Semester	Minimum Attendance requirement & 40% of credits up to either 3^{rd} or 4^{th} semester from all exams
5^{th} Semester	6^{th} Semester	Minimum Attendance requirement
6^{th} Semester	7^{th} Semester	Minimum Attendance requirement & 40% of credits up to either 5^{th} or 6^{th} semester from all exams
7^{th} Semester	8^{th} Semester	Minimum Attendance requirement

12. GAP YEAR CONCEPT

Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year study, after the 4^{th} Semester with the due recommendations of the GAP committee and approved by the principal. This may be extended to two years at the most which period is not counted for the maximum time for graduation.

13. AWARD OF B.TECH DEGREE:

A student shall be eligible for award of the B.Tech. Degree if he/she fulfills all the following conditions:

(i) Pursue the programme of study for a stipulated period of four years and not more than eight years.

(ii) Register for 160 credits and secure the same.

(iii) Registered and successfully completed all the components prescribed in the programme of study in which he/she is admitted.

(iv) All mandatory courses must be completed with satisfactory.

(vi) Obtained CGPA greater than or equal to 5.0 (minimum requirements for pass).

(vii) A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

(viii) All students shall register for NCC/NSS activities and will be required to participate in anactivity specified by NSS officer during first two years. Grade shall be awarded asSatisfactoryorUnsatisfactoryinthemarksheetonthebasisofparticipation,attendance,performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat theaboveactivityinthesubsequent years,in ordertocomplete the degreerequirements.

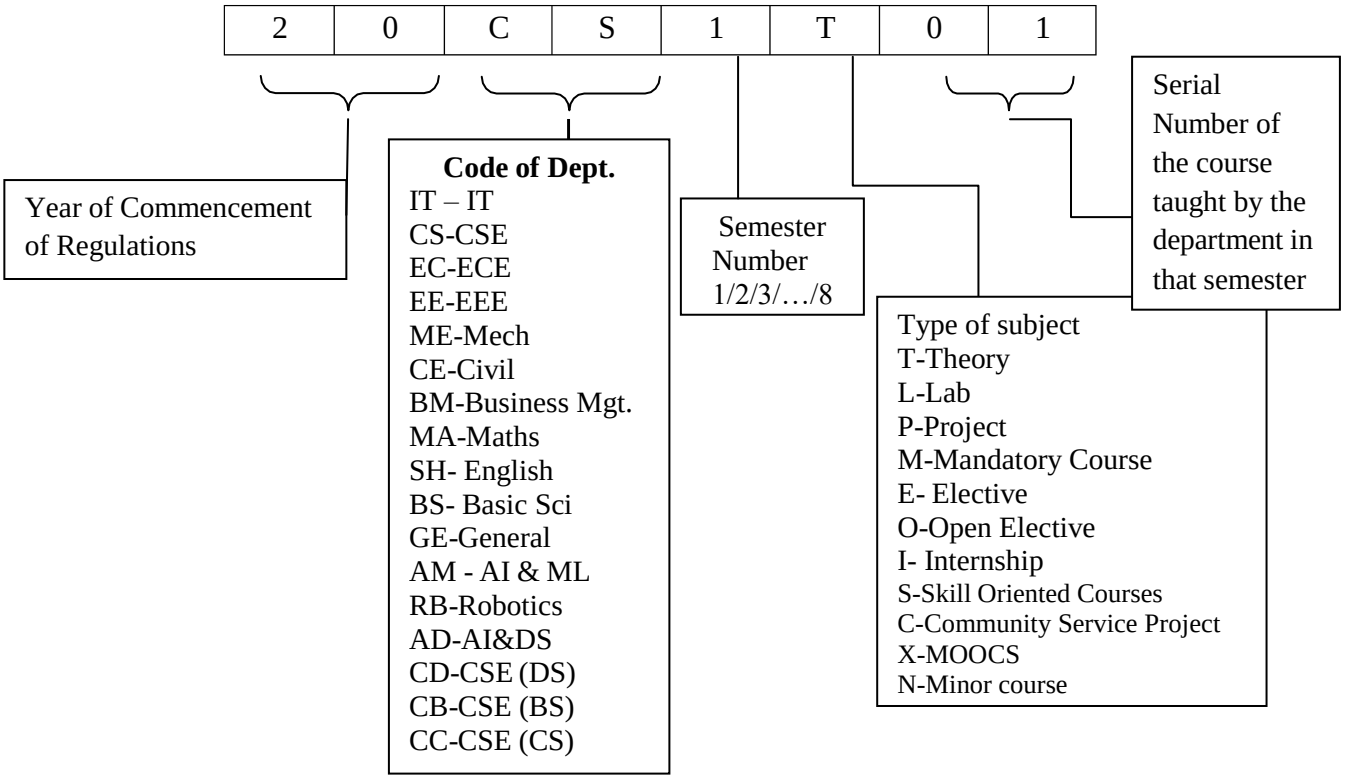
(ix) Courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

14. AWARD OF B. TECH. (HONOR)/B. TECH. (MINOR):

B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. Registering for Honors/Minor is optional. (Refer Sl.No 24& 25)

15. COURSE CODE & COURSE NUMBERING SCHEME:

The subject codes will be given by the department teaching the subject. Each subject code contains 8 characters. The 8 characters for each subject will be filled as per the following guidelines.



16. GRADING SYSTEM:

Award of Grade:

(i) Semester Grade Point Average (SGPA):

a) The Semester Grade Point Average (SGPA) will be calculated according to the formula

$$\text{SGPA (Si)} = \frac{\sum C_i G_i}{\sum C_i}$$

Where C_i = number of credits for the subject i

G_i = grade points obtained by the student in the subject.

b) To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student‟s performance in all the courses taken in all the semesters completed up to the particular point of time.

$$\text{CGPA} = \frac{\sum C_i S_i}{\sum C_i}$$

where „Si‟ is the SGPA of the ith semester and Ci is the total number ofcredits in that semester

i. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported inthe transcripts.

ii. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

iii. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D, E and F.

iv. Equivalent Percentage = (CGPA – 0.75) x 10

(ii) After a student satisfy the requirements prescribed for the award of B.Tech Programme he/she shall be placed in one of the following four grades. The award of the degree is based on CGPA on a grade point scale of 10 and given in Table 8.

Table -8

CGPA	Award of Division
≥ 7.75	First Class with Distinction (Withoutanysupplementaryappearance)
≥ 6.75 < 7.75	First Class
≥ 5.75 < 6.75	Second Class
≥ 5.00 < 5.75	Pass Class

Award of Grade in Each Semester:

(i) Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester for each subject. The letter grades and the corresponding grade points are as given in the Table 10.

Table -9

Percentage of Marks Scored	Letter Grade	Level	Grade Points
>=90	A+	Outstanding	10
80 - 89	A	Excellent	9
70-79	B	Very Good	8
60-69	C	Good	7
50-59	D	Fair	6
40-49	E	Satisfactory	5
<40	F	Fail	0
	Ab	Absent	0

(ii) A student earns a minimum of 5 grade points in a subject is declared to have successfully completed the subject, and is deemed to have earned the credits assigned to that subject. However, it should be noted that a pass in any subject/Internship/project/ shall be governed by the rules mentioned in **S.No. 13**.

(iii) Grade Sheet: A grade sheet (memorandum) will be issued to each student indicating his/her performance in all courses taken in that semester and also indicating the grades.

(iv) Transcripts: After successful completion of the programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued up to any point of study to the student on request and by paying stipulated fee in force.

(v) Candidates shall be permitted to apply for revaluation within the stipulated period with payment of prescribed fee.

(vi) The Academic Council has to approve and recommend to the JNTUK, Kakinada for the award of a degree to any student.

17. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i. The students have to acquire 121 credits from 3rd Semester to 8th Semester of Program (regular) for the award of the degree.

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

iii. The same attendance regulations are to be adopted as per the rules mentioned in item No.9.

iv. **Rules for Promotion in to Next Higher Class:** (6th Semester to 7th Semester): A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to either 5th or 6th Semester.

18. SUPPLEMENTARY EXAMINATIONS:

In addition to the Regular Final Examinations held at the end of each semester, a Supplementary Examination will be conducted. A student can appear for any number courses of supplementary examinations till he/she clears the courses. However the maximum stipulated period of programme cannot be relaxed under any circumstance.

19. ADVANCED SUPPLEMENTARY EXAMINATIONS:

Candidate who fails the courses in 7th and 8th Semester can appear for Advanced Supplementary Examinations.

20. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i. The students have to acquire 121 credits from 3rd Semester to 8th Semester of B. Tech Programme for the award of the degree.

ii. All mandatory courses must be completed with satisfactory for award of degree.

iii. Obtained CGPA greater than or equal to 4.5 (minimum requirements for pass).

iv. The same attendance regulations are to be adopted as per the rules mentioned in item No.09.

v. **Rules for Promotion from 6th Semester to 7th Semester**: A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to 6th Semester.

vi. Students, who fail to fulfill the requirement for the award of the degree in six consecutive academic years from the year of admission, shall forfeit their seat.

21. CONDUCT AND DISCIPLINE:

Students admitted in SCET are to be followed the conduct and discipline of the college and which will be updated from time to time.

22. MALPRACTICES:

If any malpractices held in internal assessment tests or Semester-End Examinations, Principal constitute a Malpractice Enquiry Committee to enquire the case. The principal shall take necessary action based on the recommendations of the committee as per stipulated norms.

23. WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

24. HONORS PROGRAMME:

a) Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

b) A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 7.75 CGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 CGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

c) Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

d) In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

e) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.

f) It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

g) The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

h) Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

i) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Honors will be shown in the transcript. None of the courses done under the dropped Honors will be shown in the transcript.

j) In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

k) Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor‟s degree.

25. MINOR PROGRAMME:

a) **i**) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme; he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

ii) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

b) The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, VLSI etc.

c) The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

d) A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 7.75 CGPA (Cumulative Grade Point Average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 7.75 CGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An CGPA of 7.75 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

e) A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

f) Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

g) In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

h) Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned

discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

i) College Academic committee evaluates the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

j) If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

k) In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

l) Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor"s degree.

26. <u>GENERAL:</u>

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final and which is to be ratified by the Chairman of the Governing Body.

d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

SEMESTER-I

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20MA1T01	Linear Algebra	3	-	-	3.0	30	70	100
2	20BS1T01	Engineering Physics	3	-	-	3.0	30	70	100
3	20CS1T01	Problem Solving UsingC Programming	3	-	-	3.0	30	70	100
4	20ME1T02	Engineering Drawing	2	-	2	3.0	30	70	100
5	20BS1L01	Engineering Physics Lab	-	-	3	1.5	30	70	100
6	20CS1L01	C Programming Lab	-	-	3	1.5	30	70	100
7	20ME1L01	Engineering Workshop	-	-	3	1.5	30	70	100
8	20HS1L01	English Proficiency Lab	-	-	3	1.5	30	70	100
		Total	**11**	**0**	**14**	**18.0**	**240**	**560**	**800**

SEMESTER-II

S.No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20MA2T02	Differential Equations and Numerical Methods	3	-	-	3.0	30	70	100
2	20BS2T02	Engineering Chemistry	3	-	-	3.0	30	70	100
3	20HS2T01	English	3	-	-	3.0	30	70	100
4	20CS2T02	Object Oriented Programming Using C++	3	-	-	3.0	30	70	100
5	20EE2T02	Electrical Networks	3	-	-	3.0	30	70	100
6	20BS2L02	Engineering Chemistry Lab	-	-	3	1.5	30	70	100
7	20IT2L01	IT Workshop	-	-	3	1.5	30	70	100
8	20CS2L02	Object Oriented Programming Using C++ Lab	-	-	3	1.5	30	70	100
9	20HS2L02	English Communications Lab	-	-	3	1.5	30	70	100
		Total	**15**	**0**	**12**	**21.0**	**270**	**630**	**900**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER III

S.NO	CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1	20MA3T05	Complex Variables and Random Process	3	-	-	3.0	30	70	100
2	20EC3T01	Electronic Circuits-I	3	-	-	3.0	30	70	100
3	20EC3T02	Digital Electronics	3	-	-	3.0	30	70	100
4	20EC3T03	Signals and Systems	3	-	-	3.0	30	70	100
5	20EC3T04	Analog Communication	3	-	-	3.0	30	70	100
6	20EC3L01	Electronic Circuits-I Lab	-	-	3	1.5	30	70	100
7	20EC3L02	Digital Electronics Lab	-	-	3	1.5	30	70	100
8	20EC3L03	Analog Communication Lab	-	-	3	1.5	30	70	100
9	20EC3S01	PCB Layout Design	1	-	2	2.0	30	70	100
10	20CE3M01	Environmental Sciences	2	-	-	-	-	-	-
		Total	**18**	**-**	**11**	**21.5**	**270**	**630**	**900**

SEMESTER IV

S.NO	CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1	20EE4T05	Electrical Machines and Control systems Engineering	3	-	-	3.0	30	70	100
2	20EC4T01	Electronics Circuits –II	3	-	-	3.0	30	70	100
3	20EC4T02	Digital Communication	3	-	-	3.0	30	70	100
4	20EC4T03	Electromagnetic Waves and Transmission Lines	3	-	-	3.0	30	70	100
5	20BM4T01	Managerial Economics and Financial Analysis	3	-	-	3.0	30	70	100
6	20EE4L03	Electrical Machines and Control systems Lab	-	-	3	1.5	30	70	100
7	20EC4L01	Electronics Circuits –II Lab	-	-	3	1.5	30	70	100
8	20EC4L02	Digital Communication Lab	-	-	3	1.5	30	70	100
9	20EC4S01	Simulation Based Circuit Design	1	-	2	2.0	30	70	100
10	20BM4M01	Indian Constitution	2	-	-	-	-	-	-
		Total	**18**	**-**	**11**	**21.5**	**270**	**630**	**900**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER V

S.NO	CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1	20EC5T01	Linear and Digital IC Applications	3	-	-	3.0	30	70	100
2	20EC5T02	Digital Signal Processing	3	-	-	3.0	30	70	100
3	20EC5T03	Antennas and Wave Propagation	3	-	-	3.0	30	70	100
4		**Professional Elective - I**	3	-	-	3.0	30	70	100
5		**Open Elective-I / Job Oriented Elective – I**	3	-	-	3.0	30	70	100
6	20EC5L01	Linear and Digital IC Applications Lab	-	-	3	1.5	30	70	100
7	20EC5L02	Digital Signal Processing Lab	-	-	3	1.5	30	70	100
8	20CS5S01	Python Programming Applications Lab	1	-	2	2	30	70	100
9	20BM5M01	Essence of Indian Traditional Knowledge	2	-	-	-	-	-	-
10	20EC5I01	Internship-I	-	-	-	1.5	50	-	50
		Total Credits				21.5	290	560	850

SEMESTER VI

S.NO	CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1	20EC6T01	Microprocessors and Microcontrollers	3	-	-	3.0	30	70	100
2	20EC6T02	VLSI Design	3	-	-	3.0	30	70	100
3	20EC6T03	Microwave and Optical Communications	3	-	-	3.0	30	70	100
4		**Professional Elective II**	3	-	-	3.0	30	70	100
5		**Open Elective II/Job Oriented Elective-II**	2	-	2	3.0	30	70	100
6	20EC6L01	Microprocessors and Microcontrollers Lab	-	-	3	1.5	30	70	100
7	20EC6L02	VLSI Design Lab	-	-	3	1.5	30	70	100
8	20EC6L03	Microwave and Optical Communications Lab	-	-	3	1.5	30	70	100
9	20HS6S01	Advanced Communication Skills Lab	1	-	2	2	30	70	100
10	20EC6C01	Community Service Project	-	-	-	4	100	-	100
11	20BM6M01	Professional Ethics and Intellectual Property Rights	2	-	-	-	-	-	-
		Total Credits				25.5	370	630	1000

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER VII

S.NO	CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1		Professional Elective - III	3	-	-	3.0	30	70	100
2		Professional Elective - IV	3	-	-	3.0	30	70	100
3		Professional Elective - V	3	-	-	3.0	30	70	100
4		Open Elective III/Job Oriented Elective-III	2	-	2	3.0	30	70	100
5		Open Elective IV/Job Oriented Elective-IV	2	-	2	3.0	30	70	100
6	20HS7T01	Universal Human Values : Understanding Harmony	3	-	-	3.0	30	70	100
7	20EC7S01	Internet of Things Lab	1	-	2	2.0	30	70	100
8	20EC7I01	Internship II	-	-	-	3	50	0	50
		Total Credits	**17**	**-**	**6**	**23**	**260**	**490**	**750**

SEMESTER VIII

S.NO	CODE	COURSE TITLE	L	T	P	C	IM	EM	TM
1	20EC8P01	Project Work, Seminar and Internship in Industry	-	-	-	8.0	60	140	200
		Total Credits	**-**	**-**	**-**	**8.0**	**60**	**140**	**200**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

PROFESSIONAL ELECTIVE I

S.No	Course Code	Course Title	Semester
1	20EC5E01	Medical Electronics	V
2	20EC5E02	Digital System Design	V
3	20EC5E03	Signal Transform Techniques	V
4	20EC5E04	Radar and Satellite Communication System	V

OPEN ELECTIVE - I

S. No	Course Code	Course Title	Offering Dept.
1	20EE5O01	Non-conventional Energy sources	EEE
2	20ME5O01	Waste to Energy Conversion	ME
3	20CS5O01	Internet of Things and Applications	CSE
4	20CS5O02	Data Engineering	CSE
5	20BM5O01	Innovations and Entrepreneurship	MBA
6	20BM5O03	Digital Marketing	MBA
7	20BM5O04	Business Environment	MBA

JOB ORIENTED ELECTIVE - I

S. No	Course Code	Course Title	Offering Dept.
1	20IT5J01	Linux Administration	IT
2	20CS5J01	Full Stack with JAVA	CSE

PROFESSIONAL ELECTIVE II

S.No	Course Code	Course Title	Semester
1	20EC6E01	Sensors and Instrumentation	VI
2	20EC6E02	Digital Design Using HDL	VI
3	20EC6E03	Digital Image Processing and its Application	VI
4	20EC6E04	Wireless Communication	VI

OPEN ELECTIVE - II

S. No	Course Code	Course Title	Offering Dept.
1	20CE6O01	Environmental Pollution and Control	**CE**
2	20CE6O02	Disaster Management	**CE**
3	20EE6O01	Fundamentals of Electrical Vehicle	**EEE**
4	20EC6O01	Mobile Communication and its Applications	**ECE**
5	20ME6O01	Basics of 3D Printing	**MECH**
6	20ME6O02	Farm Machinery	**MECH**
7	20CS6O01	Fundamentals of Software Engineering	**CSE**
8	20CS6O02	Fundamentals of Computer Networks	**CSE**
9	20BM6O01	Stress and Work Life Management	**MBA**
10	20BM6O02	Banking and Insurance	**MBA**
11	20MA6O01	Operation Research	**S&H**
12	20IT6O01	Introduction to Cloud Computing	**IT**
13	20IT6O02	E-Commerce	**IT**

JOB ORIENTED ELECTIVE - II

S. No	Course Code	Course Title	Offering Dept.
1	20CS6J01	AWS Cloud Practitioner	**CSE**
2	20CS6J02	Software Testing Tools	**CSE**
3	20IT6J01	Full Stack Development	**IT**
4	20IT6J02	Block Chain Technology	**IT**

PROFESSIONAL ELECTIVE III

S.No	Course Code	Course Title	Pre.Req	Semester
1	20EC7E01	Opto Electronic Devices	EC-I	III
2	20EC7E02	ASIC Design	VLSI	VI
3	20EC7E03	Speech Processing	SS	III
4	20EC7E04	Telecommunication Switching Networks	AC,DC	III, IV

PROFESSIONAL ELECTIVE IV

S.No	Course Code	Course Title	Pre.Req	Semester
1	20EC7E05	Analog IC Design	LDICA, VLSI	V, VI
2	20EC7E06	Embedded Systems	PC	VI
3	20EC7E07	Video Processing	SS	III
4	20EC7E08	Global Positioning and Navigation Satellite Systems	AC,DC	III, IV

PROFESSIONAL ELECTIVE V

S.No	Course Code	Course Title	Pre.Req	Semester
1	20EC7E09	Television Systems and Design	EC-I, EC-II	III, IV
2	20EC7E10	Low Power VLSI Design	VLSI	VI
3	20EC7E11	Pattern Recognition and Machine Learning	MATHS-LA	VI
4	20EC7E12	Advanced Communication Systems	AC,DC	III, IV
5	20EC7E13	5G Mobile Communication	AC,DC	VII

OPEN ELECTIVE - III

S. No	Course Code	Course Title	Offering Dept.
1	20CE7O01	Solid Waste Management	CE
2	20CE7O02	Building Planning and Drawing	CE
3	20EE7O01	Energy Auditing, Conservation and Management	EEE
4	20ME7O01	Bio-Mechanical Engineering	MECH
5	20EC7O01	Introduction to Global Positioning Systems	ECE
6	20CS7O01	Full-Stack Development	CSE
7	20BM7O01	Industrial Sociology and Psychology	MBA

OPEN ELECTIVE – IV

S. No	Course Code	Course Title	Offering Dept.
1	20CE7O03	Introduction to Watershed Management	CE
2	20EE7O02	Introduction to Programmable Logic Controller	EEE
3	20EC7O02	Remote Sensing	ECE
4	20ME7O02	Green Engineering System	MECH
5	20CS7O03	Software Testing Techniques	CSE
6	20BM7O02	Business Skill Development	MBA
7	20IT7O01	Introduction to Software Project Management	IT

MINOR DEGREE IN ELECTRONICS AND COMMUNICATION ENGINEERING

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20EC4N01	Microprocessors and Microcontrollers	3	1	-	4	30	70	100
2	20EC5N01	Electronic Devices and Circuits	3	1	-	4	30	70	100
3	20EC6N01	Digital Logic Design	3	1	-	4	30	70	100
4	20EC7N01	Signals and Systems	3	1	-	4	30	70	100
5	20EC7X01 20EC7X02	02 MOOCS courses @ 2credits each (Any ECE related Program Core subject from NPTEL/ SWAYAM course of 8 weeks (2 credits) other than the courses listed above needs to be taken)				4			

I SEMESTER	L	T	P	C
	3	-	-	3
20MA1T01: LINEAR ALGEBRA				

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- This course equips the students with standard concepts and tools from an intermediate levelto an advanced level and to develop the confidence; ability to handle various real-world problems and their applications.

Bridge Course: Limits, continuity, Types of matrices

Unit I: Matrix Operations and Solving Systems of Linear Equations

Rank of a matrix by Echelon form, Normal form - solving system of homogeneous and non-homogeneous linear equations- Gauss Elimination, Jacobi and Gauss-Seidel methods

Learning Outcomes:

At the end of this unit, the student will be able to

- Solve system of linear equations. (K2)
- Determine the rank of a matrix. (K2)

Unit II:Eigenvalues and Eigen vectors

Eigen values and Eigen vectors - and their properties (without proof).Cayley-Hamilton theorem (without proof), Finding inverse and powers of a matrix by Cayley-Hamilton theorem - Reduction of a matrix to diagonal form.

Learning Outcomes:

At the end of this unit, the student will be able to

- Findeigen values andeigenvectors of a matrix. (K2)
- findthe inverse and powers of a matrix by the Cayley-Hamilton theorem.(K2)

Unit III: Quadratic forms

Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- reduce a matrix to diagonal form and identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (K3)

Unit IV: Multivariable calculus

Expansions of functions: Taylor‟s and Maclaurin's series- Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Expand the given function as Taylor‟s and Maclaurin‟s series.(K3)
- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way in which a function varies. (K3)
- Acquire the knowledge in maxima and minima of functions of several variables (K1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (K3)

Unit V: Multiple Integrals

Double Integrals: Change of order of integration, double integrals in polar coordinates, areas enclosed by plane curves.

Triple Integrals: Evaluation of triple integrals, change of variables.

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates.(K3)
- apply double integration techniques in evaluating areas bounded by a region.(K4)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 43/e, Khanna Publishers, 2015.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. B.V. RAMANA, Higher Engineering Mathematics, Tata McGraw Hill, 2007.

Course Outcomes:

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

1. develop the use of matrix algebra techniques that is needed by engineers for practical applications (K3)
2. familiarize with functions of several variables which is useful in optimization (K3)
3. learn important tools of calculus in higher dimensions. Students will become familiar with double integral(K3)
4. familiarize with triple integral and also learn the utilization of special functions.(K4)

I SEMESTER	L	T	P	C
	3	-	-	3
20BS1T01: ENGINEERING PHYSICS				

COURSE OUTCOMES

After completion of course student able to:

1. Describe Basic crystal systems and determination of crystal structures
2. Explain Magnetic and Dielectric Materials properties
3. Describe Concept of Magnetic Induction and Super Conducting properties
4. Explain Pure &Doped Semiconductor materials for better utility
5. Describe Optical fibers and Optical properties of materials and their applications

SYLLABUS

UNIT –I: CRYSTAL STRUCTURE AND X-RAY DIFFRACTION

CRYSTAL STRUCTURE:
Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems – Structures and packing fractions of SC, BCC and FCC.

X-RAY DIFFRACTION:
Directions in crystals- planes in crystals- Miller indices and procedure to find Miller indices- Various planes in crystals- Separation between successive (h k l) planes-Bragg‟s law-Bragg‟s Spectrometer.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the seven crystal systems
- **Interpret** the crystal structure based on Bragg‟s law

UNIT – II: MAGNETIC AND DIELECTRIC PROPERTIES

MAGNETIC PROPERTIES: Introduction-Magnetic permeability – Magnetization – Relation between three magnetic vectors - Origin of magnetic moment – Classification of Magnetic materials- Dia, Para, Ferro, Anti-Ferro and Ferri-magnetism – Hysteresis- soft and Hard Magnetic materials.

DIELECTRIC PROPERTIES: Introduction-Dielectric constant- Relation between three electric vectors-Electronic and ionic polarizations (Quantitative) - orientation polarization(Qualitative) - Internal fields in solids- Clausius-Mossotti equation.

Learning Outcomes: At the end of this unit, the students will be able to

- **Classify** the magnetic materials into dia, para, ferro, anti ferro and ferri
- **Explain** the importance of hysteresis
- **Explain** the concept of polarization in dielectric materials.
- **Summarize** various types of polarization of dielectrics .
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics.

UNIT-III: ELECTROMAGNETIC WAVES AND SUPERCONDUCTIVITY

ELECTROMAGNETIC WAVES: Introduction-Electric flux –magnetic flux- Gauss law in electrostatics- Gauss law in magnetostatics- Ampere‟s law-B for a Solenoid - Biot-Savart‟s law-Magnetic Induction due to current carrying circular loop- Faraday‟s law - Maxwell‟s equations (Integral and differential forms).

SUPERCONDUCTIVITY: General and Thermal properties –Meissner effect – Type-I and Type-II superconductors – Flux quantization –BCS Theory of Superconductivity - Josephson effects – Applications of Superconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Illustrate** the concept of electro magnetism based on fundamental laws of electro magnetism
- **Explain** Maxwell‟s equations
- **Summarize** various properties and applications of superconductors

UNIT-IV: PHYSICS OF SEMICONDUCTORS:

Classification of solids based on band theory - Intrinsic semiconductors- density of charge carriers- Equation for conductivity – Extrinsic semiconductors- P-type and N-type- density of charge carriers- Drift and diffusion – Einstein‟s equation – Hall Effect- Hall coefficient – Applications of Hall effect– direct & indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Summarize** various types of solids based on band theory.
- **Outline** the properties of n-type and p-type semiconductors.
- **Identify** the type of semiconductor using Hall effect

UNIT-V: LASERS AND OPTICAL FIBERS

LASERS: Introduction– Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein‟s coefficients – Population inversion - Three level and four level laser pumping schemes - Ruby laser – Helium-Neon laser- Applications of Laser.

FIBER OPTICS: Introduction to Optical fibers- Critical angle of propagation- Total internal reflection- Acceptance angle and acceptance cone- Numerical aperture- Classification of optical fibers based on refractive index profile-Classification of optical fibers based on modes- Attenuation in optical fibers - Applications of optical fibers.

Learning Outcomes: At the end of this unit, the students will be able to

- **Design** various types of lasers
- **Explain** the principle and propagation of light through Optical fibers
- **Discuss** the application of lasers and Optical fibers

TEXT BOOK:

A text book of “Engineering Physics” by M. N.Avadhanulu, P.G. Kshirasagar& TVS Arun Murthy, SChand publications, 11th Addition 2019.

REFERENCE BOOKS:

1. Introduction to solid state physics 8th edition *by Charles Kittel*

2. Solid state Physics *by S.O. Pillai*

3. Engineering Physics *by Shatendra Sharma and Jyotsna Sharma, Pearson Education, 2018.*

4. Engineering Physics *by Palanisamy (Scitech Publishers)*

5. Engineering Physics *by D. Thirupathi Naidu and M. Veeranjaneyulu*

I SEMESTER	L	T	P	C
	3	-	-	3
20CS1T01: PROBLEM SOLVING USING C PROGRAMMING				

Course Outcomes

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

1. Analyze a computational problem and develop an algorithm/flowchart to find its solution
2. Develop C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
3. Divide a given computational problem into a number of modules and develop C program with arrays.
4. Write C programs which use pointers for array processing and parameter passing
5. Develop C programs with structure or union and files for storing the data to be processed.

UNIT-I Contact Hours : 10

INTRODUCTION TO PROGRAMMING : What is computer, Block diagram of Computer, Development of Computer languages, Translators, Computer Codes, Computer Arithmetic, Programming Techniques, Algorithm, Flowchart

BASICS OF C : History of C, Character Set, Identifiers, Keywords, Tokens, Variables, constants, operators, Data types, expressions, expression evaluation, Type conversion, operator precedence and associativity, C program structure.

UNIT-II Contact Hours : 8

CONSOLE I/O OPERATIONS : Formatted I/O - printf&scanf, Unformatted I/O functions.
CONSOLE I/O OPERATIONS : Formatted I/O - printf&scanf, Unformatted I/O functions.
while, do – while, for, nested for. Unconditional Statements - break, continue, goto, exit.

UNIT-III Contact Hours : 12

FUNCTIONS: Introduction to Functions, Types of Function, Function prototypes, parameter passing techniques, Scope of variables, Storage classes, Recursion
ARRAYS : Array declaration , initialization and Accessing, Types of Arrays : 1-D and 2-D Arrays, Arrays as Function Arguments

UNIT-IV Contact Hours : 8

STRINGS: Reading String from terminal, Writing string to Screen, String Handling Functions.
POINTERS: Pointer Declaration, Initialization and Accessing , Types of Pointers, Pointer Arithmetic, Dynamic memory allocation

UNIT-V Contact Hours : 10

STRUCTURE : Introduction to structures, Definition of structure , declaration of structure variable, accessing of structure members, array of structures, Union, enum, bit fileds, typedef
FILES : Introduction to Files, Types of File, File Modes, Writing and Reading Files, File management I/O functions

TEXT BOOKS

1. Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill
2. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE.

REFERENCE BOOKS

1. The „C‟ programming language by Kernighan and Ritchie, Prentice Hall
2. Computer Programming in „C‟ by V. Rajaraman , Prentice Hall
3. Programming and Problem Solving by M. Sprankle, Pearson Education
4. How to solve it by Computer by R.G. Dromey, Pearson Education

Online Practice and Reference Material

http://www2.its.strath.ac.uk/courses/c/
http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C_%28programming_language%29.html
http://www.stat.cmu.edu/~hseltman/Computer.html
http://projecteuler.net/

I SEMESTER	L	T	P	C
	2	-	2	3
20ME1T02: ENGINEERING DRAWING				

COURSE OBJECTIVE

Engineering drawing is the principle method of communication for engineers - the objective is to introduce the students, the techniques of constructing the various types of polygons, curves. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

COURSE OUTCOMES: Students are able to

CO1: Construct polygons, conics, cycloids, involutes. (K2)
CO2: Draw the orthographic projections of points, lines in different positions. (K2)
CO3: Draw the orthographic projections of plane surfaces in different positions. (K2)
CO4: Draw the orthographic projections of solids like prisms, cylinder, pyramids and cone. (K2)
CO5: Convert Isometric views to orthographic views and vice-versa and also visualize 2D & 3D objects using Auto CAD. (K2)

UNIT I

Polygons: Constructing regular polygons by General method.
Curves: Construction of Parabola, Ellipse and Hyperbola by Eccentricity method, Construction of Cycloid, Epi-cycloid and Hypo-cycloid and Involutes of square, Triangle, Pentagon and Hexagon.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines (First angle projection only), line parallel to both the planes, line parallel to one plane and inclined to other plane. Projections of straight lines inclined to both the planes.

UNIT III

Projections of Planes: Regular planes perpendicular and parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes (HP & VP).

UNIT IV

Projections of Solids: Prisms, Pyramids, Cone and Cylinder, Simple positions of solids and axis of the solid parallel to one plane and inclined to other plane.

UNIT V

Isometric Views: Conversion of Isometric views to Orthographic views; Conversion of Orthographic views to Isometric views.

CAD: Fundamentals of AutoCAD - For Polygons, Creating 2D And 3D Drawings.

Using Auto CAD: Computer Aided Design, Drawing practice using Auto CAD simple figures like polygons, creating 2D&3D drawings of objects using Auto CAD.

Note: In the End Examination there will be no question from CAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications 2016
2. Engineering Drawing + AutoCAD by K. Venugopal, V. Prabhu Raja, New Age 2010

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers 2016
2. Engineering Graphics for Degree by K.C. John, PHI Publishers 2009
3. Engineering Graphics by PI Varghese, McGrawHill Publishers 2013

I SEMESTER	L	T	P	C
	-	-	3	1.5
20BS1L01: ENGINEERING PHYSICS LAB				

COURSE OUTCOMES

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

CO1: Demonstrate the basic knowledge to know the frequency of a vibrator, hall coefficient, (K3)

CO2: Attain knowledge to verify some of the properties of physical optics. (K4)

CO3: Develop skills to plot various characteristic curves and to calculate the physical properties of given materials. (K4)

CO4: Calculate some the properties of semiconducting materials. (K2)

STUDENT HAS TO DO ANY TEN OF THE FOLLOWING

1. Determination of wavelength of Laser using diffraction grating.
2. Determination of Numerical Aperture and Acceptance angle of an Optical Fiber.
3. Determination of the charge carrier density by using Hall Effect.
4. Determination of the Band Gap of a Semiconductor using a p-n junction diode.
5. Study of Characteristic curves (l/V) of a Zenerdiodeto determineits Breakdown voltage.
6. Determination of Temperature coefficient of resistance of a Thermistor by using its Characteristic curve.
7. Study the variation of intensity of magnetic field along the axis of a circular current carrying coil by using Stewart and Gee‟s experiment.
8. Study of Characteristic curves (l/V) of a P-Ndiode.
9. Determine Frequency of given electrically driven tuning fork in Transverse and Longitudinal modes by using Melde‟s apparatus
10. Determine frequency of A.C. supply by using Sonometer.
11. Determination of the Time Constant for a C-R Circuit
12. Determination of the Planck's constant by using Photo-Cell
13. Determination of dielectric constant of a given material

I SEMESTER	L	T	P	C
	-	-	3	1.5
20CS1L01: C PROGRAMMING LAB				

Course Objectives:

- To impart knowledge on various Editors, Raptor.
- To make the students understand the concepts of C programming.
- To nurture the students on Control Structures and develop different operations on arrays.
- To make use of String fundamentals and modular programming constructs.
- To implement programs using dynamic memory allocation.
- To explain the concepts of Structure, Unions and files for solving various problems.

List of Experiments:

1. Introduction to Algorithms and Flowcharts

Implement Algorithm Development for Exchange the values of Two numbers.

Given a set of n student‟s examination marks (in the range 0-100) make a count of the number of students that passed the examination. A Pass is awarded for all of 50 and above.

Given a set of n numbers design an algorithm that adds these numbers and returns the resultantsum. Assume N is greater than or equal to zero.

2. Introduction to C Programming

Exposure to Turbo C, Code Blocks IDE, Dev C++, Falcon C++.

Writing simple programs using printf(), scanf() .

3. Raptor

Introduction to Raptor.

Draw a flow chart to find the Sum of 2 numbers.

Draw a flow chart to find Simple interest.

4. Basic Math

Write a C Program to convert Celsius to Fahrenheit and vice versa.

Write a C Program to find largest of three numbers using ternary operator.

Write a C Program to Calculate area of a Triangle using Heron's formula.

5. Control Flow- I

Write a C Program to Find Whether the Given Year is a Leap Year or not.

5.2)Write a C program to find the roots of a Quadratic Equation.

5.3) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide UsingSwitch…case.

6. Control Flow- II

Write a C Program to Find Whether the Given Number is Prime number or not.

Write a C Program to Find Whether the Given Number is Armstrong Number or not.

Write a C program to print Floyd Triangle.

7. Control Flow- III

Write a C program to find the sum of individual digits of a positive integer.

Write a C program to check whether given number is palindrome or not.

Write a C program to read two numbers, x and n, and then compute the sum of the geometricprogression $1+x+x^2+x^3+.....+x^n$.

Practice Programs:

Write a C program to print all natural numbers from 1 to n. - using while loop
Write a C program to print all natural numbers in reverse (from n to 1). - using while loop
Write a C program to print all alphabets from a to z. - using while loop
Write a C program to print all even numbers between 1 to 100. - using while loop
Write a C program to print sum of all even numbers between 1 to n.
Write a C program to print sum of all odd numbers between 1 to n.
Write a C program to print table of any number.
Write a C program to find first and last digit of any number.
Write a C program to count number of digits in any number.
Write a C program to calculate sum of digits of any number.
Write a C program to calculate product of digits of any number.
Write a C program to swap first and last digits of any number.
Write a C program to enter any number and print its reverse.
Write a C program to enter any number and check whether the number is palindrome or not.
Write a C program to find frequency of each digit in a given integer.
Write a C program to enter any number and print it in words.
Write a C program to print all ASCII character with their values.
Write a C program to enter any number and print all factors of the number.
Write a C program to enter any number and calculate its factorial.
Write a C program to find HCF (GCD) of two numbers.
Write a C program to find LCM of two numbers.
Write a C program to check whether a number is Prime number or not.
Write a C program to check whether a number is Armstrong number or not.
Write a C program to check whether a number is Perfect number or not.
Write a C program to check whether a number is Strong number or not.
Write a C program to print Fibonacci series up to n terms.

8. Arrays

Write a C program to search an element in the given array (Linear Search).
Write a C program to perform matrix addition.
Write a C program to perform matrix multiplication.

Practice Programs:

Write a C program to read and print elements of array.
Write a C program to find sum of all array elements. - using recursion.
Write a C program to find maximum and minimum element in an array. - using recursion.
Write a C program to find second largest element in an array.
Write a C program to copy all elements from an array to another array.
Write a C program to insert an element in an array.
Write a C program to delete an element from an array at specified position.
Write a C program to print all unique elements in the array.
Write a C program to print all negative elements in an array.
Write a C program to count total number of even and odd elements in an array.
Write a C program to count total number of negative elements in an array.
Write a C program to count total number of duplicate elements in an array.
Write a C program to delete all duplicate elements from an array.
Write a C program to count frequency of each element in an array.
Write a C program to merge two array to third array.

Write a C program to find reverse of an array.

Write a C program to convert lowercase string to uppercase.

Write a C program to convert uppercase string to lowercase.

Write a C program to toggle case of each character of a string.

Write a C program to find total number of alphabets, digits or special character in a string.

9. Pointers

Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers using Command line arguments.

Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

10. Functions, Array & Pointers

Write a C Program to demonstrate parameter passing in Functions.

Write a C Program to find Fibonacci, Factorial of a number with Recursion and without recursion.

Write a C Program to find the sum of given numbers with arrays and pointers.

Practice Programs:

Program to change the value of constant integer using pointers.

Program to print a string using pointer.

Program to count vowels and consonants in a string using pointer.

Program to read array elements and print with addresses.

11. Strings

Implementation of string manipulation operations with library function:

a) copy
b) concatenate
c) length
d) compare

Implementation of string manipulation operations without library function:

a) copy
b) concatenate
c) length
d) compare

Verify whether the given string is a palindrome or not.

12. Structures

Write a C Program to Store Information of a book Using Structure.

Write a C Program to Add Two Complex Numbers by Passing Structure to a Function.

13. Files

Write a C program to open a file and to print the contents of the file on screen.

Write a C program to copy content of one file to another file.

Write a C program to merge two files and store content in another file.

14. Application

Creating structures to capture the student‟s details save them in file in proper record format, search and prints the student details requested by the user.

Note:Draw the flowcharts using Raptor from Experiment 3 to Experiment 6.

Course Outcomes:

- Implement basic programs in C and design flowcharts in Raptor.
- Use Conditional and Iterative statements to solve real time scenarios in C.
- Implement the concept of Arrays and Modularity and Strings.
- Apply the Dynamic Memory Allocation functions using pointers.
- Develop programs using structures, and Files.

Reference Books:

1. Let Us C YashwanthKanetkar, 16th edition, BPB Publications.
2. Programming in C A-Practial Approach Ajay Mittal. Pearson Education.
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.
4. Problem solving using C , K Venugopal,3rdEdition,TMG Publication.

Web Links:

1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/
5. https://raptor.martincarlisle.com/
6. https://nptel.ac.in/courses/106105085/2

I SEMESTER	L	T	P	C
	-	-	3	1.5
20ME1L01 : ENGINEERING WORKSHOP				

COURSE OBJECTIVE: To impart hands–on practice on basic Engineering trades and skills.

COURSE OUTCOMES: Students will be able to

CO1: Model and Develop various basic prototypes in Carpentry trade [K3]

CO2: Model and Develop various basic prototypes in Fitting trade [K3]

CO3: Perform Various Forging Operations [K3]

CO4: Perform various House Wiring Techniques. [K3]

CO5: Develop various basic prototypes in the trade of Sheet metal. [K3]

NOTE: At least **Two** Exercises to be done from each trade.

TRADE:

I. CARPENTRY:

1. CROSS LAP JOINT 2. DOVETAIL JOINT 3. MORTISE and TENNON JOINT

II. FITTING:

1. SQUARE FIT 2. V-FIT 3. HALF ROUND FIT

III. FORGING:

1. ROUND ROD TO SQUARE
2. S-HOOK
3. ROUND ROD TO SQUARE HEADED BOLT

IV. HOUSE WIRING:

1. PARALLEL/SERIES CONNECTION OF THREE BULBS
2. STAIRCASE WIRING
3. FLOURESCENT LAMP FITTING

V. SHEET METAL:

1. SQUARE TRAY 2. HOLLOW CYLINDER 3. OPEN SCOOP

MANUAL:

1. Engineering Workshop Practice Lab Manual Prepared by Mechanical Faculty.

I SEMESTER	L	T	P	C
	-	-	3	1.5
20HS1L01: ENGLISH PROFICIENCY LAB				

COURSE OBJECTIVES

- To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
- To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
- To assist students to carry on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

COURSE OUTCOMES

a) Reading Skills.

- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

b) Writing Skills:

- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

c) Interactive skills:

- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

d) Life Skills and Core Skills:

- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

RELATIONSHIP OF COURSE TO PROGRAMME OUTCOMES

A	Ability to apply knowledge of mathematics, science, and engineering.	
B	Ability to design and conduct experiments, as well as to analyze and interpret data.	
C	Ability to design anEngineering system, component, or process.	
D	Ability to function on multi-disciplinary teams	
E	Ability to identify, formulate and solve engineering problems.	
F	Understanding of professional and ethical responsibility.	
G	Ability to communicate effectively	√
H	Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.	√
I	Recognition of the need for and an ability to engage in life-long learning.	
J	Knowledge of contemporary issues.	
K	Ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.	
L	Ability to find location of substations and benefits derived through their optimal location.	

COURSE DESCRIPTION

Communicating in a language is also a skill. So a student has to look for an opportunity to practice English language in order to acquire proficiency in English. „Enrich your interactive Skills: Part - A" is designed to provide opportunities for engineering students to revise and consolidate the basic skills in listening, speaking, reading and writing in addition to giving ample practice in various communicative functions and Life skills.

PREREQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

Syllabus

Unit	TOPIC
1	Vowels, Consonants, Pronunciation, Phonetic transcripts
2	Word stress and syllables
3	Rhythm and Intonation
4	Contrastive Stress –Homographs
5	Word Stress : Weak and Strong forms , Stress in compound words

Text Book:

"InfoTech English" by Maruthi Publications

Reference Books:

1. Better English Pronunciation by O" Connor
2. Phonetics and Phonology – Peter Roach
3. A Grammar of Spoken English – Harold Palmer
4. English Phonetics – Bansal and Harrison

Testing Pattern:

A) Internal lab Exam: **30 Marks**

Regular performance in the language /communication /lab completion in the lab manual 15M

Written test 15M

B) External lab Exam Pattern: **70 Marks**

Written test 30M

Oral test 30M

Viva(during exam marks will be awarded by external examiner) 10M

II SEMESTER	L	T	P	C
	3	-	-	3
20MA2T02: DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS				

Course Objectives:

- To enlighten the learners in the concept of differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Unit I: Linear differential equations of higher order:

Solutions of Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x^n, $e^{ax}V(x)$ and $x^nV(x)$ – Method of Variation of parameters.

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients (K3)
- solve the linear differential equations with constant coefficients by appropriate method (K3)

Unit –II: Partial Differential Equations of First Order:

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equations and nonlinear (standard types) equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs (K3)
- outline the basic properties of standard PDEs (K2)

Unit III: Interpolation

Finite differences, Differences of a polynomial, relation between operators, to find one or more missing terms, Newton‟s interpolation formulae, and interpolation with unequal intervals- Lagrange‟s formula.

Learning Outcomes:

After the completion of this unit student will be able to

- explain various discrete operators and find the relation among operators (K2)
- apply Newton‟s forward and backward formulas for equal and unequal intervals (K3)

Unit IV: Numerical Solution of Equations and Numerical integration

Numerical Solution of Equations: Solution of algebraic and transcendental equations - Bisection Method, Method of False Position, Newton-Raphson Method, useful deduction from Newton-Raphson Method.

Numerical Integration – Trapezoidal rule, Simpson‟s $\frac{1}{3}$ rule and Simpson‟s $\frac{3}{8}$ rule.

Learning Outcomes:

After the completion of this unit student will be able to

- find approximate roots of an equation by using different numerical methods (K3)
- find integral of a function by using different numerical methods (K3)

Unit V: Numerical Methods to Solve Ordinary Differential Equations

Numerical Methods to Solve Ordinary Differential Equations - Taylor‟s series, Euler‟s and modified Euler‟s methods, Runge-kutta method of fourth order for solving first order equations.

Learning Outcomes:
After the completion of this unit student will be able to

- solve ordinary differential equations by using different numerical schemes (K3)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 43/e, Khanna publishers,2015.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

Course Outcomes:

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

1. solve the differential equations related to various engineering fields (K3)
2. identify solution methods of partial differential equations that model physical processes (K3)
3. evaluate the approximate roots of polynomial and transcendental equations by different algorithms(K3)
4. solve integrate and ordinary differential equations by various numerical techniques.(K3)

II SEMESTER	L	T	P	C
	3	-	-	3
20BS2T02: ENGINEERING CHEMISTRY				

COURSE OUTCOMES
At the end of semester, the students will be able to

CO1: Explain the impurities present in raw water, problems associated and how to avoid them (K2)
CO2: Explain the advantages of Polymers in daily life (K2)
CO3: Explain the theory of construction of battery and fuel cells and theories of corrosion and prevention methods. (K2)
CO4: Differentiate conventional and non-conventional energy sources and their advantages and disadvantages. (K2)
CO5: Identify the usage of advanced materials in day to day life (K2)

UNIT I: WATER TECHNOLOGY [9 Hours]

Part-A

Hard water-Types of hardness-Units of Hard Water-Disadvantages of hard water-Determination of hardness by EDTA complexometric method.

Portable water- its specifications-steps involved in purification of water (Sedimentation, Filtration, Disinfection)-chlorination, break point of chlorination.

Boiler Feed Water-Boiler troubles: Scale and sludge-priming and foaming-boiler corrosion-caustic embrittlement.

Part-B

Industrial Water Treatment: Softening methods: zeolite process-ion exchange process.
Brackish water treatment (desalination methods): Reverse osmosis - electro dialysis.

Learning Outcomes: At the end of this unit, the students will be able to Explain
The impurities present in raw water, problems associated with them and how to avoidthem

UNIT-II: POLYMERS AND COMPOSITE MATERIALS [9 Hours]

Part-A

Polymers-degree of polymerization-functionality-preparation, properties and applications of individual polymers-Bakelite-PVC-Poly styrene.

Plastics: Types (thermosetting and thermoplastic)-compounding of plastics-moulding Process. (Injection moulding, Compressionmoulding, Extrusion moulding, Transfer moulding)

Part-B

Rubbers and elastomers: Introduction-natural rubber-vulcanization of rubber-synthetic rubbers-Buna-N, Buna-S.

Composite materials: Fiber reinforced plastics-biodegradable polymers-biomedical polymers, Recycling of e-waste.

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Discuss** natural and synthetic rubbers and their applications.

UNIT III: ELECTRO CHEMICAL CELLS AND CORROSION [12 Hours]

Electrochemical Cells: Introduction–single electrode potential - electrochemical cell-electrochemical series and applications. Reference electrodes-standard hydrogen electrode and calomel electrode-construction of glass electrode. Batteries: Construction, working and cell reaction of primary (dry cell) and Secondary (Pb acid and Li-ion) battery. Fuel cells (H_2-O_2, Methanol-Air cells).

Corrosion: Cause and consequences of corrosion-theories of corrosion (Chemical and Electrochemical corrosion)-types of corrosion (Galvanic, Differential aeration (waterline and pitting corrosion), stress Corrosion). Factors influencing rate of corrosion-nature of metal-nature of corrosive atmosphere. Corrosion Prevention methods: Cathodic protection-Sacrificial anodic method-Impressed voltage method. Metallic coatings: Galvanization-Tinning-Electro plating-Electro less plating.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the theory of construction of battery and fuel cells.
- **Categorize** the reasons for corrosion and study some methods of corrosion control.

UNIT IV: CONVENTIONAL AND NONCONVENTIONAL ENERGY RESOURCES [9 Hours]

Conventional energy sources: Classification and characteristics of fuels-solid, Liquid and gaseousfuels-advantages and disadvantages-calorific value-higher and lower calorific values-construction and working of bomb calorimeter-analysis of coal-proximate and ultimate analysis-numerical problems related to bomb calorimeter, Dulong‟s formula and coal analysis-petroleum refining-cracking – petrol and diesel knocking – octane number and cetane number – gaseous fuels – Natural gas – CNG - LPG

Non-conventional energy sources: Solar energy: Advantages-disadvantages of solar cells-construction and working of photo voltaic cell -Introduction to hydro power-geo thermal power-tidal and wave power.

Learning Outcomes: At the end of this unit, the students will be able to

- **Differentiate** conventional and non-conventional energy sources and their advantages and disadvantages.
- **design** sources of energy by different natural sources

UNIT V: CHEMISTRY OF MATERIALS [9 Hours]

Part-A

Nano materials: Introduction-sol-gel method-characterization by SEM and TEM methods- carbon nanotubes and fullerenes: Types, preparation and applications

Semiconductors: Preparation (Distillation, Zone refining)

Part-B

Cement: Constituents of cement -Setting and Hardening of cement - Decay of Cement.

Refractories: Definition of refractory-classification and properties of refractoriness-applications of refractories.

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the awareness of materials like nanomaterials and fullerenes and their uses.
- **Explain** the techniques that detect and measure the surface properties of materials.
- **Illustrate** the commonly used industrial materials.

Text Books:

T1. A Text Book of Engineering Chemistry -N. Y. S. Murthy, V. Anuradha& K. RamanaRao, Maruthi Publications. (2018)

T2. A Text Book of Engineering Chemistry - K. SeshaMaheswaramma, MridulaChugh, Pearson Publications (2018).

Reference Books:

R1. Engineering Chemistry – Jain & Jain, DhanpatRai Publishing Company (Latest Edition)

R2. Text Book of Engineering Chemistry - ShashiChawla, DhanpatRai& Co. (P) Limited ((Latest Edition))

R3. Chemistry –PrasantaRath, SubhenduChakroborthy, Cengage publications (2018)

II SEMESTER	L	T	P	C
	3	-	3	3
20HS2T01: ENGLISH				

A. PROGRAMMECONTENT

1 Intensive and extensive reading
2 Writtencommunication
3 Listening and oral communication
4 Vocabularyconsolidationandexpansion
5 Practicinggrammar

B. ELABORATIONOF THE PROGRAMME CONTENT

1. Intensive and Extensive Reading

a. Identifyingthemaintheme/thecentralideaofapassage
b. Understandingthemeaningofwords, phrases andsentencesincontext
c. Understandingthelogicalrelationshipbetweensentences(throughrecognitionof grammatical structures suchaslinkers andconnectors)
d. Distinguishing statements of fact from beliefs, opinions, hypotheses, and expressions ofprobabilityandcertainty
e. Inferringfacts,opinions,instances,reasons,causes,results,requests,conclusions, andgeneral statements
f. Skimmingpassages toidentifygeneralideas andinformation
g. Scanningpassages tolocatespecificdetail
h. The use of one‟s knowledge,opinions, and imagination to provide information/ situations relatedtothatgiveninthetext;and comparisonandcontrast.

2. WrittenCommunication

a. Writing outlines and summaries
b. Writing paragraphs with attention to topic sentences and supporting sentences
c. Writing paragraphs with attention to coherence and cohesion
d. Practicingclutter-freewriting

3. ListeningandOralCommunication

a. Effectivelisteninginvolving

- Identificationofkeywords andphrases andspecificinformation, applicationofone‟spreviousknowledgetounderstandtheideasdealtwith inthetextbeinglistenedto.
- Attentiontocommunicationstrategiessuchasapproachinganotherpersonand openingaconversationwithhim/her,makingfriends with astranger,thanking, apologizing,payinga compliment,seekingclarification,makingenquiries,and creatinganappropriatecontextforaformaldiscussion.

b. Takingpartinspeakingactivitiesforinteractionalpurposes suchas,
- Introducingoneselftoothers,introducingothers,makingenquiries,seekinginformation
- Respondingtoenquiries,supplyinginformation
- Expressingagreement/disagreementininformation situations

c. Takingpartinspeakingactivitiesfortransactionalpurposeswithattentiontothe communicationstrategieslistedin1(a)above.

4. Vocabularyconsolidationandexpansion

a. Inferring word meaning from available clues
b. Distinguishing words with similar meanings
c. Using connecting words
d. Learning one-wordsubstitutes
Developingaverbalrepertoirewiththefollowingdimensions:

- Contexts of use
- Collocations
- Differences in speaking and writing
- Strategicuse

e. Using strategic vocabulary to organize and manage both oral and written communicationsuccessfullyinacademic,professional,andsocialcontexts

f. Raising one‟s knowledgeof redundancy, circumlocution, and imprecise and confusingexpressionsinordertoavoidtheminone‟s ownspeechandwriting.

5. Practicinggrammar

a. Consolidation as wellas remediationinthefollowingareas:
Parts of speech, Tenses and usage of grammar in context
b. LearningtoavoidsomeofthecommonpitfallsintheareaofgrammarinIndianusageof English(e.g.usingthepresentcontinuoustensetodescribeactionswhichhappen regularly;usingstateverbsinthecontinuousform;tensemixing)

C.TEXT BOOK: Building Effective Communication Skills

By Maruthi Publications (2019)

Syllabus :

S No	Content
UNIT –I	**Vocabulary Building** **1.1** Video Lesson 1.2.1 Word formation Root words Prefixes and Suffixes Synonyms and Antonyms **Parts of Speech** **Note- making, Note-taking**
UNIT -II	**Basic Writing Skills** **2.1** Video Lesson 2.2.1 Basic sentence structure 2.2.2. Clauses and Phrases Punctuations Creating coherence Organizing principles of paragraph documents Techniques for writing precisely **Tenses** **Letter Writing**
UNIT-III	**Identifying Common Errors in Writing**

	3.1 Video Lesson Sub +verb agreement Noun pronoun agreement Articles Preposition Redundancies Clichés **Active - Passive Voice** **Reported Speech** **3.4 Resume Writing**
UNIT-IV	**Nature and Style of sensible Writing** **4.1** Video Lesson Describing Classifying Writing Introduction and conclusion **4.3.1Conditional Sentences** **4.3.2Degrees of Comparison** **4.4 Email writing**
UNIT-V	**Writing Practice** **5.1** Video Lesson Comprehension Precise writing Essay Writing **Simple Compound and Complex Sentences** **Report Writing**

II SEMESTER	L	T	P	C
	3	-	-	3
20CS2T02: OBJECTORIENTEDPROGRAMMINGUSINGC++				

COURSE OUTCOMES:

At the end of the Course, Students will be able to:
1. Proficient in Principles of object-oriented technology.
2. The Evolution and Purpose of Object Oriented Programming.
3. Mastering in basic Object Oriented programming concepts and logic implementations.
4. Knowledge in file I/O operations and exceptions
5. Ability to identify and implement appropriate Solutions for a given Problem.
6. Know the terms Object-oriented Programming, Class ,Object,Constructor, Destructor, friend, static, Data Abstraction, Encapsulation, Inheritance, Polymorphism, File I/O, templates, Exceptions and where they are applicable

UNIT I

INTRODUCTION: The Object-Oriented Technology, Disadvantages of Conventional Programming, Advantages of OOP, Structure of a C++ Program, Differences between C and C++

INPUT AND OUTPUT IN C++: Streams, Stream Classes Hierarchy, Bit Fields, Manipulators. Tokens in C++, Data Types, Constants, L Value and R Values, Operators in C and C++, Scope Access Operator, Comma Operator, This Operator, Reference Variable, Decision and Loop Statements.

UNIT II

FUNCTIONS IN C++: Passing Arguments to a Function, Default Arguments, Const Arguments, Inputting Default Arguments, Inline Functions, Function Overloading.

CLASSES AND OBJECTS: Class Definition, Declaring Objects, Access specifiers and their scope, Member functions, Outside member functions as inline, Data Hiding or Encapsulation, Memory for Class and Objects, Static Member variables, Static Member Functions, Static Object, Array of Objects, Objects as Function Arguments, Friend Functions, Friend class, Local class, Empty Class, Qualifiers and Nested Classes, Member Function and Non-Member Function.

UNIT III

CONSTRUCTORS AND DESTRUCTORS: Introduction of Constructor, Destructor & Characteristics, Parameterized Constructor, Overloading Constructors, Constructor with Default Arguments, Copy Constructor

OPERATOR OVERLOADING: Introduction of Overloading, Overloading Unary Operators, Constraint on Increment and Decrement Operators, Overloading Binary Operators, Overloading with Friend Functions, Overloading Assignment Operator, Rules for Overloading Operators.

UNIT IV

INHERITANCE: Introduction of Inheritance, Access specifiers, Protected Data with Private Inheritance, Types of Inheritances, Virtual Base Class, Constructors and Destructors in Inheritance, Constructor and Destructor in Derived Class, Advantages and Disadvantages of Inheritance.

POLYMORPHISM: Polymorphism, Types, Pointer and Inheritance, Virtual and Pure Virtual Functions, Abstract Classes.

UNIT V

APPLICATIONS WITH FILES: File Stream Classes, File Opening Modes, File Pointers and Manipulators, Sequential Access Files, Binary and ASCII Files, Random Access Files.

TEMPLATES & EXCEPTION HANDLING

Principles of Exception Handling, Keywords, Exception Handling Mechanism, Multiple Catch Statements, Catching Multiple Exceptions.
Generic Programming with Templates, Need for Templates- Definition of class Templates.
Introduction to STL- Containers, Algorithms, Iterators.

TEXT BOOKS

1. Programming in C++,Ashok N Kamthane, Pearson, 4th edition
2. The C++ Programming Language, B. Stroutstrup, Pearson Education. , 4th edition
3. The Complete Reference C++, Herbert Schildt, Tata McGraw Hill, 4th edition

REFERENCES

1. Object Oriented Programming C++, Joyce Farrell, Cengage, 4th edition
2. Mastering C++ , Venugopal, Raj Kumar, Ravi Kumar TMH, 2nd edition
3. Object Oriented Programming with C++, SouravSahay and OXFORD, 2nd edition

LINKS

https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/

https://www.tutorialspoint.com/cplusplus/cpp_object_oriented.htm

II SEMESTER	L	T	P	C
	3	-	-	3
20EE2T02: ELECTRICAL NETWORKS				

Course Outcomes: ***Aftersuccessful completion of this course, students should be able to:***

CO1 : State the basic concepts of Electrical circuits

CO2 : Demonstrate the Single Phase AC circuits.

CO3 : Interpret the behavior of the circuit at series & parallel resonance circuits.

CO4 : Explain the properties of electromagnetic circuit and their application.

CO5 : Illustrate the Network Theorems(DC & AC Excitation)

SYLLABUS

UNIT-I : FUNDAMENTALS OF ELECTRICAL CIRCUITS

Basic Concepts of Active and Passive Components and their V-I Relations - Ohm‟s and Kirchhoff‟s laws ,Dependent and Independent Sources- Source Transformation Technique - Network Reduction Techniques(series, parallel, series-parallel, star-to-delta and delta-to-star transformation), Nodal Analysis and Mesh Analysis

UNIT-II : SINGLE PHASE A.C CIRCUITS

Periodic waveforms (determination of RMS, average value and form factor), concept of phasor, phase angle and phase difference, complex and polar forms of representations-Concept of Reactance, Impedance, Susceptance and Admittance. Steady-state analysis of R, L and C circuits (Series & Parallel Circuits), power factor and its significance.

UNIT-III : RESONANCE - LOCUS DIAGRAMS

Resonance: Series and parallel resonance, Concept of Band Width and Quality Factor ,Problems

Locus diagram for various combinations of Series RL, RC, RLC Circuits & Parallel Circuits

UNIT-IV : MAGNETIC CIRCUITS

Basic Definition of MMF, Flux and Reluctance, Analogy Between Electrical and Magnetic Circuits, Faraday‟s Laws of Electromagnetic Induction,Concept of Self and Mutual Inductance, Dot Convention, Coefficient of Coupling and Composite Magnetic Circuit, Analysis of Series and Parallel Magnetic Circuits.

UNIT-V : NETWORK THEOREMS (DC & AC EXCITATION)

Superposition Theorem, Thevenin‟s Theorem, Norton‟s Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Millman,,s Theorem and Compensation Theorem.

TEXT BOOKS:

1. Fundamentals of Electric Circuits "Charles K.Alexander, Mathew N.O.Sadiku, TataMcGraw-Hill sixth edition-2019.
2. Circuits & Networks Analysis & Synthesis by A. Sudhakar and Shyammohan S Palli,TataMcGraw- Hill Fifth edition-2017.
3. Circuit Theory by A.ChakrabartiDanapatRai& Co publisher.Seventh - Revised edition(2018).

REFERENCE BOOKS:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,McGraw HillCompany,6th edition Eighth edition (4 August 2013)
2. Network Analysis by N.C.Jagan, C.LakshmiNarayana BS publications 2nd edition -2017
3. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.Third edition, 2019.

II SEMESTER	L	T	P	C
	-	-	3	1.5
20BS2L02: ENGINEERING CHEMISTRY LAB				

Outcomes: The experiments introduce volumetric analysis: Acid-Base, complexometric, Redox, Conductometric and potentiometric titrations. Then they are exposed to a few instrumental methods of chemical analysis.

Thus at the end of the lab course, the student is exposed and able to

1. Identify the concentration of given solution by different methods of chemical analysis (**K3**)
2. Analyze the water purity by checking hardness, DO and Acidity. (**K4**)
3. Estimate the Cu^{+2}, Fe^{+3}, Ca^{+2}, Mg^{+2} ions and Ascorbic acid present in given solution. (**K4**)
4. Identify the pour and cloud point of lubricants. **(K3)**
5. Understand the principles of conductometric and potentiometric titrations. (**K2**)

Syllabus:

1. Estimation of HCl using standard Na_2CO_3 through acid-base titration.
2. Estimate the total hardness of water using standardized EDTA solution through complexometric titration.
3. Estimation of $KMnO_4$ using standard $H_2C_2O_4$ through redox titration method.
4. Estimation of Dissolved Oxygen in given water sample by Wrinkler‟s Method
5. Determination of Ferric (Fe^{+3}) ions using standard $K_2Cr_2O_7$ solution
6. Determination of Copper (II) using standard hypo solution.
7. Estimation of strong acid by using strong base through conductometric titration method.
8. Estimation of strong acid by using strong base through potentiometric titration method.
9. Preparation of polymer (Demo).
10. Determination of Vitamin „C‟.
11. Determination of Pour and Cloud Point of lubricating oils

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

II SEMESTER	L	T	P	C
	-	-	3	1.5
20IT2L01 : IT WORKSHOP				

Course Objectives:

1. The course focuses on enhancing student knowledge in computer peripherals and assembling.
2. To install operating system on computers and create new email account.

3. To understand basic software like WinRAR, WinZip, PDF readers and web browser.

4. To provide technical training to the students on Google tools like forms, calendar, drive, and classroom.

Course Outcomes:

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

1. Attain complete knowledge of a computer hardware
2. Able to install basic computer engineering software.
3. Able to do document task through MS office.
4. Attain technically strong usage of Google Tools and Email handling.
5. Able to understand network troubleshooting.

LIST OF EXPERIMENTS

1. Components of Computer & Assembling a Computer:
Learning about the different parts of the computer and its advancement
- Processor
- Memory – Types
- Motherboard
- Peripheral interfaces – I/O devices

2. Components of Computer & Assembling a Computer:
- Learn about the proper connectivity among the devices inside the PC
- Assembling the different parts of the computer inside the cabinet

3. Productivity Tools - Learning Basic Software:
- Installation of Productivity tools like WinRAR, WinZip, and PDF Reader.
- Installation of Application programs like Microsoft Office, Image Editor and Web browsers.
- Connect the Printer and Scanner Devices perform printing and scanning operation.

4. Productivity Tools:
Microsoft-Word orientation –To create project certificate, Formatting Fonts, Drop Cap,Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option.

5. Productivity Tools:
Microsoft-Word orientation- Mail Merge, Macros, References.

6. Productivity Tools:

Microsoft-PowerPoint utilities - PPT Orientation, Slide Layouts, Inserting Text, Word Art,Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks, Inserting Images, Clip Art, Audio, Video, Objects, Tables and Charts.

7. Productivity Tools:

Microsoft-Excel orientation - Gridlines, Format Cells, Summation, auto fill, Formatting Text,Cell Referencing, Formulae in excel – average, stddeviation etc., Macros.

8. Productivity Tools:

Microsoft-Excel orientation- Charts, Hyper linking, Split cells, freeze panes, group and outline, Conditional formatting, Sort and Filter, .csv file.

9. Introduction to Google Tools:

- Design a Google form and collect a response data among students using Google Form.
- Schedule one day of your activities using Google Calendar.
- Store and retrieve data from cloud storage using Google Drive.
- Orientation towards Google Classroom.

10. Network basics:

Introduction, Types of networks, IP addressing, LAN, Network troubleshooting.

II SEMESTER	L	T	P	C
	-	-	3	1.5
20CS2L02 : OBJECTORIENTEDPROGRAMMINGUSINGC++LAB				

COURSEOUTCOMES:

Attheendof the course, Students willbeableto:

1. Abletodifferentiatestructure-orientedprogrammingandobject-orientedprogramming.
2. Abletounderstandandapplyvariousobject-orientedfeatures.
3. Abletoknowconceptsinoperatoroverloading,functionoverloading&polymorphism.
4. Abletowrite,compileanddebugprogramsinC++language.
5. Designprogramsinvolvingconstructors,destructors.
6. Abletoreuseofcodeusinginheritance.
7. Toimplementtheconceptoffiles, templates and exceptions.
8. TowritediversifiedsolutionsusingC++language.

EXERCISE-1(BASICS)

A. WriteaCPP Programtodemonstratethestructureofa C++program.

B. WriteaCPP Programtodisplaythenamesofheaderfiles,definitionsandlistoffunctionssupported.

C. Writeaprogramtoshowthebaseofanumericvalueofavariableusing Hex, Octand Dec manipulatorfunctions.

D. WriteaCPP Programtouseofthestandardmanipulatorsnormallyusedinthestreamclasses.

E. WriteaCPP Programtodemonstratetheusageofbitfields.

F. WriteaCPP Programtodefineconstantpointerandpointertoconstantandperformpossibleoperations.

G. WriteaCPP Programtoaccessavariableindifferentscopesbyusingscoperesolutionoperatorandtheuseof commaoperator.

EXERCISE-2(CLASSES & OBJECTS)

A. WriteaCPP Programtoswaptwonumbersusingcallbyvalue,callbyaddress,callbyreference,andreturn by reference.

B. WriteaCPP Programtocalculatethe squareandcubeofanumberusinginlinefunctionsandmacros.(Demonstratetheuseofinlinefunctions compared tomacros).

C. WriteaCPP Programtofindtheareaofarectangle,atriangle, andsurfaceareaofasphereusingfunctionoverloading.

D. WriteaCPP Programtodeclareallmembersofaclassaspublic,Accessthemembersusingobjects.(Usepublic, protected, private).
E. WriteaCPP Programtoaccessthememberfunctionsinsideandoutsideaclass.
F. WriteaCPP Programtoaccessprivatedatausingnon-memberfunctions.(Usefriendfunction).
G. WriteaCPP Programtopass objectstofunctionsbypassbyvaluemethod.
H. WriteaCPP Programtodeclaremain()functionasmemberfunctionandoverloadit.

EXERCISE-3(CONSTRUCTORSANDOPERATOROVERLOADING)

A. WriteaCPP Programtoshowthat"foreachobjectconstructorsiscalledseparately"andreadthevaluesthrough keyboard (UseConstructor).
B. WriteaCPP Programtocreateconstructorwithargumentsandpasstheargumentstoconstructor.
C. WriteaCPP Programtocreateobjectandreleasethemusingdestructor.
D. WriteaCPP Programtoperformaddition,subtraction,multiplication oftwo objectsusingoperatorkeyword.
E. WriteaCPP Programtooverloadunaryandbinaryoperatoroverloadingwithfriendfunction.

EXERCISE-4(INHERITANCEANDPOLYMORPHISM)

A. WriteaCPP Programtoderiveaclasspubliclyfrombaseclass.Declarebaseclassmembersunderpublic, privateand protected.
B. WriteaCPP Programtoderivesingleandmultipleinheritances.
C. WriteaCPP Programtodeclarevirtualbaseclass. Deriveaclass using twovirtualclasses.
D. WriteaCPP Programto implementationofVirtualFunction.
E. WriteaCPP ProgramtoImplementationofPureVirtualFunction.

EXERCISE-5(FILES,TEMPLATESAND EXCEPTIONHANDLING)

A. WriteaCPP Programtowriteandreadtextinafile.Useofstreamandifstreamclasses.
B. WriteaCPP Programtoopenafileforwritingandreadingpurpose.Useopen()function.
C. WriteaCPP Programtowrite text ina file.Readthetext from the file from EOF.Displaythecontents in reverseorder.
D. WriteaCPP Programtodemonstratethatthedataisreadfromfileusing ASCIIformat.
E. WriteaCPP Programtofindthefactorialofanumber.Throwmultipleexceptionsanddefinemultiplecatch statementsto handleexceptions.
F. Write aC++Programtoillustratetemplateclass

Practice Programs

1. WriteC++ProgramtoCreateFloyd'sTriangle
2. WriteC++ProgramtoAddTwoMatrices usingMulti-dimensionalArrays
3. WriteC++ProgramtoMultiply Matrix by passing it to a Function

Toperformthistaskthreefunctionsaremade:
Totakematrixelementsfromuser To

multiplytwo matrix
Todisplaytheresultantmatrixaftermultiplication

4. Write a C++Programtocreateaclassforstudenttogetandprintdetails ofN students.

(C++programtodemonstrateexampleofarrayofobjects.)

5. Write a C++ProgramtoconverttimefromHH:MM:SS formattoseconds usingclass

6. Write a C++ program to convert time from seconds to HH:MM:SS format using class.

7.Write a C++Programtodefineaclassemployeehavingmembers Emp-id,Emp-name, Basicsalaryandfunctionsaccept()anddisplay().CalculateDA=25%ofbasicsalary,

HRA=800,I-tax=15%ofbasicsalary.Displaythepayslipusingappropriateoutputformat.

1) Toacceptthedata
2) Todisplaythedata

8. Write a C++Programtocheckprime numberornotusingclass

9. To create a class staff having fields: Staff-id , name, salary and functions accept() and display(). Calculate DA=25% of basic salary, HRA=800, I-tax=15% of basic salary.Displaythepay slip using appropriateoutputformat.

1) Toacceptthedata
2) Todisplaythedata
3) Tosortthedataby name

10. Todefineaclass torepresentabankaccount.Includethefollowingmembers:Datamembers:

1) Nameofthedepositor
2) Accountnumber
3) Typeofaccount
4) Balance amount in the account.

Memberfunctions:

1) Toassigninitialvalues
2) Todepositanamount
3) Towithdraw anamountaftercheckingthebalance
4) Todisplaynameandbalance.

11. Tocreateaclass foranelectricityboardthatcharges thefollowingrates tousers

a) Forfirst100 units :40p perunit
b) Fornext200units :50pperunit
c) Beyond300units :60pperunit

All users are charged a minimum of Rs.500. If the total cost is more than Rs.250.00 then an additionalcharges of 15% areadded.
WriteaC++programusingclass toreadthenames ofusers &numberofunits consumed&printoutthechargeswith names.

12. Write a C++programtodemonstrate overloadingnew anddeleteoperator

13. Write a C++programtocompare two strings usingOperatorOverloading

14. Write a C++programtoconcatenatetwostringsusingOperatorOverloading

15. Write a C++ Program to Find the Number of Vowels, Consonants,Digits and White Spaces in aString
16. Write a C++ Program to removeallCharactersinaStringexceptAlphabets.
17. Write aC++Programtofindthe frequencyof charactersina string
18) Write aC++Programto remove all duplicates from the input string. Print all the duplicates in theinputstring.
19. Write aC++Programto remove characters from the first string which is present in the secondstring
20. Write aC++Programto check ifstringsarerotationsofeachotherornot
21. Write C++ Program to read a string. Add the same string in the reverse order to the end of thesamestring.
22. Write aC++Programto readastring.Changethefirstletterofeverycapitalword.
23. Write aC++Programto declarestringobjects.Performassignmentandconcatenationwiththestringobjects.
24. Write aC++Programto performstringoperationsusingstringlibraryfunctions.
25. Write aC++Programto returnmaximumoccurringcharacterintheinputstring
26. Write aC++Programusingstringmanipulatingfunctions.
27. WriteaC++ProgramtoImplementStackinSTLusingthefollowing
    1. InsertElementintotheStack
    2. Delete Element from theStack
    3. SizeoftheStack
    4. TopElementoftheStack
    5. Exit
28. WriteaC++ProgramtoImplementStringinSTLusingfollowing
    1. InsertSubstringinaString
    2. EraseSubstringfromaString
    3. AppendSubstringtoaString
    4. ReplacetheStringwithaSubstring
    5. SizeoftheString
    6. FindsubstringinaString
    7. DisplaytheString
    8. Exit
29. WriteaC++ProgramtoImplementArrayinSTLusingfollowing
    1. InsertElementintotheArray
    2. Sizeofthearray
    3. FrontElementofArray
    4. ElementofArray
    5. DisplayelementsoftheArray
    6. Exit
30. WriteaC++ProgramtoImplementBubbleSortusingtemplates inC++

II SEMESTER	L	T	P	C
	-	-	3	1.5
20HS2L02: ENGLISH COMMUNICATIONSLAB				

COURSE OBJECTIVES

- To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
- To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
- To assist students to carry on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

COURSE OUTCOMES

e) Reading Skills.

- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

f) Writing Skills:

- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

g) Interactive skills:

- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

h) Life Skills and Core Skills:

- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

RELATIONSHIP OF COURSE TO PROGRAMME OUTCOMES

A	Ability to apply knowledge of mathematics, science, and engineering.	
B	Ability to design and conduct experiments, as well as to analyze and interpret data.	
C	Ability to design anEngineering system, component, or process.	
D	Ability to function on multi-disciplinary teams	
E	Ability to identify, formulate and solve engineering problems.	
F	Understanding of professional and ethical responsibility.	
G	Ability to communicate effectively	√
H	Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.	√
I	Recognition of the need for and an ability to engage in life-long learning.	
J	Knowledge of contemporary issues.	
K	Ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.	
L	Ability to find location of substations and benefits derived through their optimal location.	

COURSE DESCRIPTION

Communicating in a language is also a skill. So a student has to look for an opportunity to practice English language in order to acquire proficiency in English. „Enrich your interactive Skills: Part - A‟ is designed to provide opportunities for engineering students to revise and consolidate the basic skills in listening, speaking, reading and writing in addition to giving ample practice in various communicative functions and Life skills.

PREREQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

Syllabus

Unit	TOPIC
1	Vowels, Consonants, Pronunciation, Phonetic transcripts
2	Word stress and syllables
3	Rhythm and Intonation
4	Contrastive Stress –Homographs
5	Word Stress : Weak and Strong forms , Stress in compound words

Text Book:

"InfoTech English" by Maruthi Publications

Reference Books:

1. Better English Pronunciation by O‟ Connor
2. Phonetics and Phonology – Peter Roach
3. A Grammar of Spoken English – Harold Palmer
4. English Phonetics – Bansal and Harrison

Testing Pattern:

B) Internal lab Exam: **30 Marks**

Regular performance in the language /communication /lab completion in the lab manual 15M

Written test 15M

B) External lab Exam Pattern: **70 Marks**

Written test 30M

Oral test 30M

Viva(during exam marks will be awarded by external examiner) 10M

III SEMESTER	L	T	P	C
	3	-	-	3
20MA3T05: COMPLEX VARIABLES AND RANDOM PROCESS				

Prerequisites

Subjectneeds theknowledgeinfundamentals ofsettheory,partialfractions,andbasicsingeometry,realnumbersystem,elementarycalculus andbasicideaofprobability.

COURSEOBJECTIVES:

- This course will illuminate the students in the concepts of Complex Variables and StochasticProcess.
- To equip the students with standard concepts and tools from intermediate level to advancedlevel Mathematics to develop the confidence and ability among the students to handlevariousrealworldproblems andtheirapplications.

Unit-IFunctionsofacomplexvariable:

Continuity–Differentiability–Analyticity–properties–Cauchy-RiemannequationsinCartesianandpolar coordinates.Harmonicandconjugateharmonicfunctions–Milne–Thomsonmethod.

LearningOutcomes:

Afterthecompletionofthisunitstudentwillbeableto

- Definecontinuity,differentiabilityandanalyticityforcomplexfunctions(K1)
- ApplyCauchyRiemannequationstocomplex functions inordertodeterminewhether agivencontinuousfunctionisanalytic(K3)

Unit-IIComplexpowerseries:

Radiusofconvergence– ExpansionbyTaylor‟sseries,Maclaurin‟sseriesandLaurent'sseries(Onlystatements)andrelatedproblems,Sing ularities

LearningOutcomes:

Afterthecompletionofthisunitstudentwillbeableto

- EvaluatetheTaylor'sandLaurent'sexpansionofsimplefunctions(K3)
- Determinethenatureofthesingularities(K3)

Unit-IIIComplexIntegration andResidue:

Cauchy‟s theorem–Cauchy‟sintegralformula– Generalizedintegralformula(Onlystatements)andrelatedproblems.Evaluationofresidue– Residuetheorem(Statementonly) andrelatedproblems.

LearningOutcomes:

After the completion of this unit student will be able to

- Evaluateacontour integralusingCauchy‟stheoremand Cauchy‟sintegralformula(K3)
- Makeuseofthe Cauchy‟sresiduetheoremto evaluatecertain integrals(K3)

Unit-IVTheRandomVariableanditsdistributions:

The Random Variable Concept: Definition of a Random Variable – Conditions for a Function to be aRandomVariable – DiscreteRandomVariables–DistributionFunction– Binomial,PoissonDistributionsContinuousRandomvariables-DistributionFunction-Gaussian,Exponentialdistributions.

LearningOutcomes:

After the completion of this unit student will be able to

- □ Calculateprobability mass function, density function of discrete and continuous randomvariables.(K2)
- □ Calculate the cumulative distribution functions for discreteand continuous randomvariables.(K2)

Unit-V Operation onOneRandomVariable

Expectation: Expected value of a random variable – Expected Value of a Function of a RandomVariable. Moments: Moments about the origin - Central Moments - Variance -Functions that giveMoments:Momentgeneratingfunction.

TwoRandomVariables:

Introduction, vector random variables, Joint distribution and its properties- joint distributionfunction,propertiesofjointdistributions,marginaldistributions.

LearningOutcomes:

Afterthecompletionofthisunitstudentwillbeableto

- □ Calculatetheexpectedvalue, variance,moments,MGF,ofadiscreteandcontinuousrandomvariables(K3)
- □ Define vectorrandomvariables,Jointdistributionand marginaldistributions.(K1)

COURSEOUTCOMES: Studentsareable to

1. Solvethefundamentalsofthetheoryofanalyticfunctions
2. ExpandthegivenfunctioninTailorsseries, Maclaurin‟sseriesandLaurent‟sseries.
3. Findresiduesat singularpoints,ableto evaluateintegrals.
4. Constructtheprobabilitydistribution functionofrandomvariables.
5. Calculateexpectationsofrandomvariableslikevarianceandmoments.

TextBooks:

1. B.S.Grewal,HigherEngineeringMathematics,43/e,KhannaPublishers, 2014.
2. Probability,Randomvariables&RandomSignalPrinciples–PeytoonZpeebles, TMH,4thEdition, 2001.

References:

1. B.V.Ramana,HigherEngineeringMathematics,TataMcGrawHill,2007
2. Complexvariables&StatisticalMethods, S.Chandpublications
3. Probability&StatisticsbyK.Murugesan,P.Gurusamy,AnuradhaPublications

III SEMESTER	L	T	P	C
	3	-	-	3
20EC3T01:ELECTRONIC CIRCUITS-I				

COURSE OUTCOMES

After completion of the course students are able to

CO1: Explain the characteristics of different semiconductor diodes and its applications (K2)

CO2Describe the characteristics of Transistors, FET and biasing. (K1)

CO3: Construct the wave shaping circuits of non sinusoidal signals. (K3)

CO4: Analyze and design the Multi vibrators using BJT(K4)

UNIT-I

SEMICONDUCTOR DIODES AND IT's APPLICATIONS

Band structure of pn junction, Diode current components, Volt-ampere characteristics, Transition and diffusion capacitance of p-n junction diode, Breakdown of junctions, Zener and Avalanche breakdowns, Tunnel Diode Construction, operation and characteristics.Diode as a Switch. Rectifiers: Half wave, full wave: center tap and bridge type, analysis for different parameters: PIV, TUF, efficiency, ripple factor, regulation, etc. Capacitive Filter analysis for ripple factor and regulation

UNIT-II

JUNCTION TRANSISTOR CHARACTERISTICS AND BIASING

PNP and NPN junction transistors, Characteristics of the current flow across the base regions, Transistor as a device in CB, CE and CC configurations and their characteristics. The operating Point, DC & AC load lines, Fixed Bias and problems, Collector Feedback Bias, Emitter Feed Back Bias, Self Bias and problems, Stabilization, various stabilization circuits, Transistor as a Switch.

UNIT–III

JFET & MOSFET

FET types, construction, operation, characteristics, parameters, MOSFET-construction, characteristics and comparative study of Enhancement and Depletion MOSFET (P-channel& N-channel).Comparison between JFET and MOSFET.FET & MOSFET BIASING: Introduction, Fixed-Bias configuration, Self-Bias Configuration Voltage- Divider Biasing and stabilization. Relevant problems.

UNIT-IV

WAVE SHAPING CIRCUITS:

Low pass & high pass RC circuits (step response & square), High pass RC circuit as a Differentiator, Low passes RC circuit as integrator.

Clipping circuits: Classification, diode clippers, transistor clippers, Transfer characteristics, **Clamping circuits**: Classification, clamping operations, Clamping circuit theorem, practical clamping circuits.

UNIT-V

MULTIVIBRATORS:

Classification of multivibrators, Design and analysis of multivibrators: Bistablemultivibrator ,Schmitt trigger using BJT. Monostable, AstableMultivibrators(only collector Coupled), Types of triggering circuits for Multivibrators

TEXT BOOKS:

1. J. Millman&C.Halkias -„Electronic devices & circuits"- Tata McGraw Hill Publication. -IInd Edition,2003. (Units – 1,2,3)
2. Pulse Digital and Switching Waveforms - J. Millman and H.Taub, McGraw-Hill, -IInd Edition, 1991.(Units – 4,5)

REFERENCES BOOKS:

1. Sanjeev Gupta –„Electronic devices & circuits"- Dhanpat Rai Publications IV Edition.,2012.
2. A. Anand Kumar- Pulse and Digital Circuits, PHI.-IV Edition, 2005.
3. S. Salivahanan, N. Suresh Kumar and A. Vallava Raj, "Electronic Devices and circuits", TMH, 2nd Edition 2008.

e-RESOURCES:

https://www.electronicsforu.com/resources/electronic-devices-and-circuit-theory
https://www.elprocus.com/types-of-clipper-and-clamper-circuits-and-applications

III SEMESTER	L	T	P	C
	3	-	-	3
20EC3T02:DIGITAL ELECTRONICS				

COURSE OUTCOMES:

After completion of the course, students are able to
CO1: Describe the different types of number systems and Boolean algebra.(K1)
CO2: Explain the minimization techniques and universal gates.(K2)
CO3: Construct the logic circuits of various combinational circuits.(K3)
CO4: Explain the behavior of various sequential circuits.(K2,K4)

UNIT-I

BASICS OF DIGITAL SYSTEMS:
Introduction to Number Systems: Number base conversions, Binary to Octal, Octal to Binary, Binary to Hexadecimal, Hexadecimal to Binary, Unsigned and Signed Binary numbers.1"s and 2"s complement of binary numbers, Binary codes, Special codes like Gray codes, Excess-3 codes, Binary to Gray code and Gray code to Binary code conversion.Logic gates.

UNIT-II

SIMPLIFICATION OF BOOLEAN FUNCTIONS:
Minimization Techniques: Boolean postulates and laws, De-Morgan"s theorems, Principle of Duality, Boolean laws, Canonical and Standard forms.Min-terms, Max terms, Sum of Products (SOP) and Product of Sums (POS), Minimization of Booleanexpressions by using Boolean laws and theorems. Karnaugh map minimization: 3 and 4 variables. Design of all logic gates by using Universal gates

UNIT-III

ARITHMATIC LOGIC CIRCUITS:
Half adder, Half Subtractor, Full adder, Full Subtractor,4-bit Parallel adder, 4-bit Adder/Subtractor, Carry look ahead adder, BCD adder, Excess-3 adder, Magnitude Comparators, Code converters.

UNIT-IV

COMBINATIONAL LOGIC CIRCUITS:
Encoders, Decoders, Priority encoder, Multiplexer, De-multiplexers, Realization of Boolean functions using decoders and multiplexers.Memory devices: Random Access Memory, Read only Memory, Programmable Read only Memory, Programmable Logic Devices: Programmable Logic Array, Programmable Array Logic.

UNIT-V

SEQUENTIAL LOGIC CIRCUITS:
Latches, Flip-Flops: RS, D, JK, T and Master-Slave JK, Truth tables and Excitation tables. Flip-Flop conversions, Synchronous and Asynchronous counters, Up-Down counter, Ring counter and Johnson counter. Shift Registers: SISO, SIPO, PISO, PIPO.

TEXTBOOKS:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.

REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.

e-RESOURCES:

1. www.pdfdrive.com
2. www.booksboon.com
3. www.manybooks.com

III SEMESTER	L	T	P	C
	3	-	-	3
20EC3T03: SIGNALS AND SYSTEMS				

COURSE OUTCOMES

After completion of the course, students are able to

CO1:Describe the signal fundamentals in terms of types and how to represent the various signals. (K1)

CO2:Explain the concept of Fourier series and Fourier transforms to determine the signal and system characteristics. (K2, K4)

CO3:Demonstrate the concept of sampling theorem, convolution and correlation and also signal transmission through linear systems. (K3)

CO4:Demonstrate the concept of ROC (Region Of Convergence) using Laplace and Z- Transforms to analyze the continuous and discrete time systems. (K3, K4)

UNIT- I :INTRODUCTION TO SIGNALS AND SYSTEMS

Introduction to Signals: Continuous time signals and Discrete time signals- Periodic and Aperiodic signals- Even and Odd signals- Energy and Power signals- Deterministic and Random signals-Complex Exponential and Sinusoidal signals, Standard Functions - Unit impulse and Unit step &Unit ramp signal.

Systems: Continuous time systems and Discrete time systems- Linear and Non-Linear systems- Time Invariant and Time Variant systems- Causal and Non-causal system- BIBO system- Memory and Memoryless systems

UNIT-II:CONVOLUTIONAND CORRELATION

Convolution and Correlation: Concept of convolution, Graphical representation of convolution,Properties ofConvolution like Cumulative, Associative, Distributive, Shifting, Scaling. Convolution Integral and Convolution Sum.

Cross correlation and Auto correlation of functions, properties of correlation function with examplesRelation between Auto correlation and energy signal, PSD.

UNIT-III:FOURIER SERIES AND SAMPLING

Concept of Orthogonal functions with examples. -Fourier Series Representation of Continuous-Time Periodic Signals. Deriving Fourier transform coefficients.Relation between Trigonometric coefficients and Exponential coefficient, Dirchillet conditions.

Sampling Theorem-Time domain and frequency domain statements- Reconstruction of a Signal from its sample- The Effect of under sampling (Aliasing).

UNIT-IV:CONTINUOUS-TIME TRANSFORMS:

Unilateral and bi-lateral Fourier Transform- Properties of Fourier transform, The Convolution Property, Parseval‟s Theorem, The Multiplication Property. Inverse Fourier Transform. Relation between LT and CTFT.

Laplace Transform: Unilateral and bi-lateral Laplace Transforms. ROC, Constraints of ROC, Laplace Transform of standard functions, Properties, Inverse Laplace Transform. Initial and Final Value theorems.

UNIT-V:DISCRETE-TIME TRANSFORMS

Z-transform: Unilateral and bi-lateral z-transform, ROC, Constraints of ROC, Properties of Z-transforms, Convolution Property, Inverse z-Transform(Direct and Indirect methods). Initial and Final Value theorems, Relation between DTFT and Z-Transform.

TEXT BOOKS

1. B.P. Lathi, "Principles of Linear Systems & Signals", Oxford Press, Second Edition 2005.(UNITS - I,II&III)
2. A.V.Oppenheim, A.S.Willsky and S.H.Nawab,,Signals and Systems – 4nd Edition, Prentice-Hall India.2009 (UNITS –IV&V)

REFERENCE BOOKS

1. John G. Proakis and Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PearsonEducation, 3rd edition, 2002.
2. Simon Haykin and Barry Van Veen,"Signals and Systems", John Wiley & Sons In, 2001.

E-CONTENT

1.https://nptel.ac.in/courses/117/101/117101055/

2.www.pdfdrive.com

3. https://www.tutorialspoint.com/signals_and_systems/signals_and_systems_overview.htm
4. www.booksboon.com
5. www.manybooks.com
6. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011

III SEMESTER	L	T	P	C
	3	-	-	3
20EC3T04: ANALOG COMMUNICATION				

COURSE OUTCOMES:

At the end of this course, student will be able to
CO1: Understand the concept of communication system, need for modulation, modulation and demodulation techniques in AM.
CO2: Describe the concepts of DSB-SC, SSB, FM and Pulse Analog modulation techniques.
CO3: Analyze the transmission and reception of a signal in a communication system by using different types of transmitters and receivers.
CO4: Estimate the effect of noise on AM, DSB-SC, SSB and FM.

UNIT I

AMPLITUDE MODULATION (DSB-FC): Introduction to communication system,Block diagram, Need for Modulation, Amplitude Modulation: Time domain and frequency domain description, Single tone modulation, Degrees of modulation, Power and Current relationship, Generation of AM waves: Square law Modulator, Switching modulator, Detection of AM Waves: Square law detector, Envelope detector.

UNIT II

DSB-SC AND SSB MODULATION: Double side band suppressed carrier modulation: Time domain and frequency domain description, Generation of DSB-SC waves: Balanced Modulator, Ring Modulator, Coherent detection of DSB-SC Modulated wave. Single side Band Suppressed Carrier Modulation: Frequency domain description, Frequencydiscrimination method for generation of SSB Modulated wave, Time domain description, Phase discrimination method for generation of SSB Modulated wave. Coherent detection of SSB wave.

UNIT III

ANGLE MODULATION: Basic concepts, Relation between FM and PM, Frequency Modulation: Single tone frequency modulation,Narrow band FM, Wide band FM, Transmission bandwidth of FM wave, Generation of FM wave: Direct FM, Indirect FM, Detection of FM wave: Slope detector, Balanced Slope detector and Phase discriminator.

UNIT IV

RADIO TRANSMITTERS AND RECEIVERS: Radio Transmitter: Classification of Transmitters, AMTransmitter (Low level and High level), FM Transmitters: Variable reactance type and Phase modulated FM Transmitters, Radio Receiver: Classification of Receivers, Tuned Radio Frequency receiver, Super heterodyne receiver, Characteristics of Radio receiver, RF section, IF Section, AGC, FM Receiver, Amplitude limiter.

UNIT V

ANALOG PULSE MODULATION & NOISE IN CW MODULATION: Types of Analog pulse modulations, Generation and detection of PAM (Single polarity), PWM and PPM. Types of Noise (Internal and External), Derive figure of merit for DSB-SC, SSB, AM and FM systems, Pre-emphasis and de-emphasis circuits.

TEXT BOOKS:

1. Principles of Communication Systems - Simon Haykin, John Wiley, 2nd Edition.
(Unit-1,2,3 and 5)
2. Electronic Communication System – George Kennedy and Bernard Davis, TMH 2004.
(Unit-1,2,3 and 4)

REFERENCE BOOKS:

1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe, TMH, 2007, 3rd Edition.
2. Communication Systems – B.P. Lathi, BS Publication, 2006.
3. Communication Systems: Analog and Digital, Sanjay Sharma S. K. Kataria& Sons, 2012.

e-RESOURCES:

1. www.pdfdrive.com
2. www.booksboon.com
3. www.manybooks.com

III SEMESTER	L	T	P	C
	-	-	3	1.5
20EC3L01: ELECTRONIC CIRCUITS - I LAB				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1 : Describe the diode, FET and transistor characteristics (K1)

CO2 : Explain the rectifier circuits using diodes and implement them using hardware.(K2,K3)

CO3 :Construct various Linear and Non-Linear wave shaping circuits and implement them using hardware, also observe their responses for different input signals(K3)

CO4 : Analyze the switching characteristics and generate non-sinusoidal waveformsusingTransistorcircuits.(K4)

PART A: (Only for viva voce Examination)

ELECTRONIC WORKSHOP PRACTICE (in 2 lab sessions):

1. Study of basic electronic components-active/passive, meters, DC & AC sources, Switches, breadboard,etc.
2. Study and operation of a) Multimeters (Analog and Digital) b) Function Generator c) Regulated Power Supplies d) Study and Operation of CRO.

PART B: (Any ten experiments)

1. PN Junction diode characteristics a) Forward bias b) Reverse bias (cut-in voltage & Resistance calculations).
2. Zener Diode regulation characteristics.
3. Transistor CB characteristics (Input and Output).
4. Transistor CE characteristics (Input and Output).
5. Half wave Rectifier without and with filter.
6. Full wave Rectifier without and with filter.
7. FET characteristics (Drain and Transfer)
8. Wave Shaping Circuits: RC Low Pass & High Pass Circuits.
9. Clippers using Diodes
10. Clampers.
11. Transistor acts as a Switch.
12. AstableMultivibrators
13. Mono-stable Multivibrator
14. Bi-stable Multivibrator
15. Schmitt Trigger using BJT

List of Experiments: (Content Beyond the syllabus)

1. LED Characteristics
2. Characteristics of SCR
3. UJT Characteristics

Equipment Required for Laboratory:

1. Regulated Power supplies (RPS) - 0-30v
2. CROs - 0-20MHz
3. Function Generators - 0-1 M Hz
4. Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes

7. Micro Ammeters (Analog or Digital) - 0-20μA, 0-50μA, 0-100μA, 0-200μA
8. Voltmeters (Analog or Digital) - 0-50V, 0-100V, 0-250V
9. Electronic Components - Resistors, Capacitors, BJTs, PN diode, Zener diode, Photo diode, FETs, diodes (Ge& Si Type), transistors (NPN & PNP)

III SEMESTER	L	T	P	C
	-	-	3	1.5
20EC3L02: DIGITAL ELECTRONICS LAB				

COURSE OUTCOMES

After completion of the course, students are able to
CO1:Describe and implementation of code conversion(K1)
CO2:Explain simple Boolean expressions using the theorems and to minimize the combinational functions.(K2,K3)
CO3:Analyze combinational circuits like Adders, Subtractors, Encoders, Decoders etc. (K4)
CO4:Construct various types of sequential circuits like Flipflops, counters and Registers (K3)

LIST OF EXPERIMENTS:

Minimum of TEN Experiments has to be performed

1. Implementing of logic gates with Universal Gates.
2. Design a logic diagram for the given SOP or POS form and verify the De-Morgan laws.
3. Construct and verify the truth tables of Half Adder, Full Adder using two Half Adders & one OR gate.
4. Design a Combinational Logic circuit for
   a. 4x1 MUX and verify the truth table.
   b. 2 - variable function using 4x1 MUX and verify the truth table.
5. Design a Combinational Logic circuit for 1x4 De- MUX and verify the truth table.
6. Design 4-bit Comparator using IC 7485 and verify the Truth Table.
7. Design 3 to 8 Decoder using IC 74138 and verify the Truth Table.
8. Design and implementation of code conversion from binary -to-gray.
9. Design Universal Shift Register using IC 74194 and verify the Truth Table.
10. Verify the truth tables of all Flip- Flops.
11. Implementation of Master Slave Flip-Flop with J-K Flip- Flop and verify the truth table.
12. Design a Decade Counter using IC 7490 and verify the truth table.
13. Design the Mod 5 counter using any Flip -Flop.
14. Construct 4-bit ring counter using any Flip –Flop and verify the truth table.
15. Design a 8 – bit Shift right Register using D-Flip -Flop and verify the truth table.

Equipment Required For Laboratory:

1. RPS – 0-30 v
2. IC,,s- 7400, 7402, 7485, 74194, 74138, 7408, 7404, 7432, 7468, 74151, 74153, 7490.
3. Digital logic trainers & bread boards.

III SEMESTER	L	T	P	C
	-	-	3	1.5
20EC3L03: ANALOG COMMUNICATION LAB				

COURSE OUTCOMES:

At the end of this course, student will able to
CO1: Understood the communication system, need for modulation, modulation and demodulation techniques in AM, DSB-SC.
CO2: Describe the concept of single side band suppressed carrier SSB-SC, VSB and Angle modulation.
CO3: To analyze the reception of a signal in a communication system by using different types of AM and FM transmitters/receivers.
CO4: Apply the concepts of Pulse Analog Modulation technique like PAM, PWM and PPM.

LIST OF EXPERIMENTS

ANY TEN EXPERIMENTS TO BE DONE: (a. Hardware, b. MATLAB Simulink)

1. Amplitude Modulation and Demodulation.
2. AM-DSB-SC Modulation and Demodulation.
3. Diode Detector Characteristics.
4. Pre-emphasis and De-emphasis.
5. Frequency Modulation and Demodulation.
6. SSB System.
7. Sampling Theorem.
8. Pulse Amplitude Modulation and Demodulation.
9. Pulse Width Modulation and Demodulation.
10. Pulse Position Modulation and Demodulation.

EQUIPMENT REQUIRED FOR LABORATORIES:
1. RPS – 0 to 30 V
2. CRO – 0 to 20 MHz
3. Function Generators – 0 to 1 MHz
4. Multimeters
5. Lab Experimental kits for Analog Communication
6. Components

SOFTWARE REQUIRED:

1. Computer systems with latest specifications
2. Connected in LAN (optional)
3. Operating system (windows XP)
4. Simulations software (MATLAB-Simulink)

III SEMESTER	L	T	P	C
	1	-	2	2
20EC3S01: PCB LAYOUT DESIGN				

COURSE OUTCOMES:

At the end of this course, student will able to
CO1: Understand the design of a Printed Circuit Board using software.
CO2: Understand to fabricate various circuits in PCB.
CO3: Understand the design, fabricate and perform the experiment of various switches and logic gates.
CO4: Understand the design, fabricate and perform the experiment of low-pass and high-pass filter circuits.

Thisisabasiccoursefordesigning PCB using the software. PCB (Printed Circuit Board) designingisanintegralpartofeachelectronicproductandthisprogramisdesignedto make students capable todesign theirown PCBprojects up to industrial grade.

LIST OF EXPERIMENTS:

1. Verification of Ohm‟s Law
2. Diode as a switch
3. Transistor as a switch
4. FET as a switch
5. SCR as a switch
6. Implementation of Basic Logic Gates with Diodes and Resistors
7. Implementation of NOR Gate using AND , OR and NOT
8. Implementation of NAND Gate using AND , OR and NOT
9. Buzzer operation
10. LED operation
11. Implementation of Low Pass filter
12. Implementation of High Pass filter

EQUIPMENT REQUIRED

- PCB Board
- Soldering Kit (Soldering, Gun, Soldering Iron, Soft Sponge, Flux, Wire, Solder Paste)
- ActiveComponents
  - Diode
  - Transistor
  - MOSFET
  - LED
  - SCR
  - IntegratedCircuits(ICs)
- PassiveComponents
  - Resistor
  - Capacitor
  - Inductor
  - Speaker/Buzzer

III SEMESTER	L	T	P	C
	2	-	-	-
20CE3M01 – ENVIRONMENTAL SCIENCES				

UNIT-I: Multidisciplinary nature of Environmental Studies:
Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;.Role of information technology in environment and human health.
Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II: Natural Resources:
Natural resources and associated problems. Forest resources: Use and over –exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III: Biodiversity and its conservation:
Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV Environmental Pollution:
Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his wellbeing.
Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT – V Social Issues and the Environment:
Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.
Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.
The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

1. K. V. S. G. MuraliKrishna , Environmental Studies,VGS Publishers, Vijayawada, 2010
2. R. Rajagopalan, Environmental Studies, 2nd Edition, Oxford University Press, 2011
3. P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani, Environmental Studies, 2nd Edition , Pearson Education, Chennai,2015

Reference:

1. Deeshita Dave & P. UdayaBhaskar Text Book of Environmental Studies, Cengage Learning, 2011
2. Shaashi Chawla, A Textbook of Environmental Studies, TMH, New Delhi,2017
3. Benny Joseph, Environmental Studies, Tata McGraw Hill Co, New Delhi, 2006
4. Anubha Kaushik, C P Kaushik , Perspectives in Environment Studies, New Age International Publishers, 2014

IV SEMESTER	L	T	P	C
	3	-	-	3
20EE4T05 : ELECTRICAL MACHINES AND CONTROL SYSTEMS ENGINEERING				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Demonstrate the operation and construction of dc machines

CO2 : Demonstrate the operation and construction of ac machines

CO3 : Apply Block Diagram and Signal Flow Graph Techniques for Determining the Transfer Function.

CO4 : Analysis a System Using Time Domain.

CO5 : Analysis a System Using Frequency Domain.

SYLLABUS

UNIT-I DC MACHINES

Construction and principle of operation of DC machine – Emf equation for generator – classification of DC machines - Types of DC Generators, D.C Motors – Principle of operation – Back E.M.F. - Torque equation, Types of DC motors.

Testing of Dc Machines: Speed control of D.C. Motors, Swinburne‟s method

UNIT-II : AC MACHINES

Transformer: Principle of operation, Construction details,emf equation,Equivalent circuit –Regulation – losses and efficiency. Voltage regulation, O.C.& S.C. Tests.

Three phase Induction Motor: Construction, Equivalent circuit, Torque equation and torque-slip characteristics.

Alternator: Construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method.

UNIT-III MATHEMATICAL MODELING OF CONTROL SYSTEMS

Introduction, Open Loop and Closed Loop control systems and their differences, Classification of control systems, Feedback characteristics, and Transfer function of linear systems. Differential equations of electrical networks, Translational and Rotational mechanical systems. Block diagram algebra and Problems, Signal flow graph – Reduction using Mason‟s gain formula

UNIT-IV TIME RESPONSE ANALYSIS

Introduction-Standard Test Signals-Time Response of First Order Systems-Time Response of Second Order Systems-Time Domain Specifications, Steady State Errors & Error Constants

The concept of stability – Routh‟s stability criterion –limitations of Routh‟s stability, Root locus concept – construction of root loci .Effect of addition of poles and zeros root locus

UNIT-V FREQUENCY RESPONSE ANALYSIS

Frequency domain specifications – Bode diagrams – transfer function from the Bode diagram – phase margin and gain margin – stability analysis from Bode plots. Polar plots. Compensation techniques – Lag, Lead, Lead-Lag Controllers.

TEXT BOOKS:

1. I. J. Nagrath& D. P. Kothari, "Electrical machines", Tata McGraw Hill.
2. P.S.Bimbhra, "Electrical Machinery", Khanna Publishers
3. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
4. Ghosh, "Control Systems: Theory and Applications", Pearson.

REFERENCE BOOKS:

1. B.C. Kuo, "Automatic Control systems", Wiley India Ltd.
2. D. Roy Choudhary, "Modern Control Engineering" Prentice Hall of India.
3. M. Gopal, "Control Systems: Principles and Design" Tata McGraw Hill

IV SEMESTER	L	T	P	C
	3	-	-	3
20EC4T01 : ELECTRONICS CIRCUITS-II				

COURSE OUTCOMES

After completion of the course, students are able to

CO1:Describe the frequency response of single-stage amplifiers and multistage amplifiers using BJTs and FETs in different configurations.(K1)
CO2:Construct Hybrid- π Common Emitter transistor model.(K3)
CO3:Compare and analyze the different types of feedback amplifiers and oscillator circuits.(K4)
CO4:Explain the efficiency of different types of power amplifiers. (K2)

UNIT –I

SMALL SIGNAL LOW-FREQUENCY AMPLIFIER MODELS:

BJT: h-Parameters, Hybrid model for transistor (CE, CB& CC configuration), Classification of voltage amplifiers, Derivations for voltage gain, current gain, input resistance & Output resistance of CE, CB& CC amplifiers.

FET: Small signal model, Study of CG,CS, and CD amplifiers, Low-frequency response of FET amplifier circuits.Comparison of FET amplifiers.

UNIT –II

HIGH-FREQUENCY AMPLIFIER MODELS:

BJT:Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid π conductances, Hybrid π capacitances, validity of hybrid πmodel, determination of high-frequency parameters in terms of low- frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response.

FET: Analysis of common Source and common drain

UNIT –III

MULTISTAGE AMPLIFIERS :

Classification of amplifiers, cascaded transistor amplifier, two stage Direct, RC and Transformer coupled amplifiers (Quantitative Theory),Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower.

UNIT –IV

FEEDBACK AMPLIFIERS AND OSCILLATORS:

Concepts of feedback–Classification of feedback amplifiers – Generalcharacteristics of negative feedback amplifiers –EffectofFeedbackon amplifier characteristics –Voltage series, Voltage shunt, Current series, and Current shunt Feedback configurations –problems.Condition for oscillations.RCand LC type Oscillators – Frequency and amplitude stability of oscillators – Generalized analysis of LC oscillators, Quartz, Hartley, and Colpitts Oscillators – RC-phase shift and Wien-bridge oscillators.

UNIT –V

POWER AMPLIFIERS:

Classification of power amplifier, Class-A Power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer Coupled Amplifier, Push Pull and Complimentary Symmetry Class B and Class

AB Power Amplifiers - Principle of operation of class-C Amplifier, Transistor Power Dissipation, Thermal runaway, Thermal stability, and Heat Sinks.

TEXTBOOKS:

1. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 11th Edition, Pearson Education, 2013.(UNIT-I,II,III,IV,V)
2. Jacob Millman, Christos C.Halkias, Satyabrata Jit, "Electronic devices & circuits", 4th Edition, McGraw Hill Publication, 2015.(UNIT-I,II,III,IV,V)

REFERENCES BOOKS:

1. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012
2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", 2nd Edition, Tata McGraw Hill, 2017.
3. David A. Bell –„Electronic devices & circuits"- Vth Edition- Prentice Hall India, 2008.

E-REFERENCES:

1. NPTEL – Electronic Circuits
https://nptel.ac.in/courses/108/102/108102095/

2. https://www.tutorialspoint.com/amplifiers/amplifiers_feedback.htm

IV SEMESTER	L	T	P	C
	3	-	-	3
20EC4T02: DIGITAL COMMUNICATION				

COURSE OUTCOMES:

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

CO1: Understand the concept of various waveform coding techniques.

CO2: Describe various digital modulation techniques and different information theory concepts.

CO3: Apply the different source coding techniques in the data compression during transmission.

CO4: Explain the channel coding techniques for error detection and correction in digital communication.

UNIT– I

WAVEFORM CODING TECHNIQUES: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization and Coding, Quantization error, Differential PCM systems (DPCM), Delta modulation, its drawbacks, Adaptive Delta modulation, comparison of PCM and DM Systems.

UNIT– II

DIGITAL MODULATION TECHNIQUES: Introduction, Generation, Detection, Signal space representation and Bandwidth of ASK, FSK, PSK, DPSK, QPSK, M-ary PSK, FSK, QAM, Similarity of BFSK and BPSK, Comparison of all digital modulation techniques.

UNIT– III

INFORMATION THEORY AND SOURCE CODING:

Information theory: Concept of amount of information and its properties. Average information (Entropy) and its properties.Information rate, Mutual information, and its properties.Source coding: Introduction, Shannon‟s theorems, Shannon-Fano coding: Efficiency, Redundancy, and Variance calculations. Huffman coding: Efficiency, Redundancy, and Variance calculations.

UNIT– IV

LINEAR BLOCK CODES AND BINARY CYCLIC CODES: Matrix description of Linear Block codes, Representation of „G‟ Matrix and „H‟ Matrix, Encoding, Error detection and correction capabilities of Linear block codes, Single error correcting Hamming codes, Syndrome calculation, Decoding. Binary cyclic codes: Algebraic structure of cyclic codes, Encoding, Syndrome calculation, Error detection and error correction, and Decoding.

UNIT– V

CONVOLUTIONAL CODES: Encoding of Convolutional codes, Time domain approach, Transform domain approach. Graphical approach: Code tree, Trellis and State diagram, Viterbi decoding.

TEXT BOOKS:

1. Digital communications, Simon Haykin, John Wiley, 2005, 1st Edition**.** (Unit1,2,3)
2. Digital communication, R.S. Chittode, Technical Publications, Second Revised Edition 2009. (Unit1,2,3,4,5)

REFERENCES:

1. Digital and Analog Communication Systems, K.SamShanmugam John Wiley, 2005, 1st Edition.
2. Principles of Communication Systems, H. Taub and D. Schilling, TMH, 2003, 3rd Edition.

e-RESOURCES:

1. www.pdfdrive.com
2. www.booksboon.com
3. www.manybooks.com

IV SEMESTER	L	T	P	C
	3	-	-	3
20EC4T03: ELECTROMAGNETIC WAVES AND TRANSMISSION LINES				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1. Explain the basics of electrostatic & electromagnetic.(K2,K3)
CO2. Illustrate Maxwell equations and different postulates of EM fields, depending on the media. (K3)
CO3. Describe the behavior of EM waves propagation in conducting and dielectric media.(K1)
CO4. Analyze the propagation problems of EM waves through transmission lines and its design. (K4)

UNIT –I

ELECTROSTATICS AND MAGNETOSTATICS:

ELECTROSTATICS: Coulomb‟s Law, Electric Field Intensity, Fields due to Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Energy density, Dielectric Constant, Poisson‟s and Laplace‟s Equations. **Magneto Statics**: Biot-Savart Law, Ampere‟s Circuital Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials.

UNIT-II

MAXWELL'S EQUATIONS (STATIC & DYNAMIC FIELDS): Faraday‟s Law, continuity equation for time-varying fields, conduction and displacement current densities, Inconsistency of Ampere‟s Law, Maxwell‟s Equations in Different Final Forms, and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Dispersive Medium, Phase Velocity, Group Velocity,Beat phenomenon

UNIT –III

EM WAVE CHARACTERISTICS - I: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Relations between E & H. Wave Propagation in Lossless and Conducting Media. Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Depth of penetration, Polarization, Related Problems.

UNIT- IV

EM WAVE CHARACTERISTICS – II: Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle, Total Internal Reflection, Poynting Vector and Poynting Theorem, Uncertainty principle

UNIT- V

TRANSMISSION LINES :

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants (Expressions for Characteristic Impedance, Propagation Constant), Infinite Line Concepts, Lossless Characterization, Distortion – Condition for Distortion less and Minimum Attenuation, Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. λ/4, λ/2, λ/8 Lines, Impedance Transformations. Single and Double Stub Matching, Smith chart, Configuration, and Applications.

TEXT BOOKS:

1.N.O.Sadiku,, S.V Kulakarni, Principles of Electromagnetics -Matthew Oxford Univ.Press, 6th ed, 2017. **(UNIT I,II,III,IV,V)**

2. E.C.Jorden and K.G.Balmain, Electromagnetic Waves and Radiating Systems - PHI 2nd Edition, 2000. **(UNIT III,IV)**

REFERENCE BOOKS:

1. Y. MallikarjunaReddy , Electromagnetic Waves and Transmission Lines –University press (India) Pvt.,Ltd.,2015.

2.John .D. Ryder Networks, Lines and Fields II Edition

3. G. S. N. Raju, Electromagnetic Field Theory and Transmission Lines- Pearson Ed. P te. Ltd., 2005.

E REFERENCES

1. https://nptel.ac.in/courses/117/103/117103065/
2. https://www.smartzworld.com/notes/electromagnetic-theory-and-transmission-lines-pdf-notes-emtl-notes-pdf/

IV SEMESTER	L	T	P	C
	3	-	-	3
20BM4T01: MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

UNIT–I Managerial Economics and Demand Analysis: Definition – Nature and Scope of Managerial Economics - Relation with other disciplines - Concept of Demand-Types-Determinants - Law of Demand - Elasticity of Demand - Types and Measurement-Demand forecasting.

UNIT–II Production and Cost Analysis: Production function - Law of Variable proportions - Isoquants and Iso costs -Law of returns- Economies of Scale - Cost Concepts - Cost Volume Profit Analysis – Applications of BEP (Simple Problems).

UNIT-III Market Structures and Pricing Policies: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price & Output Determination - Pricing Methods

UNIT-IV Forms of Organizations and Business Cycles: Business Organization- Sole Trader – Partnership - Joint Stock Company - State/Public Enterprises and their forms - Business Cycles: Meaning and Features - Phases of Business Cycle.

UNIT–V Capital Budgeting and Accounting: Concept and sources-Techniques of evaluating capital budgeting(Simple problems)
Introduction to Accounting: Branches-Systems of Accounting-Single Entry-Double Entry System-Journal-Ledger-Trail Balance-Final Accounts-Ratio Analysis(Simple problems)

TEXTBOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. T.V.Ramana& B. Kuberudu: Managerial Economics and Financial Analysis, Himalaya Publishing House,Mumbai
3. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2003.

REFERENCE BOOKS:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey&Chrystel, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics in a Global Economy, 4th Edition, Thomson. 7. Narayanaswamy: Financial Accounting A Managerial Perspective, PHI.
8. Raghunatha Reddy &Narasimhachary: Managerial Economics& Financial Analysis, Scitech.
9. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas.

IV SEMESTER	L	T	P	C
	-	-	3	1.5
20EE4L03 : ELECTRICAL MACHINES AND CONTROL SYSTEMS LAB				

LIST OF EXPERIMENTS

Part –A

(Any Five Experiments has to be conducted)

1. Brake test on three phase squirrel cage induction Motor
2. Regulation of a three –phase alternator by EMF &MMF.Methods
3. Brake Test on D.C. Shunt Motor
4. Load Test on DC Generators.
5. Open Circuit Characteristics of DC Generator (Self and Separately Excited)
6. Speed control of D.C. motors using armature control and field control methods
7. Swinburne‟s test
8. Open circuit & Short circuit test on single-phase transformer

Part –B

(Any Five Experiments has to be conducted)

1. Time response of Second order system
2. Transfer function of DC motor
3.Transfer function of DC generator
4. Temperature controller using PID
5. DC position control system
6. Lead-lag Compensation
7. Linear system Analysis (Using Matlab Software)
8. Bode Plot, Root locus, Nyquist Plots for the transfer functions of systems (Using Matlab Software)

IV SEMESTER	L	T	P	C
	-	-	3	1.5
20EC4L01 : ELECTRONICS CIRCUITS-II LAB				

COURSE OUTCOMES

After completion of the course, students are able to

CO1:Design the single-stage and multistage amplifier using BJTs and FETs.

CO2:Differentiate different types of feedback amplifiers, calculate the input resistance and output resistance of feedback amplifiers.

CO3:Generate the waveforms of oscillators with different frequencies. Obtain the efficiency of the single-stage power amplifiers.

CO4:Construct and analyze the characteristics of the Series Voltage Regulator and Shunt Voltage Regulator.

PART A

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Single Stage CE Amplifier
2. Single Stage CC Amplifier
3. Two-Stage RC Coupled Amplifier
4. Current- Series Feedback amplifier
5. Voltage Shunt Feedback amplifier
6. RC Phase ShiftOscillator
7. Wien Bridge Oscillator
8. HartleyOscillator
9. Colpitt‟s Oscillator
10. Class A Series-fed Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Shunt Voltage Regulator
13. Series Voltage Regulator
14. Common Source FET amplifier.
15. h - parameter of CE configuration

List of Experiments: (Content Beyond the syllabus)

1. Linear Voltage Regulators(7805/7905)
2. Design of PCB for Fixed Voltage Regulator Circuits.

Note: The students are required to design the electronic circuit and they have to perform the simulationusing Multisim/Pspice/Equivalent Licensed simulation software tool. Further, they are required to verify the result of the necessary experiments using the required components in the hardware laboratory.

PART B: Equipment/Software required for Laboratory

Software:

1. Multisim/ Pspice/Equivalent Licensed simulation software tool.
2. Computer Systems with required specifications.

Hardware:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes/CROs
3. Analog/Digital Function Generators

4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters and Voltmeters (Analog or Digital)
8. Active & Passive Electronic Components

IV SEMESTER	L	T	P	C
	-	-	3	1.5
20EC4L02: DIGITAL COMMUNICATION LAB				

COURSE OUTCOMES:

At the end of this course, students will be able to
CO1: Understood the concepts of various waveform coding techniques.
CO2: Describe various digital modulation techniques and different information theory concepts.
CO3: Analyze the different source coding techniques in data compression during transmission.
CO4: Apply the channel coding techniques for error detection and correction in digital communication.

LIST OF EXPERIMENTS

Any TEN Experiments to be done: (a. Hardware, b. MATLAB Simulink)

1. Pulse Code Modulation and to compare practical and theoretical values.
2. Differential Pulse Code Modulation & demodulation.
3. Delta Modulation and Demodulation.
4. ASK Modulation and Demodulation.
5. FSK Modulation and Demodulation.
6. Phase shift keying Modulation and Demodulation.
7. Differential Phase shift keying Modulator and Demodulator.
8. Source coding: Encoding and Decoding.
9. Study of Linear block codes: Encoding and Decoding.
10. Study of Convolution codes: Encoding and Decoding.

EQUIPMENT REQUIRED FOR LABORATORIES:

1. RPS - 0 to 30 V
2. CRO - 0 to 20 MHz
3. Function Generators - 0 to 1 MHz
4. Lab Experimental kits for Digital Communication.

SOFTWARE REQUIRED:

1. Computer systems with the latest specifications
2. Connected in LAN (optional)
3. Operating system (windows XP)
4. Simulations software (MATLAB-Simulink)

IV SEMESTER	L	T	P	C
	1	-	2	2
20EC4S01: SIMULATION BASED CIRCUIT DESIGN				

COURSE OUTCOMES

After completion of the course, students are able to

CO1:Design the single-stage amplifier using FETs.

CO2: Analyze different types of encoders and decoders,

CO3: Generate the waveforms of different frequencies using Flip-Flops

CO4: Construct and analyze the characteristics of analog-to-digital converter and digital-to-analog converters

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Common Source Amplifier
2. Cascode Amplifier
3. Class A-B Power Amplifier
4. Current Series Voltage Regulator
5. Current Shunt Voltage Regulator
6. Multiplexer (8:1)
7. Multiplexer (32:1)
8. 2 To 4 Decoder and 3 To 8 Decoder
9. 8-3 Encoder and Priority Encoder
10. Decade Counter
11. 4-Bit Counter (7493)
12. Universal Shift Register (74194)
13. 74ls155 De-Multiplexer (4:1)
14. D-Flip Flop
15. 8-Bit Synchronous Counter
16. Analog To Digital Converter
17. Digital To Analog Converter

SOFTWARE REQUIRED:

1. Simulations software (MICROWIND, P SPICE)
2. Computer systems with latest specifications with LAN (optional)

IVSEMESTER	L	T	P	C
	2	-	-	-
20BM4M01 – INDIAN CONSTITUTION				

UNIT I: Introduction to Indian Constitution-Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II: Union Government and Administration Structure of the Indian Union: Federalism, Centre State relationship, President: Role, powers and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

UNIT III: State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT IV:.Local Administration - District‟s Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions of Pachayat Raj Institution: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

UNIT V:Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate -State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.

TEXTBOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics

REFERENCE BOOKS:

1. D.C. Gupta, Indian Government and Politics
2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, Indian Government andPolitics Hans
4. J. Raj IndianGovernment and Politics
5. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
6. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

e-Resources:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

SEMESTER-V	L	T	P	C
	3	-	-	3
20EC5T01: LINEAR AND DIGITAL IC APPLICATIONS				

COURSE OUTCOMES:
After completion of this course, the students are able to
CO1: Demonstrate the performance parameters and characteristics of operational amplifiers. (K3)
CO2: Summarize the function of Opamp-based active filters, timers and converters. (K2)
CO3: Construct and implement the Combinational circuits using digital ICs.(K3)
CO4: Construct and implement the Sequential circuits using digital ICs.(K3)

UNIT I: INTEGRATED CIRCUITS:
Integrated circuits-Types, Classification, Package Types and temperature ranges, Differential Amplifier-DC and AC analysis of Dual input balanced output Configuration, DC and AC analysis of Dual input unbalanced output Configuration, Cascade Differential Amplifier Stages, Level translator. Characteristics of OP-Amps, Op-amp Block Diagram, ideal and practical Op-amp specifications. Op-Amp parameters,(DC and AC characteristics) 741 op-amp & its features, slew rate, CMRR, PSRR

UNIT II: LINEAR and NON-LINEAR APPLICATIONS OF OP-AMPS:
Linear Applications of Op-Amp: Inverting and Non-inverting amplifier, Integrator, and differentiator, Summing and Difference amplifier, Non-Linear Applications of Op-Amp: Comparators, Triangular and Square wave generators. Sine wave generation: principle, Wein-bridge, phase-shift oscillators.

UNIT-III: ACTIVE FILTERS, TIMERS and CONVERTERS:
Introduction, classification, Butter worth filters – 1st order, LPF, HPF, Band pass, Band reject and all-pass filters, Timers**:** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. Digital to analog and analog to digital converters: Introduction, weighted resistor DAC, R-2R ladder DAC, Different types of ADCs – parallel Comparator type ADC, successive approximation ADC

UNIT-IV:COMBINATIONAL LOGIC DESIGN:
Introduction, Design and Analysis procedures, Decoders, encoders, multiplexers and demultiplexer, comparators, Ripple Adder, Binary Parallel Adder, Look ahead carry generator, Combinational multipliers, Design considerations of the above combinational logic circuits with relevant Digital ICs.

UNIT-V:SEQUENTIAL LOGIC DESIGN:
SSI latches and flip-flops, Design of Counters using Digital ICs, Counter applications, Synchronous design methodology, Universal Shift Register, Ring Counter, Johnson Counter, Design considerations of the above sequential logic circuits with relevant Digital ICs.

TEXTBOOKS:

1. D. Roy Chowdary, "Linear Integrated Circuits", 2nd Edition, New Age International (p) Ltd,2018.(**Unit-I, II, III)**
2. John F. Wakerly, "Digital Design Principles & Practices", 5th Edition, PHI/ Pearson Education Asia, 2018 (**Unit-IV, V)**

REFERENCES:

1. Sergio Franco, "Design with Operational Amplifiers & Analog Integrated Circuits", McGraw Hill, 2016.
2. Floyd and Jain, "Digital fundamentals",8th Edition, Pearson education, 2015.

E-REFERENCES:

1. https://lecturenotes.in/subject/449/linear-and-digital-ic-application-ica
2. https://nptel.ac.in/courses/108/108/108108111/

SEMESTER-V	L	T	P	C
	3	-	-	3
20EC5T02: DIGITAL SIGNAL PROCESSING				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1:Illustrate digital signals, systems and their significance. (K1)

CO2: Develop the digital signals using various digital transforms DFT, FFT etc. (K3)

CO3: Understand the FIR and IIR structures from the designed digital filter. (K2)

CO4: Use the Multirate Processing concepts in various applications. (K3)

UNIT-I: INTRODUCTION: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations.Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.

UNIT-II: DISCRETE FOURIER SERIES & FOURIER TRANSFORMS: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT-III: DESIGN OF IIR DIGITAL FILTERS& REALIZATIONS: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

UNIT- IV: DESIGN OF FIR DIGITAL FILTERS & REALIZATIONS: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters.Basic structures of FIR systems, Lattice structures, Lattice-ladder structures.

UNIT-V: MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction, Decimation, Interpolation Sampling rate conversion , Implementation of sampling rate converters, Applications – Sub-band Coding of Speech Signals, Implementation of Digital Filter Banks, Trans-multiplexers.

TEXT BOOKS:

1. John G. Proakis, Dimitris G.Manolakis, “Digital Signal Processing, Principles, Algorithms, and Applications”, Pearson Education / PHI, 2017. (Unit I-V)
2. MH Hayes, Digital Signal Processing – Schaum‟s Outlines, TATA McGraw Hill, 2016 (I-V)

REFERENCES

1. A.V.Oppenheim and R.W. Schaffer , “Discrete Time Signal Processing”,1st edition, PHI, 2015.
2. B.Venkataramani, M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications”,TATA McGraw Hill, 2015.

E-REFERENCES:

1. https://nptel.ac.in/courses/117102060
2. www.ocw.mit.edu

SEMESTER-V	L	T	P	C
	3	-	-	3
20EC5T03: ANTENNAS AND WAVE PROPAGATION				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Describe different types of antenna parameters. (K1)

CO2. Calculate the fields radiated by various types of antennas. (K3)

CO3. Explain various categories of antennas and antenna arrays. (K2)

CO4. Illustrate and identify the characteristics of radio wave propagation. (K3)

UNIT-I: ANTENNA FUNDAMENTALS:

Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height.

UNIT-II: THIN LINEAR WIRE ANTENNAS:

Retarded Potentials, Radiation from Small Electric Dipole and Half wave Dipole, Evaluation of Field Components, Power Radiated, Radiation Resistance, Beam widths, Directivity, Effective Area and Effective Height. Antenna Theorems – Reciprocity and Maximum power transfer theorems, Loop Antennas: Small Loops - Directivity and radiation resistance for small loops.

UNIT-III: ANTENNA ARRAYS:

Two element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison; Concept of Scanning Arrays. Binomial Arrays.Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics.

UNIT-IV: NON-RESONANT AND MICROWAVE RADIATORS:

Introduction, Travelling wave radiators – basic concepts, Long wire antennas– field strength calculations and patterns, Microstrip antenna (Rectangular patch antenna): introduction, Geometry, features, advantages, limitations and different feed systems of microstrip antenna. Helical Antenna –Geometry, basic properties and operational modes (axial & normal modes). Reflector Antennas: Flat Sheet, Corner Reflectors and Paraboloidal Reflectors.

UNIT-V: WAVE PROPAGATION:

Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation– Characteristics, wave tilt.Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance – Calculations for flat and spherical earth cases. Space Wave Propagation – Mechanism, LOS and Radio Horizon, Field Strength, Fundamental Equation for Free-Space Propagation, Duct Propagation.

TEXT BOOKS:

1. Constantine A. Balanis "Antenna Theory and Applications",Wiley 4th edition, 2021.(UNIT-1 to 5)
2. G.S.N.Raju, "Antennas and wave propagation ", 5th edition, Pearson Education, South Asia 2012. (UNIT-1, 2, 3, 4 & 5)

REFERENCES

1. John D.Kraus and Ronald J.Marhefka Ahmad S Khan, "Antennas and wave propagation", 5th edition, McGraw Hill Education private limited, 2018. (UNIT-1,2 & 3)
2. K.D.Prasad, Satya Prakashan, " Antennas and wave propagation", 2019-20 edition ,Satya Prakashan Publications, New Delhi,2020 (UNIT-1,2,3,4 & 5)

E-REFERENCES

1. https://nptel.ac.in/courses/108101092
2. https://www.tutorialspoint.com/antenna_theory/antenna_theory_types_of_propagation.htm

SEMESTER-V PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20EC5E01: MEDICAL ELECTRONICS				

COURSE OUTCOMES:

After completion of the course, students are able to,
CO1: Describe various biosignals and vital parameters.(K1)
CO2: Explain about various Assist Devices.(K2)
CO3: Explain the function and application of various diagnostic and therapeutic equipment.(K2)
CO4: Explain the recent developments in the field of biomedical engineering (K3)

UNIT-I: ELECTRO-PHYSIOLOGY AND BIOPOTENTIAL RECORDING
The origin of Bio-potentials, biopotential electrodes, bio-amplifiers, ECG, EEG, EMG,PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT-II: BIO-CHEMICAL AND NON-ELECTRICAL PARAMETER MEASUREMENT
pH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse rate, Blood cell counters.

UNIT-III: ASSIST DEVICES
Cardiac pacemakers – Need, different types, DC defibrillators - asynchronous and synchronous, Hemodialyser- Membrane, Dialysate.Heart-lung machine - Block diagram, oxygenators, and pumps.

UNIT-IV: PHYSICAL MEDICINE AND BIOTELEMETRY
Diathermies- Shortwave, ultrasonic and microwave type, and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, and electrical safety.

UNIT-V: RECENT TRENDS IN MEDICAL INSTRUMENTATION
Thermography- principle, detectors, Endoscopy unit, Applications of Laser in medicine, cryogenic application, Introduction to telemedicine. Wearable devices- smart watches, activity trackers, heart rate, BP, Glucose, weight monitor. Artificial Intelligence (AI), IOT in Medical Electronics.

TEXT BOOKS:
1. Leslie Cromwell, Fred J. Weibell, "Erich A. Pfeiffer, Biomedical Instrumentation and Measurements", Pearson Education India, 2nd Edition, 2015.
2. John G.Webster, "Medical Instrumentation Application and Design", John Wiley and Sons, New York, 4th Edition, 2019.

REFERENCES
1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 3rd Edition, 2018.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 5th Edition, 2019.

E-REFERENCES
1. https://nptel.ac.in/courses/108108180
2. https://www.robots.ox.ac.uk/~neil/teaching/lectures/med_elec/downloads.html.

SEMESTER-V PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20EC5E02: DIGITAL SYSTEM DESIGN				

COURSE OUTCOMES:
After completion of the course, students are able to,

CO1: Develop the Combinational and Sequential logic circuit. (K3)
CO2: Describe the FSM and synchronous state machines.(K1)
CO3: Classify various logic families. (K2)
CO4: Construct the HDL Design flow.(K3)

UNIT 1: COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN
Combinational circuits:
Half adder full adder, BCD adder, code converters, magnitude comparator, multiplexers, and decoders.
Sequential circuits:
Flip Flops-SR, JK, T, D and master-slave FF, ripple and synchronous counters, shift registers.

UNIT 2: FINITE STATE MACHINES
Sequential circuit and examples - Finite State Model(FSM) and definitions, Capabilities and Limitations of Finite State machines – State Equivalence and Machine Minimization – input-output transformations– Mealy and Moore model – Conversion from Mealy to Moore model and vice-versa.

UNIT 3: SYNCHRONOUS STATE MACHINE DESIGN
Concept of synchronous state machine-Mathematical Representation of Synchronous sequential Machine - Synthesis of Synchronous Sequential Circuit – sequence detector - state changes referred to the number of state flip-flops, redundant states, General state machine architecture.

UNIT 4: LOGIC FAMILIES
Specifications, noise margin, propagation delay, fan-in, fan-out, Transistor-Transistor Logic (TTL), Emitter-Coupled Logic (ECL), CMOS Logic, TTL and CMOS Gates.

UNIT 5: VLSI DESIGN FLOW
Schematic, HDL, different modelling styles in Verilog: Behavioral and Structural Modeling, Data types and objects, Synthesis and Simulation Verilog constructs and codes for combinational and sequential circuits.

TEXT BOOKS:
1. R. P. Jain, “Modern Digital Electronics”, 4th Edition, Tata McGraw-Hill, 2017.(UNIT I-IV)
2. J Bhaskar, “A Verilog HDL Primer ”, 3rd edition, Kluwer, 2015.(Unit V)

REFERENCES:
1. A Anand Kumar, “Switching Theory and Logic Design” 3rd edition, PHI, 2016.
2. Zvi Kohavi & Niraj K. Jha, “Switching and Finite Automata Theory”, 3rd Edition, Cambridge, 2015.

E-REFERENCES:
1. NPTEL, “Digital system design “- https://nptel.ac.in/courses/108106177
2. Tutorialspoint, “Digital Electronicsand Logic Design “- https://tutorialspoint.dev/computer-science/digital-electronics-and-logic-design

SEMESTER-V PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20EC5E03: SIGNAL TRANSFORM TECHNIQUES				

COURSE OUTCOMES:

Upon completing this course, the students will be able to

CO1: Explain the basics of various two-dimensional transforms and their applications (K3)
CO2: Understand the concepts of CWT (K2)
CO3: Explain the multi-rate analysis and DWT (K2)
CO4: Observe the fundamentals of special transforms (K1)

UNIT I: TRANSFORMS:

Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT,– definition, properties, and applications

UNIT II: FOURIER ANALYSIS:

Vector space, Hilbert spaces, Fourier basis, FT- Limitations of Fourier Analysis, Need for time-frequency analysis, DFT, 2D-DFT: Definition, Properties, and Applications, IDFT, Hilbert Transform, STFT.

UNIT-III: CONTINUOUS WAVELET TRANSFORM (CWT):

Shortcomings of STFT, Need for wavelets, Wavelet Basis- Concept of Scale and its relation with frequency, Continuous-time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT, Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

UNIT-IV: MULTI-RATE ANALYSIS AND DWT:

Need for Scaling function – Multi-Resolution Analysis, Two Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT-V: SPECIAL TOPICS:

Wavelet Packet Transform, Multidimensional Wavelets, Bi-orthogonal basis- BSplines, Lifting Scheme of Wavelet Generation, Multi Wavelets

TEXT BOOKS:

1. Raghuveer M.Rao and Ajit S.Bopardikar, “Wavelet Transforms-Introduction theory and applications”, First Edition, Pearson Edu, Asia, New Delhi, 2016.

2. Soman. K. P, Ramachandran and K.I, Printice “Insight into Wavelets from Theory to practice", First Edition, PHI, 2018.

REFERENCES:

1. M.Jayaraman, S.Esakkirajan, T.Veera Kumar, “Digital Image Processing”, TMH, 2016.

2. Stephen G. Mallat “A Wavelet Tour of Signal Processing”, Second Edition, Academic Press,2015.

E-REFERENCES:

1. https://nptel.ac.in/courses/111106111
2. https://www.nti-audio.com/en/support/know-how/fast-fourier-transform-fft

SEMESTER-V PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20EC5E04: RADAR AND SATELLITE COMMUNICATION SYSTEM				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Explain the basic concepts of the radar system.(K2)

CO2: Describe the operation and applicability of CW, MTI Radar, and detection of Radar signals in noise.(K1)

CO3: Demonstrate the concept of satellite communications and orbital mechanics. (K3)

CO4: Explain the multiple access techniques used in Satellite Communication (K2)

UNIT-I:BASICS OF RADAR SYSTEM:

Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Related Problems. Radar Equation: Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Probability Density Function and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere). Transmitter power, PRF and Range Ambiguities, System Losses (Qualitative treatment), Antenna Parameters, Related Problems.

UNIT-II:RADAR TECHNOLOGY:

Doppler Effect, CW Radar, Non-zero IF Receiver, Receiver Bandwidth Requirement, Applications of CW Radar. FMCW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), MTIR Radar with Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers - Filter Characteristics, Blind Speeds, Double Cancellation staggered PRFs, MTI Radar Parameters, Limitations to MTI Performance, Two frequency MTI, Area MTI.

UNIT-III:DETECTION OF RADAR SIGNALS IN NOISE:

Introduction, Matched Filter Receiver -response Characteristics and Derivation, Correlation detection, Detection criteria, Detector characteristics, Automatic Detection, Constant False Alarm Rate Receiver, Performance of the Radar Operator.

UNIT-IV:INTRODUCTION TO SATELLITE:

Origin of Satellite Communications, Historical Background, Introduction to Polar, geo-synchronous and geostationary satellites, Kepler‟s Laws, Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches, and launch vehicles – SSLV, PSLV, GSLV & GSLV MK-III Services, Orbital effects in communication systems performance, Indian scenario in Communication Satellite.

UNIT-V:MULTIPLE ACCESSING TECHNIQUES:

Frequency allocations for Satellite Services, Applications,Multiple Accessing Techniques: FDMA, TDMA, CDMA, and SDMA, Future Trends of Satellite Communications.

TEXT BOOKS:

1. Skolnik, „Introduction to Radar Systems“,3rdEdition, TMH, 2016**.**

2. K.N. Raja Rao, “Fundamentals of Satellite Communications”, PHI, 2014.

REFERENCES:

1. Byron Edde, “Radar: Principles, Technologies, Applications”, Pearson Education, 2014.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud,“Satellite Communications Engineering”, 2nd Edition, Pearson Publications,2013.

E-REFERENCES:

1. Radar System, “https://nptel.ac.in/courses/108105154”
2. Satellite Communications, “https://nptel.ac.in/courses/117105131”

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20EE5O01 - NON-CONVENTIONAL ENERGY SOURCES				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Analyze solar radiation data and solar thermal systems (k4)
CO2 : Identify the methods and analysis of wind energy generation systems (k3)
CO3 : Explain the biomass and geothermal energy, its mechanism of production and its applications (k2)
CO4 : Explain the basic principle and working of hydro, tidal energy systems. (k2)
CO5 : Explain the basics of Chemical Energy Sources(k2)

SYLLABUS

UNIT-I : Solar Energy:
Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

UNIT-II : Wind Energy:
Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT-III : Biomass and Geothermal Energy:
Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant
Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems

UNIT-IV : Energy From hydro, oceans, Waves & Tides:
Hydro: Basic working principle – classification of hydro – types of turbines
Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.
Waves: Introduction - Energy and Power from the waves - Wave Energy conversion devices.
Tides: Basic principle of Tide Energy -Components of Tidal Energy.

UNIT-V : Chemical Energy Sources:
Fuel Cells: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.
Hydrogen Energy: Introduction - Methods of Hydrogen Production - Storage and Applications
Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types.

TEXT BOOKS:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

REFERENCE BOOKS:

1. S.P.Sukhatme&J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.
3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20ME5O01 - WASTE TO ENERGY CONVERSION				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1. Describe the concept of waste to energy, classifications, and principles. [K2]
CO2. Explain management principles for the production of energy from waste. [K2]
CO3. Explain the best available technologies for waste to energy. [K2]
CO4. Describe the waste-to-energy options landfill gas, and energy from plastics.[K2]
CO5. Apply the knowledge in planning and operations of waste to energy plants [K3]

UNIT-I INTRODUCTION

Waste - types of waste, Principles of waste management, Waste utilization, Waste management hierarchy, 3R Principle of Reduce, Reuse, and Recycle, Waste as a resource, alternate energy source.

UNIT-II WASTE SOURCES & CHARACTERIZATION

Source of waste, Waste production in different sectors such as domestic, industrial, agriculture, and post-consumer waste, etc, Waste management tools and techniques for reducing waste segregation and scientific disposal, Characterization of waste for energy utilization, and Waste selection criteria.

UNIT-III TECHNOLOGIES FOR WASTE TO ENERGY

Energy biochemical conversion – energy production from organic waste through anaerobic digestion, fermentation, Thermo-chemical conversion – combustion, incineration, heat recovery, pyrolysis, gasification, plasma arc technology, other newer technologies, Case studies.

UNIT-IV WASTE TO ENERGY OPTIONS

Waste to energy options - landfill gas, methane emission, collection, and recovery, Refuse Derived Fuel (RDF), Fluff, Briquettes, Pellets, Alternate Fuel Resource (AFR) – production and use in cement plants, Energy from plastic wastes, Non-recyclable plastic wastes for energy recovery, Energy recovery from wastes and optimization of its use, Energy analysis.

UNIT-V WASTE TO ENERGY PLANTS & ENVIRONMENTAL IMPLICATIONS

Wasteto Energy Plants: Waste management activities – collection, segregation, transportation and storage requirements, Location and Site of waste to energy plants.
EnvironmentalImplications: Environmental impact of waste to energy, Safety, and environmental standards, Savings on non-renewable fuel resources, Carbon credits, and its types.

TEXT BOOKS:

1. Marc Rogoff Francois Screve, Waste-to-Energy, 3rd Edition, William Andrew, 2019.
2. B.T. Nijaguna, Biogas Technology, 1st Edition, New Age International Pvt. Ltd, 2002.

REFERENCE BOOKS:

1. Vishal Prasad, BarkhaVaish, Advances in Waste-to-Energy Technologies, 1st Edition, CRC Press, 2019.
2. Dev Vrat Kamboj, Manoj Kumar Solanki, Waste to Energy: Prospects and Applications, 1st Edition, Springer, 2021.
3. P. Jayarama Reddy, Energy Recovery from Municipal Solid Waste by Thermal Conversion Technologies, 1st Edition, CRC Press/ Balkema, 2016.

WEB REFERENCE:

1. https://archive.nptel.ac.in/courses/103/107/103107125/

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20CS5O01 - INTERNET OF THINGS AND APPLICATIONS				

COURSE OUTCOMES:

At the end of the course, students are able to

1. Explain the Arduino IDE tool and Arduino Programming concept.
2. Illustrate concept hardware configuration with Firmata protocols.
3. Explain the knowledge of Arduino pin configuration.
4. Differentiate various sensors configuration and workflows.
5. Define the architecture of IoT.

UNIT-I (Introduction to Arduino)

Introduction to Arduino, history of Arduino, variants, Uno board block diagram, installation of Arduino, Arduino IDE, Arduino programming, functions, and statements.

UNIT-II (Configuration)

Connecting the Arduino board, introducing the Firmata Protocol, uploading a Firmata sketch to the Arduino board, and testing the Firmata protocol.

UNIT-III (Components)

List of components, software flow design, hardware flow design, hardware prototyping software, designing the hardware prototype, Arduino sketch default functions and custom function, setting Arduino board, pin configuration, working with pins.

UNIT-IV (Prototype)

Potentiometer-continuous observation from an analog input connection, Buzzer-generating sound alarm pattern, DC motor-controlling motor speed using PWM, LED- controlling LED brightness using PWM, Servomotor- moving the motor to a certain angle.

UNIT-V (Networking and cloud)

Arduino and computer networking, networking fundamentals, Obtaining the IP address, Networking extensions for Arduino with libraries and class, architecture of IoT web applications, IoT cloud platforms, develop cloud-based IoT applications.

TEXTBOOKS:

1. Python programming for Arduino by Pratik desai, Packt Publishing.
2. Internet of Things with Arduino Cookbook by Marco Schwartz.
3. Introduction to Arduino by Alan G. Smith.

REFERENCES:

1. Beginning Arduino by Michael McRoberts, 2e.
2. Getting Started with Arduino Massimo Banzi Second Edition.

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20CS5O02 - DATA ENGINEERING				

Course Outcomes:

Studentsare able to state and analyze:

1. Preprocessing techniques for various datasets,
2. Standard database systems concepts like tables, relations, query,NoSQL
3. Information retrieval techniques such as Relevance Ranking,Indexing etc
4. Data processing algorithms and data structures
5. Visualization techniques like Table, graph, histogram, pie-chart

UNIT- I:

Data Engineering:introduction, importance of data engineering, Data engineering vs data science
Data Collection: Various sources of data, types of data: text, video, audio, biology etc.
Data Preprocessing: data Cleaning: missing values, noise elimination, data integration, data transformation: Normalization, Data Reduction: data cube aggregation, dimensionality reduction.

UNIT-II

Data bases: Database Schema, ER diagram, introduction to SQL, functions and stored procedures, indexing: B+tree index files, data base system architecture: Client-Server Architecture, introduction to MongoDB,
NoSQL: The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL

UNIT-III

Information Retrieval: Relevance Ranking Using Terms,Relevance Using Hyperlinks,Synonyms, Homonyms, and Ontologies,Indexing of Documents,Measuring Retrieval Effectiveness,Crawling and Indexing the Web,Information Retrieval: Beyond Ranking of Pages, Directories and Categories

UNIT-IV

Data Analysis: correlation analysis: bivariate correlation, partial correlation, correlation coefficients.
Regression: simple linear regression, multiple linear regression, principal component analysis, analysis of variance

UNIT- V

Data Visualization: Table, graph, histogram, piechart, areaplot, boxplot, scatter-plot, bubble-plot, waffle charts, word clouds.

TEXT BOOKS:

1. Data mining concepts and techniques Jiawei Han and Micheline Kamber (UNIT-I)
2. Silberschatz, Korth, Sudarshan, "Database System Concepts" McGraw Hill Education, Sixth edition, 2010, ISBN-13: 978-9332901384 (UNIT-II, UNIT-III)
3. "NoSQL distilled" A Brief Guide to the Emerging World of Polyglot PersistencePramod J. Sadalage Martin Fowler, Addison Wesley (UNIT-II)
4. Correlation and regression analysis by Dr. Mohamed Ahmed Zaid (UNIT-IV)

REFERENCE BOOKS:

1. Brian Shive, "Data Engineering: A Novel Approach to Data Design", Technics Publications, 2013. ISBN-13: 978-1935504603.
2. Joel Grus, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O"Reilly, 2016. ISBN-13: 978-9352134915.

WEB LINKS:

https://chartio.com/learn/charts/essential-chart-types

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O01 - INNOVATIONS AND ENTREPRENEURSHIP				

UNIT-I INNOVATION MANAGEMENT: Concept–Objectives-types of Innovation process of Innovation- sources of Innovation-Levels of Innovation -barriers of Innovation-– Open and Closed Innovation-challenges faced while managing innovation.

UNIT-IICREATIVE INTELLIGENCE: Concept of Creativity-Importance Characteristics-Types of Creativity-Traits Congenial to Creativity-Triarchic theory of Intelligence – Creative thinking –Types-process of creative thinking-Sources and techniques for generating ideas.

UNIT-III ENTREPRENEURSHIP: Concept- characteristics-Importance classification-Theories of Entrepreneurship-entrepreneurship development-entrepreneurial process- challenges-Women Entrepreneurs.

UNIT-IVPROJECT FORMULATION AND APPRAISAL: Concept -Need Significance-steps - Economic Analysis; Financial Analysis; Market Analysis; Technical feasibility-project Appraisal-techniques of project appraisal.

UNIT-V INSTITUTIONS PROMOTING SMALL BUSINESS ENTERPRISES: Central level Institutions; SIDBI, NSIC, KVIC,SSIDC - State level Institutions- DICs – SFC SSIDC- other financial assistance, Government policy and taxation benefits- government policy for SSIs

TEXT BOOKS:

1. Vasanth Desai, ―Entrepreneurship, Himalaya Publishing House, New Delhi, 2012 2. Arya Kumar: ―Entrepreneurship, Pearson, Publishing House, New Delhi, 2012. 3. Keith Goffin and Rick Mitchell-Innovation Management,Springer,2016

REFERENCES BOOKS:

1. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004.
2. Vinnie Jauhari, SudanshuBhushan, Innovation Management, Oxford Higher Education, 2014

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O03 - DIGITAL MARKETING				

UNIT I- Introduction to Digital Marketing: Concept – scope- importance of digital marketing - Traditional marketing versus digital marketing – Types of digital marketing marketing mix and its implications for digital marketing--Challenges and opportunities for digital marketing

UNIT II- Content Marketing: Understanding Content Marketing, Content Creation Framework, Content marketing strategy and planning- Types of content marketing - Measuring and Analysing Your Content-Viral Marketing-Blog Marketing.

Unit III- Search Engine Optimization (SEO): What is SEO? SEO Importance and Its Growth in recent years, Ecosystem of a search engine, kinds of traffic, Keyword Research & Analysis (Free and Paid tool & Extension), Recent Google Updates

UNIT IV-Email and Mobile Marketing: Introduction, process, design, content,email marketing metrics. Mobile Marketing: Concept, Process-tools-opportunities and challenges.

UNIT V-Social Media Marketing: Concepts- Process - Tools- Google and the Search Engine, Facebook, Twitter, YouTube and LinkedIn- Issues: Credibility, Fake News, Paid Influencers; social media and Hate/ Phobic campaigns.

TEXT BOOKS:

1.Puneet Singh Bhatia, “Fundamentals of Digital Marketing”, Pearson Education Publications, 2nd edition 2019

2. Seema Gupta, “Digital Marketing”, McGraw Hill Publications”, 2nd edition 2020 3.Ryan Deiss, Russ Henneberry, “Digital Marketing For Dummies”, Wiley Publications, 2020

REFERENCES BOOKS:

1. Joe Pulizzi, “Epic Content Marketing”, McGraw Hill Education, 2019

2. Puneet Singh Bhatia, “Social Media & Mobile Marketing”, Wiley Publications, 2019

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O04 - BUSINESS ENVIRONMENT				

Unit-I Business Environment: Components and Significance – Economic Scope – Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

Unit-II: Structure of Indian Economy: Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy - Policy Resolutions of 1991- Economic Reforms-PPP

Unit-III Indian Business Environment: Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trend in Indian Business Environment

Unit-IV: International Trade: Balance of Payments – Concepts, Disequilibrium in BOP: Methods of Correction - Trade Barriers and Trade Strategy - Free Trade vs. Protection - World Financial Environment: Foreign Exchange Market Mechanism, Exchange Rate Determination, and Euro Currency.

Unit-V: Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trading Blocks – WTO Origin, Objectives, Organisation, Structure and Functioning – WTO and India.

TEXT BOOKS:

1. Chidambaram, Indian Business Environment, Vikas, New Delhi
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.

REFERENCES BOOKS:

1. Pandey G.N., Environmental Management, Vikas Publishing House.
2. Sundaram& Black, International Business Environment – The Text and Cases, Prentice Hall of India.
3. Ghosh PK., Business Environment,Sultan Chand & Sons, New Delhi
4. Daniel John D and Redebough, Lee. H., International Business, AddisionWesley India
5. Saleem, Business Environment, Pearson, New Delhi.
6. Bhalla, V.K., & S. Sivaramu, International Business Environment and Business, Annual Publications

V SEMESTER (JOB ORIENTED ELECTIVE-I)	L	T	P	C
	3	-	-	3
20IT5J01 - LINUX ADMINISTRATION				

Course Outcomes:

At the end of the course, the students will be able to:
1. Use various Linux commands that are used to manipulate system operations at admin level.
2. Write Shell Programming using Linux commands.
3. Design and write application to manipulate internal kernel-level Linux File System.
4. Explain the user, group and storage management.
5. Configure SSH client and server.

UNIT – I

Introduction To Linux And Linux Utilities: A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, unlink, du, find, unmask, ulimit, ps, finger, tail, head, sort, nl, uniq, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio, apt.

UNIT – II

Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.

Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT - III

Grep: Operation, grep Family(grep, egrep, fgrep), Searching for File Content.

Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.

Unix File Structure: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers.

UNIT – IV

User and Group Management: User accounts, local groups and group memberships, Configure networking and hostname resolution statically or dynamically, start, stop, and check the status of network services and network related commands.

Storage Management: List, create, delete, and modify physical storage partitions and tools

UNIT – V

Configuring SSH: Enabling the SSH Server, Using the SSH Client, Configuring Key- Based SSH Authentication, Using Graphical Applications with SSH.

Practical Learning: Installation of Any open source Linux Distribution, AWS Instance Creation and Learn How to Access through SSH.

TEXT BOOKS:

1. W. Richard. Stevens, Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.
2. Behrouz A. Forouzan, Richard F. Gilberg, Unix and shell Programming Thomson

REFERENCES:

1. Robert Love, O‟Reilly, Linux System Programming, SPD.
2. W.R.Stevens, Advanced Programming in the UNIX environment, 2nd Edition, PearsonEducation.
3. W.R. Stevens, UNIX Network Programming, PHI.
4. Graham Glass, King Ables, UNIX for Programmers and Users, 3rd Edition, Pearson Education.

V SEMESTER (JOB ORIENTED ELECTIVE-I)	L	T	P	C
	3	-	-	3
20CS5J01 - FULL STACK WITH JAVA				

COURSE OUTCOMES:

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

Design simple web pages using markup languages like HTML and CSS.

Create dynamic web pages using DHTML and Javascript that is easy to navigate and use.

Create web pages using AngularJS.

Build web applications using Servlet and JSP.

Understand various operations on Mongo Database.

UNIT-I:

HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.

CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds,CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II:

Client-Side Scripting using JavaScript and DOM

Java Script: The Basics of JavaScript, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, Functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.

DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III:

Angular JS

Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV:

Servlet and JSP

Servlet: Servlet Basics, Need of Server Side Programming,Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives-include(), forward(), sendRedirect(), HttpServletRequest and HttpServlet Response in Servlet, Servlet and JDBC Integration.

JSP: JSP Basics, JSP Scripting Elements (Declaration, Expression, Scriptlet), Directive Elements (page,include,taglib) , Action Elements (jsp:forward, jsp: include,jsp:useBean), JSP Implicit Objects.

UNIT-V

Mongo DB: Introduction to Mongo DB, Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

TEXT BOOKS:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Head First Servlet and JSP

4. Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

REFERENCE BOOKS:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3. Pro Angular JS by Adam Freeman
4. MEAN Web Development by Amos Q. Haviv

SEMESTER-V	L	T	P	C
	-	-	3	1.5
20EC5L01: LINEAR AND DIGITAL IC APPLICATIONS LAB				

COURSE OUTCOMES:

Upon completing this course, the students will be able to

CO1: Illustrate various linear circuits using operational amplifiers.(K3)

CO2: Demonstrate various combinational circuits and Sequential Circuits using Digital ICs.(K3)

CO3: Describe and Implement different Circuits with different ICs.(K2)

CO4: Examine their knowledge on analog circuits & digital circuits.(K1)

Minimum Ten Experiments to be conducted (7 from Part-A & 3 from Part-B)

PART (A)

1. Verify the operation of op–amp as an adder, subtractor and Comparator.
2. Differentiate the operation of op–amp as an Integrator and Differentiator using IC 741.
3. Realize an op–amp as first-order Butterworth low pass and high pass filters For a given cut-off frequency and verify the frequency response characteristics.
4. Infer how IC 741 op-amp can be used as RC phase shift oscillator for a desired Frequency
5.Design and construct a Wien bridge oscillator using Op-Amp 741 and (i) Plot the output waveform (ii) Measure the frequency of oscillation
6. Construct and setup an astable multivibrator using Op-amp 741 and Plot the waveforms
7.Construct and setup a monostable multivibrator using Op-amp 741 and Plot the waveforms
7. Design and setup voltage controlled oscillator using IC566 and plot the waveforms
8.Implement a low voltage regulator using IC723 and plot the regulation characteristics
9.Construct and setupFunction Generator using Op-amp 741 and Plot the waveforms.

PART (B)

10. Construct XOR/XNOR gates with universal gates.
11. Examine the operation of IC-74151 as 8X1 line Multiplexer.
12. Develop Half subtractor & Full subtractor using logic gates.
13. Implement a 4-bit carry look-ahead adder using Logic Gates
14.ConstructBCD Counter Circuit using the 74LS90 Decade Counter
15.Design D-Flipfop and T-Flipfops using JK-flipflop

ONLINE TOOLS:

1. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/electronerds/index.html
2. https://dld-iitb.vlabs.ac.in/

SEMESTER-V	L	T	P	C
	-	-	3	1.5
20EC5L02 : DIGITAL SIGNAL PROCESSING LAB				

COURSE OUTCOMES:

After this course, students are able to

CO1: Apply the basics of MATLAB and C-languages for the development of various DSP applications.(K3)

CO2: Understand and analyze the various applications by transforming the input sequence using FFT algorithm.(K2)

CO3: Illustrate the IIR and FIR digital filters and use them in different applications.(K3)

CO4: Develop various real-time applications using digital signal processors such as TMS3206713/TMS6712.(K3)

LIST OF EXPERIMENTS

1. Introduction To Matlab
2. To Generate Basic Discrete-Time Sequences
3. To Compute FFT and IFFT
4. To find the Sum of Sinusoidal Signals
5. To compute the Power Density Spectrum sequence
6. To find the Response of the LTI Discrete-Time System
7. To find the Frequency Response of LTI Discrete-Time System
8. To Study the architecture of DSP chips-TMS 320C 5X/6X Instructions.
9. To verify Linear Convolution
10. To verify Circular Convolution

PART-2 (FILTERS)

1. Frequency Response of FIR Low pass Filter using Windows
2. Frequency Response of FIR High pass Filter using Windows
3. Frequency Response of IIR Low pass Butterworth Filter
4. Frequency Response of IIR High pass Butterworth Filter
5. Frequency Response of IIR Low pass Chebyshev Type-I Filter
6. Frequency Response of IIR High pass Chebyshev Type-I Filter
7. Frequency Response of IIR Low pass Chebyshev Type-II Filter
8. Frequency Response of IIR High pass Chebyshev Type-II Filter

OPEN-ENDED EXPERIMENTS:

1. To Generate DTMF Signal
2. To Implement the Decimation Process.
3. To Implement the Interpolation Process.
4. To Implement the I/D Sampling Rate Converters.

OPEN SOURCE TOOLS:

1. https://www.scilab.org/
2. https://octave-online.net/

SEMESTER-V	L	T	P	C
	1	-	2	2
20CS5S01 : PYTHON PROGRAMMING APPLICATIONS LAB				

COURSE OUTCOMES:

CO1: Apply core programming basics and program design with functions using Python programming language.

CO2: Interpret the high-performance programs designed to strengthen the practical expertise.

CO3: Develop applications for real time problems by applying python data structure concepts.

CO4: Test and apply the concepts of packages, handling, multithreading and socket programming.

CO5: Divide the importance of object-oriented programming over structuredprogramming.

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a PythonScript
b) Write a program to purposefully raise Indentation Error and Correctit

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from theuser.
b) Write a program add.py that takes 2 numbers as command line arguments and prints itssum.

Exercise - 3 Control Flow

a) Write a Program for checking whether the given number is an even number ornot.
b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . ..1/10
c) Write a program using a for loop that loops over a sequence. What issequence?
d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number tozero.

Exercise 4 - Control Flow - Continued

a) Find the sum of all the primes below two million. Each new term in the Fibonacci sequenceis generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...
b) By considering the terms in the Fibonacci sequence whose values do not exceed fourmillion, find the sum of the even-valuedterms.

Exercise - 5 - DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary datastructure
b) Write a program to use split and join methods in the string and trace a birthday with a dictionary datastructure.

Exercise - 6 DS - Continued

a) Write a program combine lists that combine these lists into adictionary.
b) Write a program to count the frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a textfile?

Exercise - 7 Files

a) Write a program to print each line of a file in reverseorder.
b) Write a program to compute the number of characters, words and lines in afile.

Exercise - 8 Functions

a) Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls arecolliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius

If (distance between two balls centers) <= (sum of their radii) then (they are colliding)
b) Find the mean, median, and mode for the given set of numbers in alist.

Exercise - 9 Functions - Continued

a) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation onb.
b) Write a function dups to find all duplicates in thelist.
c) Write a function unique to find all the unique elements of alist.

Exercise - 10 - Functions - Problem Solving

a) Write a function cumulative product to compute cumulative product of a list ofnumbers.
b) Write a function reverse to reverse a list. Without using the reversefunction.
c) Write a function to compute gcd, lcm of two numbers. Each function shouldn‟t exceed oneline.

Exercise 11 - Multi-D Lists

a) Write a program that defines a matrix andprints
b) Write a program to perform the addition of two square matrices
c) Write a program to perform the multiplication of two squarematrices

Exercise - 12 - Modules

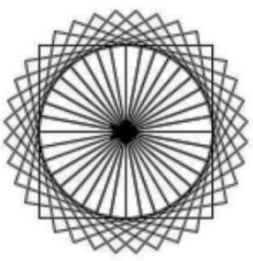
a) Install packages requests, flask and explore them. using(pip)
b) Write a script that imports requests and fetch content from thepage.
c) Write a simple script that serves a simple HTTP Response and a simple HTMLPage

Exercise - 13 OOP

a) Class variables and instance variable and illustration of theself-variable
i) Robot ii) ATM Machine

Exercise - 14 GUI, Graphics

a) Write a GUI for an Expression Calculator usingtk
b) Write a program to implement the following figures usingturtle



SEMESTER-V	L	T	P	C

	2	-	-	-

20BM5M01: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

UNIT-I:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT-2:

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-3:

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT-4:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-5:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

REFERENCE BOOKS:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino.

WEB LINKS:

1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/121106003/

SEMESTER-VI	L	T	P	C
	3	-	-	3
20EC6T01: MICROPROCESSORS AND MICROCONTROLLERS				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Summarize architecture, instructions and addressing modes of 8086 Microprocessor (K2)

CO2: Explain 8086 interfacing with different peripherals and implement programs (K2)

CO3: Examine 8051 Microcontroller interfacing and implement programs (K1)

CO4: Understand the architecture and applications of advanced processors (K2)

UNIT-I: INTRODUCTION TO PROCESSORS

Introduction: Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, CISC and RISC architectures.

8086: Main features, pin diagram/description, 8086 microprocessor family, Architecture of 8086, Register Organization, Memory Segmentation, Memory addresses, Physical Memory Organization, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT-II: 8086 PROGRAMMING

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, and assembly language program development tools.

UNIT-III: 8086 INTERFACING

8086 Interfacing: Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters.

UNIT-IV: 8051 MICROCONTROLLER

8051 microcontroller: Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, LCD Interfacing.

UNIT-V: ADVANCED PROCESSORS

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

Intel Processors: Recent INTEL processors-Pentium processors, i3, i5 and i7 processors.

TEXT BOOKS:

1. Douglas V Hall, SSSP Rao, Microprocessors and Interfacing – Programming and Hardware, 3rd Edition, Tata McGraw Hill Education Private Limited,2017.

2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay, The 8051 Microcontrollers and Embedded Systems Using Assembly and C, 2-Edition, Pearson, 2011.

3.Joseph Yiu's,The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Third Edition, Elsevier, 2014

REFERENCES:

1.A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGraw-Hill, 2017.
2.Dr Alexander G. Dean,Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach, Published by Arm Education, Media,2017.

E-REFERENCES:

1. Microprocessors and Microcontrollers
   www.tutorialspoint.com/microprocessor/index.htm

2. Microprocessors and Microcontrollers, NPTEL
   https://nptel.ac.in/courses/108/105/108105102/

SEMESTER-VI	L	T	P	C
	3	-	-	3
20EC6T02: VLSI DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1:Develop the VHDL program for digital circuits using different styles (K3)

CO2: Explain the fabrication process and Electrical properties of MOS Circuits (K2)

CO3: Describe the CMOS circuit design processes, scaling and testing of MOS circuits (K1)

CO4: Summarize the use of different semiconductor ICs (K2)

UNIT-I:DIGITAL SYSTEM DESIGN USING HDL:

Introduction to HDL and History of VHDL, VHDL requirements, VLSI Design flow and Circuit design process, Hardware simulation and Synthesis, Levels of abstraction. Various design styles of VHDL-data flow modelling, behavioral modelling, and structural modelling. VHDL Programs to design the circuits using all three modelling –Half adder, Full adder, Mux, Demux, Decoder, Encoder Universal shift register, and counter.

UNIT-II: FABRICATION AND BASIC ELECTRICAL PROPERTIES OF MOSFET: Introduction to IC Technology – MOS, NMOS, PMOS, CMOS &BiCMOS. Introduction to GaAs, FinFET, ULSI Technology and its applications.

BASIC ELECTRICAL PROPERTIES: Basic Electrical Properties of MOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit; Pass transistor, Transmission Gates, NMOS Inverter, CMOS Inverter analysis and design, Bi-CMOS Inverter.

UNIT-III: **MOS CIRCUIT DESIGN PROCESS AND SCALING:** VLSI Design Flow, MOS Layers, CMOS circuit diagram, Stick Diagram, Design Rules-Lambda Based, micron-based and Layout diagram, 2-micrometer CMOS Design rules for wires, Contacts and Transistors, Layout Diagrams of CMOS Inverters and Gates.

SCALING: Scaling of MOS circuits, Limitations of Scaling.

UNIT-IV: BASIC CIRCUIT CONCEPTS *AND CMOS TESTING*:

Sheet Resistance, and its concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, and some examples with calculations. The Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation delays, Wiring capacitances and Choice of layers.

CMOS TESTING : CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

UNIT-V: **SEMICONDUCTOR IC DESIGN:**

Introduction to Programmable Logic Devices (PLDs)- Programmable Logic Array (PLA), Programmable Array Logic (PAL)-implementation of logic functions using PLA/PAL. Implementation approaches in ASIC Design- Full custom design, semi-custom design, gate arrays, standard cells, Complex Programmable Logic Devices (CPLDs), Field programmable gate arrays (FPGAs)-architectures and applications.

Introduction to System-on-Chip (SoC) and Network-on-Chip (NoC)-2D NoC, 3D NoC, Wireless NoC.

TEXTBOOKS:

1. Kamran Eshraghian, EshraghianDougles and A. Pucknell, and SholehEshraghian, "Essentials of VLSI Circuits and Systems", PHI, 2015 Edition. **(UNIT-II,III,IV,V)**

2. J. Bhaskar, "VHDL Primer",Prentice Hall Of India Publications,2018 edition. **(UNIT-I)**

REFERENCES:

1. K.Lal Kishore and V.S.V.Prabhakar, "VLSI Designing", 2nd Edition, I.K.International Publishing House Private Limited, 2018.
2. A.Albert Raj & T. Latha, "VLSI Design", PHI Learning Private Limited, 2019.

E-REFERENCES:

1. https://nptel.ac.in/courses/117101058
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm

SEMESTER-VI	L	T	P	C
	3	-	-	3
20EC6T03: MICROWAVE AND OPTICAL COMMUNICATIONS				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Summarize different types of modes in wave guides and characteristics. (K2)

CO2: Interpret different types of microwave devices and measurements. (K2)

CO3: Examine the optical fiber components such as sources, detectors and amplifiers. (K1)

CO4: Explain the key features of optical fiber, and describe various types of optical fibres and coupling losses.(K2)

UNIT-1: WAVEGUIDES:

Microwave Spectrum, Bands, Applications and Advantagesof Microwaves, Rectangular Waveguides TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Dominant and Degenerate Modes, Phase and Group Velocities, Wavelengths and Impedance Relations, Power Transmission and Losses in Rectangular wave guide, Impossibility of TEM mode.

UNIT-2: MICROWAVE ACTIVE & PASSIVE DEVICES:

Gunn Diode Principle-Two Valley Model Theory/RWH Theory-Characteristics Modes, Principle of Operation of IMPATT, TRAPATT, BARITT and PIN diodes, Two Cavity Klystron Amplifier, Reflex Klystron Oscillator Modes and Efficiency considerations, Magnetrons, TWT and Slow wave Structures. Scattering parameters: E and H-Plane Tees, Hybrid Ring (Rat-Race),Magic Tee, Directional Couplers, Power divider, Fixed& Variable Attenuators and Ferrite Devices.

UNIT - 3: MICROWAVE MEASUREMENTS:

Description of Microwave bench, and their features, precautions, VSWR Meter, Frequency Meter, Power Meter,Slotted line section, Measurement of Attenuation, Frequency, Impedance, Power,VSWR, Cavity Q.

UNIT – 4: OPTICAL FIBERS AND DEVICES:

Historical development, The general system, advantages and applications of OFC, Propagation of light Optical fiber structures, Acceptance angle, Numerical aperture, Attenuation loss, Absorption loss, Scattering loss and Radiation loss,single mode fiber connector, Splicing Technique, Optical Fiber connector, and their types.

UNIT – 5: OPTICAL NETWORKS:

Optical Source – LED‟s Structures Materials, Quantum efficiency, Power, Modulation and Power band width product, ILD characteristics, Optical Detectors – PIN and APD characteristics, Optical transmitters and receivers, System block diagram, Point to point link design, Power budget analysis, Line coding in optical links, WDM- DWDM.

TEXT BOOKS:

1. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd Edition, PHI (ke), 2016.
2. Gerd Kaiser, “Optical Communication”, 5th. Ed., MGH, 2017.

REFERENCES:

1. Annapurna Das, Sisir.K.Das, “Microwave Engineering”, 3rd edition, McGrawHill Education,2017.
2. John. M. Senior,“Optical Fiber Communications Principles and Practice” 2nd Edition, PHI, 2012.

E-REFERENCES:

1. Microwave Engineering, “https://nptel.ac.in/courses/108103141”
2. Optical Communication, “https://nptel.ac.in/courses/108106167”

SEMESTER-VI PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20EC6E01: SENSORS AND INSTRUMENTATION				

COURSE OUTCOMES:

Upon completing this course, the student will be able to

CO1: Understand the concepts of Electrical and Mechanical Transducers (K2)

CO2: Explain the measurement and characteristics of various instruments (K3)

CO3: Enumerate the knowledge about basic Signal Conditioning Elements (K1)

CO4: Understand the feedback in Instruments (K2)

UNIT I:ELECTRICAL TRANSDUCERS:

Resistance Thermometers; Interfacing Resistive Transducers to Electronic Circuits; Thermistors-Measurement of Temperature and Thermal Conductivity, Temperature Control; Resistance Strain Gauges-Gauge Factor, Bonded and Unbonded Strain Gauges; Self Generating and Non-Self Generating Inductive Transducers; Linear Variable Differential Transformers; Capacitive Transducers – Potentiometric Transducers; Thermoelectric Transducers and Sources of Errors in Thermocouples; Piezoelectric Transducers.

UNIT II: MECHANICAL TRANSDUCERS:

Temperature- Bimetallic Element and Fluid Expansion type Thermometers; Pressure- Manometers and Bourdon Gauges; Force- Balances Liquid Level- Float Systems and Level to Pressure Converters; Flow-Pitot Static Tubes and Turbine type Flow Meters. Hot Wire Anemometer. Proximity Sensors- Reed Sensors, Inductive proximity sensor, Capacitive proximity sensor, Optical sensor with through beam, Ultrasonic sensors.

UNIT III:MEASUREMENT AND CHARACTERISTICS:

Elements of a Measurement System; Classification of Instruments; Static Performance Parameters; Loading and Impedance Matching; Errors and Uncertainties in Measurement; Process and Standards of Calibration; Dynamic Characteristics Transfer Function Representation of a Measurement System, Impulse and Step Responses of First and Second Order Systems, Frequency Response of First and Second Order Systems.

UNIT IV:BASIC SIGNAL CONDITIONING ELEMENTS:

Amplifiers- Non Electrical and Electrical types; Op AmpsInverting, Non-Inverting, Summing, Differential, and Charge Amplifiers; Differentiating and Integrating Elements; Filters; Data Transmission Elements-Electrical, Pneumatic, Position and Radio Frequency Transmission types; Compensation Elements for First and Second Order Systems – Basic Indicating, Recording, and Display Elements.

UNIT V:SMART WEARABLE SENSORS

Introduction-Systems design - Challenges in chemical and biochemical sensing - Application areas - Wearable inertial sensors - obtained parameters from inertial sensors - Applications for wearable motion sensors - Practical considerations for wearable inertial sensor - Application in clinical practice and future scope.

TEXTBOOKS:

1. K. Lal Kishor, “Electronic Measurements and Instrumentation”, 2nd edition (k.e),Pearson Education Publications, 2019.
2. H. S. Kalsi, “Electronic Instrumentation”, 1st edition, TMH Publications, 2017.

REFERENCES:

1. Albert D Helfrick and William D Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 1st edition, PHI, 2016.
2. CS Rangan, GR Sarma, and VSV Mani, "Instrumentation Devices and Systems", Tata McGraw-Hill,2015.

E-REFERENCES:

1. https://nptel.ac.in/courses/108108147
2. https://automationforum.co/transducer-vs-sensor/

SEMESTER-VI PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20EC6E02: DIGITAL DESIGN USING HDL				

COURSE OUTCOMES:

Upon completing this course, the student will be able to

CO1: Describe the basics of HDL Programming basics and different tools used in developing HDL Programs (K1)

CO2: Demonstrate the gate level and behavioural modelling (K2)

CO3: Describe any digital circuit using both concurrent and Sequential Programming concepts (K3)

CO4: Explain various Testing techniques used in testing digital circuits (K2)

UNIT - I: INTRODUCTION TO HDL LANGUAGES

History of HDL, Design flow, levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools.Different styles of coding, Language constructs and conventions using lexical tokens.

UNIT - II:GATE LEVEL MODELING:

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. Design gate-level programs developing Dataflow coding with the Introduction of Continuous Assignment Structure, Delays and Continuous Assignment**.**

UNIT-III: BEHAVIORAL MODELING:

Introduction, Conditional statements, Operations and Assignments,Functional Bi-furcation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Design at Behavioral Level, Blocking and Non-Blocking Assignments, the 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, The Disable Construct, While Loop, Forever Loop, Parallel Blocks, Force-Release, Construct, Event.

UNIT - IV: SWITCH LEVEL MODELING:

Basic Transistor Switches, CMOS Switches, Bi-Directional Gates, Time Delays with Switch Primitives, Instantiation with 'Strengths' and 'Delays' Strength Contention with Tri-reg Nets.Path Delays, Module Parameters,System Tasks and Functions, Hierarchical Access,User Defined Primitives.Generation of Test bench for HDL language.

UNIT-V: **CIRCUIT DESCRIPTION AND COMPONENTS TEST AND VERIFICATION:**

Sequential Models, Feedback Model, Basic Memory Components, Functional Register, Static Machine Coding, Introduction to Components Test and Verification, Test Bench - Combinational Circuits Testing, System on Chip, Sequential Circuit Testing, Design Verification,BIST and BILBO techniques.

TEXT BOOKS:

1.Padmanabhan, B Bala Tripura Sundari, “Design Through Verilog HDL”, Wiley 2018. **(Unit I- V).**

2. ZainalabdienNavabi, “Verliog Digital System Design”,TMH, 2nd Edition, 2017.**(Unit I-V).**

REFERENCES:

1. Samir Palnitkar “Verilog HDL” -, 2nd Edition, Pearson Education, 2015.
2. Stephen Brown,ZvonkocVranesic, “Fundamentals of Digital Logic with Verilog Design”, TMH, 3rd Edition, 2013.

E-REFERENCES:

1. https://nptel.ac.in/courses/108103179
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_verilog_introduction.htm

SEMESTER-VI PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20EC6E03: DIGITAL IMAGE PROCESSING AND ITS APPLICATION				

COURSE OUTCOMES:

After the completion of this course, students are able to

CO1: Define basic concepts of digital image processing, intensity transformations and spatial filtering (K1)

CO2: Apply image restoration and reconstruction process in the images (K3)

CO3: Understand the Multi-Resolution Processing And Image Compression (K2)

CO4: Understand the concepts of Morphological Image Processing, segmentation and color Image Processing (K3)

UNIT-I:BASICS OF DIGITAL IMAGE PROCESSING:

Origins of digital image processing, uses digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, Elements of visual perception, light and electromagnetic spectrum, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels**.**

UNIT-II:INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING:

Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Filtering in the frequency domain: Preliminary concepts, the discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform. The basic of filtering in the frequency domain, image smoothing and sharpening using frequency domain filters.

UNIT-III: IMAGE RESTORATION AND RECONSTRUCTION:

A model of the image degradation Restoration process, Noise models, restoration in the presence of noise only- Spatial Filtering - Mean filters, order statistic filters and adaptive filters.

Periodic Noise Reduction by frequency domain filtering,Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering,geometric mean filter, image reconstruction from projections.

UNIT-IV: MULTI-RESOLUTION PROCESSING AND IMAGE COMPRESSION:

Image pyramids, sub-band coding &Haar transform multi-resolution expressions, wavelet transforms in one dimension. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. Image compression: Fundamentals, various compression methods-coding techniques, digital image water marking.

UNIT-V:MORPHOLOGICAL IMAGE PROCESSING, SEGMENTATION AND COLOR IMAGE PROCESSING:

Preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, Image segmentation- Fundamentals, point, line, edge detection thresholding, region -based segmentation, color fundamentals, color models, pseudo color image processing, basic of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

APPLICATIONS & CASE STUDIES: Industrial applications, Medical applications, Military applications etc of image processing, patterns classification,case studies.

TEXT BOOK:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing, 3rd edition", Prentice Hall, 2018. (UNIT I-V)

REFERENCES:

1. R. C. Gonzalez, R. E. Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB" 3rd edition, Gatesmark, 2020.
2. Jayaraman, S. Esakkirajan, and T. Veera kumar, "Digital Image Processing", Tata McGraw-Hill Education, 2017.

E-REFERENCES:

1. https://nptel.ac.in/courses/117105135
2. https://www.tutorialspoint.com/dip/applications_and_usage.htm

SEMESTER-VI PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20EC6E04: WIRELESS COMMUNICATION				

COURSE OUTCOMES

On the completion of this course, the students will be able to:

CO1: Describe the functioning of various example wireless communication systems, their evolution and standards.(K1)

CO2: Construct the cellular communication system, architecture, functioning, and various standards.(K3)

CO3: Demonstrate an understanding of signal propagation in the cellular environment and explain wireless communication networks.(K2)

CO4: Understand the functioning, protocols, capabilities and application of various wireless communication networks.(K2)

UNIT-I :INTRODUCTION:

An overview of wireless communication and future vision. Wireless communication system and standards: satellite communication system, GPS, paging system, cordless phone, wireless local loop, RFID.

UNIT-II:THE CELLULAR FUNDAMENTALS:

Cellular communication and frequency reuse, general architecture of a cellular system, channel assignment strategies, hand-off in a cellular system. Interference and cellular system capacity: co-channel interference and adjacent channel interference, power control, typical cellular standards (AMPS, GSM, GPRS, WCDMA, LTE, concept of LTE-advanced), 4G features and challenges, 5G vision.

UNIT-III:SIGNAL PROPAGATION IN MOBILE COMMUNICATION:

Mobile cellular environment, multipath propagation and fading, free space propagation model, propagation path loss, outdoor propagation models (Okumura model &Hata model), indoor propagation models, power delay profile, channel parameters (delay spread, doppler spread, coherence bandwidth, coherence time, LCR and ADF).

UNIT-IV: WIRELESS COMMUNICATION NETWORKS:

Wireless Personal Area Networks (Bluetooth, UWB and ZigBee), Wireless Local Area Networks (IEEE 802.11, network architecture, medium access methods, WLAN standards), Wireless Metropolitan Area Networks (WiMAX), Ad-hoc Wireless Networks.

UNIT-V:MULTIPLE ACCESS SCHEMES:

Duplexing schemes, FDMA, TDMA, SDMA, spread spectrum technique and CDMA, OFDMA, ALOHA and CSMA.

TEXT BOOKS:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press,2020.(Unit-I, II, III, IV)
2. William Stallings, “Wireless Communication and Networking”, PHI, 2014.(Unit I-V)

REFERENCES:

1. Vijay K Garg, “Wireless Communications and Networks”, Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2017 (Indian reprint)
2. Sanjay Kumar, “Wireless Communication the Fundamental and Advanced Concepts”, River Publishers, Denmark, 2015 (Indian reprint).

E-REFERENCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.tutorialspoint.com/wireless_communication/wireless_communication_overview.htm

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CE6O01:: ENVIRONMENTAL POLLUTION AND CONTROL				

Course Outcomes:

Students are able to

1. Identify the air pollutant causes and control devices. (K2)
2. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods. (K2)
3. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city. (K2)
4. Know the causes of noise pollution and ISO14000 standards. (K2)
5. Know the Treatment and management of hazardous waste. (K2)

UNIT–I: Air Pollution

Air pollution causes-control methods–particulate control devices – methods of controlling Gaseous Emissions – Air quality standards.

UNIT–II: Industrial wastewater Management

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization– Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

UNIT–III: Solid Waste Management

Solid waste characteristics–basics of on-site handling and collection–separation and processing– Incineration- Composting-Solid waste disposal methods – fundamentals of landfilling.

UNIT–IV: Noise Pollution

Noise standards, Measurement and control methods – Reducing residential and industrial noise– ISO14000

UNIT–V: Hazardous Waste

Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

TEXT BOOKS

1. K. Sasi Kumar, S.A. Gopi Krishna, “Solid Waste Management”,PHI New Delhi,2014.
2. D. Srinivasan, “Environmental Engineering”, PHI Learning Private Limited, New Delhi, 2011.

REFERENCES BOOKS

1. Ruth F. Weiner and Robin Matthews, „Environmental Engineering,„ 4th Edition Elsevier, 2003.
2. J.G. Henry and G.W. Heinke,„Environmental Science and Engineering„– Pearson Education,2002
3. Mackenzie L Davis & David A Cornwell, “Environmental Engineering”,McGraw Hill Publishing,2002.
4. Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus, “Environmental Engineering”, Mc-Graw-Hill Book Company, New Delhi, 1985.

E-Resources

1. https://nptel.ac.in/courses/123105001

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CE6O02 :: DISASTER MANAGEMENT				

Course Outcomes:
Students are able to

1. Identify the tools of integrating disaster management principles in disaster mitigation process. (K2)
2. Discuss about different approaches needed to manage pre and post- disaster activities**. (K2)**
3. Prepare the process of risk management and develop a basic understanding method for the role of public in risk management. (K2)
4. Administer the role of technology in Disaster management. (K2)
5. Conclude the planning strategies for education and community preparedness programmes. (K2)

UNIT-I: Natural Hazards and Disaster management:

Introduction of DM – Inter disciplinary nature of the subject- Disaster Management cycle- Five priorities for action. Case study methods of the following: floods, draughts -Earthquakes- global warming, cyclones & Tsunamis- Post Tsunami hazards along the Indian coast - landslides.

UNIT-II: **Man Made Disaster and their management along with case study methods of the following**: Fire hazards - transport hazard dynamics -Solid waste management- post disaster – Bioterrorism -threat in mega cities, rail and aircraft accidents, and Emerging infectious diseases & Aids and their management.

UNIT-III: **Risk and Vulnerability**:

Building codes and land use planning - social vulnerability - environmental vulnerability - Macroeconomic management and sustainable development, climate change risk rendition - financial management of disaster - related losses.

UNIT-IV: **Role of Technology in Disaster managements**:

Disaster management for infra structures, taxonomy of infrastructure - treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earthquakes -flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training transformable indigenous knowledge in disaster reduction.

UNIT-V: **Education and Community Preparedness**

Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community-based disaster recovery -Community-based disaster management and social capital-Designing resilience-building community capacity for action.

TEXT BOOKS

1. Jagbir Singh, „Disaster Management - Future Challenges and Opportunities", I K International Publishing House Pvt. Ltd-2017
2. Tushar Bhattacharya, „Disaster Science & Management", Tata McGraw Hill Education Pvt. Ltd., New Delhi.-2012.

REFERENCES BOOKS

1. Prof. R.B. Singh, "Disaster Management and Mitigation", World Focus 2016.
2. Rajib shah & R. Krishnamurthy, „Disaster Management - Global Challenges and Local Solutions" Universities press-2009.
3. H K Gupta, 'Disaster Management", Universities press-2003

E-RESOURCES

1. https://archive.nptel.ac.in/courses/105/104/105104183/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EE6O01:: FUNDAMENTALS OF ELECTRICAL VEHICLES				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Illustrate different types of electric vehicles
CO2 : Select suitable power converters for EV applications
CO3 : Design HEV configuration for a specific application
CO4 : Choose an effective method for EV and HEV applications
CO5 : Analyse a battery management system for EV and HEV

UNIT-I : INTRODUCTION

Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles

UNIT-II : COMPONENTS OF ELECTRIC VEHICLES

Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

UNIT-III : HYBRID ELECTRIC VEHICLES

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.

UNIT-IV : MOTORS FOR ELECTRIC VEHICLES

Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only)

UNIT-V : ENERGY SOURCES FOR ELECTRIC VEHICLES

Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it‟s working.

TEXT BOOKS:

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Denton - Tom. Electric and hybrid vehicles.Routledge - 2020.

REFERENCE BOOKS:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles.CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EC6O01:: MOBILE COMMUNICATION AND ITS APPLICATIONS				

COURSE OUTCOMES:

Students are able to

CO1. Design Hexagonal shaped cells and how these are implemented in the real world.

CO2. Explain different types of antenna systems in mobile communication.

CO3. Analyze Handoffs and different types of handoffs and Dropped call rates and their evaluation.

CO4. Describe the Parameters of Mobile multipath channels, Types of small-scale fading.

UNIT-I

INTRODUCTION :

Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, and Third Generation Wireless Networks, Wireless Local Loop(WLL), Wireless LANs, Bluetooth, Personal Area Networks(PANs), A Simplified Reference Model, Applications.

UNIT-II

ELEMENTS OF MOBILE COMMUNICATIONS:

General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in an Omni directional Antenna system, Cell splitting, consideration of the components of Cellular system.

UNIT-III

THE MOBILE CONCEPT :

Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co-Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring.

UNIT-IV

MOBILE RADIO PROPAGATION :

Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into the building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small-scale fading.

UNIT-V

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:

Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non-fixed channel assignment.

TEXTBOOKS:

1. Wireless Communications by Theodore S. Rappaport, principles and practice,2nd Editions. (**Unit-I, III, IV & V)**

2. Mobile Cellular Communication by Gottapu Sasibhushana Rao, Pearson International, 2012. **(UNIT - I, II, III &IV)**

3. Mobile Cellular Telecommunications –W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006. **(UNIT-V & VI)**

REFERENCES:

1. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.
2. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20ME6O01 ::BASICS OF 3D PRINTING				

COURSEOBJECTIVES:

- To explore the technology used in additive manufacturing.
- ToacquireknowledgeforselectingcorrectCADformatsinmanufacturingprocess.
- To understand the operating principles and limitations of liquid, solid and laser-based additive manufacturing systems.
- To design the process of additive manufacturing including tools used for design.
- Toacquireknowledgeonimportantprocessparametersforbio-manufacturing

COURSEOUTCOMES: Students are able to

CO1: To impart the fundamentals of Additive Manufacturing Technologies for engineering applications[K2]
CO2: Select and use correct CAD for mats in the manufacture of a3D printed part.[K2]
CO3: Explain the operating principles, capabilities, and limitations of liquid, solid and laser based additive manufacturing system.[K2]
CO4: Enumerate the design process for additive manufacturing including tools used for design and some features required for design. [K2]
CO5: Describe the important process parameters for bio-manufacturing and determine the suitable additive technique for bio-manufacturing, aerospace and manufacturing engineering.[K2]

UNIT I
INTRODUCTION
3D printing Overview, History, Need, Classification, Additive Manufacturing Technology in product development, Materials for Additive Manufacturing Technology.

UNIT II
REVERSE ENGINEERING
BasicConcept–3DScanning Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology, Part Orientation and support generation, Model Slicing, Tool path Generation.

UNIT III
ADDITIVE MANUFACTURING SYSTEMS
SOLID& LIQUID BASED- Classification, Stereo lithography Apparatus (SLA) - Principle, process, advantages, Fused Deposition Modeling –Principle, process, advantages.
LASERBASED- Selective Laser Sintering–Principle, Process, advantages, Three-Dimensional Printing –Principle, process, advantages – Laser Engineered Net Shaping (LENS).

UNIT IV
DESIGN FOR AM
Motivation, Design for Manufacturing and Assembly (DFMA)-concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM-Part Orientation, Removal of Supports,

Hollowing out parts, Inclusion of Undercuts, Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/numbers etc.

UNIT V

APPLICATIONS OF 3D PRINTING

Customized implants and prosthesis: Design and development, Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE), Applications of 3D Printing in Aerospace, Automotive, Manufacturing and Architectural Engineering.

TEXTBOOKS:

1. Patri K. Venuvinod., and Weiy in Ma., Rapid prototyping Laser based and other Technologies, First Edition, Springer Science +Business Media, LLC, 2004.
2. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, Third Edition, World Scientific Publishers, 2016.
3. Gebhardt A, Rapid prototyping, Hanser Gardener Publications,2017.
4. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications, World Scientific Publishers, Fourth Edition of Rapid Prototyping, 2018.

REFERENCES:

1. LiouL.W.and LiouF.W.,Rapid Prototyping and Engineering applications:A toolbox for prototype development, CRC Press, 2017.
2. Kamrani A.K. and Nasr E.A., Rapid Prototyping: Theory and practice, Springer, 2016.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2015.

WEB REFERENCES:

1. https://all3dp.com/
2. https://www.thingiverse.com/
3. https://additivemanufacturing.com/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20ME6O02 :: FARM MACHINERY				

COURSE OBJECTIVES: The objectives of this course are

- To impart the students to understand the fundamentals of machinery in farming.
- To enable the students to acquire knowledge on tillage and equipment used.
- To introduce the students about various types of earth-moving equipment.
- To enable the students to acquire knowledge on seeding and spraying equipment.
- To introduce the fundamentals of transplanting machinery and fertilizer equipment.

COURSE OUTCOMES: Students will be able to

CO1. Explain various types of machinery in farming. [K2]
CO2. Illustrate types of farm operation for craft cultivation with scientific understanding. [K2]
CO3. Explain various types of earth-moving equipment. [K2]
CO4. Summarize various seeding methods and sprayer types. [K2]
CO5. Explain transplanting methods and fertilizer equipment. [K2]

UNIT I
FARM MECHANIZATION:
Farm mechanization- objectives of farm mechanization, sources of farm power, classification of farm machines.Materials of construction and heat treatment. principles of operation and selection of machines used for production of crops, Field capacities of different implements and their economics, Problems on field capacities and cost of cultivation

UNIT II
TILLAGE EQUIPMENT:
Tillage equipment - classification and types of tillage, Primary tillage implements-mould board plough and its parts, disc plough, and other ploughs, Secondary tillage equipment- disc harrows, Implements-cultivators, intercultural implements. Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipment, Draft and unit draft-related problems.

UNIT III
EARTH MOVING EQUIPMENT
Earth moving equipment - terminology, construction and their working principles, shovels, bulldozers, trenches and elevators.

UNIT IV
SEED DRILLS AND SPRAYER:
Seeding - methods, types of seed metering mechanism, types of furrow openers. Calibration of seed drills, Adjustment of seed drills – objectives, uses of plant protection equipment
Sprayers - types of sprayers and dusters, sprayer calibration and selection, Constructional features of different components of sprayers and dusters

UNIT V
TRANSPLANTING AND FERTILIZER:
Transplanting and fertilizer - transplanting methods, different types of transplanting machinery, working principle, adjustments in transplanting equipment
Fertilizer - application equipment, fertilizer meeting mechanism calibration of fertilizer equipment.

TEXTBOOKS

1. Fakir Chara Das, Kishore Chandra and Shishira Kanth, Farm Machinery and Equipment, 1st Edition, Akinik Publications, 2020
2. Triveni Prasad Singh, Farm Machinery, 1st Edition, Prentice Hall India Pvt, Limited, 2016.

REFERENCES

1. Surendra Singh, Farm Machinery Principal And Applications, 1st Edition, Indian Council of Agricultural Research, 2017

2. Smith H P, Farm Machinery and Equipment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2007.

WEB REFERENCE:

1. https://nptel.ac.in/courses/126105009

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6O01:: FUNDAMENTALS OF SOFTWAREENGINEERING				

COURSE OUTCOMES:

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

CO1: Identify, formulate the various software engineering concepts

CO2: Different software development process models.

CO3: Analyze and specify software requirements with various stakeholders of a software development project

CO4: Apply systematic procedure for software design and deployment.

CO5: Compare and contrast the various testing methods and art of debugging

UNIT I

SOFTWARE AND SOFTWARE ENGINEERING: The nature of Software: Define software (Software Characteristics), Software Application Domains, **SoftwareEngineering**: Definition, Layered Technology,**Software Process:** GenericProcess framework activities, Umbrella activities,Software Myths and Reality,GenericProcess model, Capability Maturity Model Integration (CMMI).

UNIT-II

PROCESS MODELS: Process Assessment and improvement.Prescriptive Process models:Waterfall Model, IncrementalProcess Model**,**Evolutionary Process Models: Prototyping, Spiral model, The Unified Process.Personal and Team process models: Personal software process (PSP), Team software process (TSP), Product and Process,

UNIT-III

REQUIREMENTS ANALYSIS AND SPECIFICATION: Functional Requirements, Non- Functional Requirements, Software Requirements Document (Software Requirements Specification SRS),Requirements Specification, Requirements Engineering**,** Eliciting Requirements(elicitation), Developing Use cases, Validating Requirements, Requirements Management: Requirements Planning, Requirements Change management.

UNIT-IV

SOFTWARE DESIGN: Design process**, Design concepts**: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information hiding, Functional independence, Refinement, Aspects, refactoring, Object-oriented design concepts, Design classes.

The Design Model: Data Design Elements, Architectural Design elements, Designing Class Based Components: Basic Design Principles, Component-Level Design guidelines, Cohesion and coupling.

User Interface Design: The Golden Rules

UNIT-V

TESTING: The strategies for Conventional Strategies: Unit Testing – Integration Testing. Test Strategies for Object-Oriented Software, Software testing fundamentals, white box testing- Basis path testing: Flow graph Notation, independent Program paths, Deriving test cases, Graph Matrices. control structure testing.

black box testing: Graph Based Testing Methods, Equivalence Partitioning, Boundary value Analysis. Validation Testing, System Testing. Art of Debugging: The Debugging process.

TEXTBOOK:

1. Software Engineering, A practitioner's Approach- Roger S. pressman, 8th edition,McGraw-Hill InternationalEdition, 2014.
2. SoftwareEngineering,IanSommerville,10th Edition,PearsonEducationAsia,2016.

REFERENCEBOOKS:

1. SoftwareEngineering,PankajJalote,APreciseApproach",WileyIndia,2010.
2. SystemsAnalysisandDesign-ShelyCashmanRosenblatt,9th Edition, Thomson Publications, 2016.
3. SoftwareProjectManagement,BobHughes,MikeCotterellandRajibMall,FifthEdition,TataMcGrawHill,New Delhi, 2012.
4. https://nptel.ac.in/courses/106101061/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6O02:: FUNDAMENTALS OF COMPUTER NETWORKS				

COURSE OUTCOMES

At the end of the course, students are able to

1. Differentiatenetwork referenc**e** models such as OSI**,** TCP/IP
2. Classify various Data Link Layer protocols such as sliding window.
3. Distinguish various MACsublocotorp reyallsuch as ALOHA, CSMA, CSMA/CD
4. DifferentiateNetwork layerprotocols IPv4 and IPv6
5. Distinguish various Transport layer protocols and their applications

UNIT 1:

Data communication Components: Representation of data and its flow of networks, Categories of Networks, Various Connection Topologies, Protocols and Standards, OSI network model, TCP/IP Protocol suit, addressing

UNIT 2:

Physical Layer: Transmission Media:Guided Media,Unguided Media

Data Link Layer: Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC, Flow Control and Error control protocols: Stop and Wait, Go back – N ARQ, Selective Repeat ARQ

UNIT 3:

Medium Access Sub Layer: Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.Controlled Access protocols: Reservation, Polling, Token passing

UNIT 4:

Network Layer: IPv4 address: Address Space,Notations,Classful Addressing,Classless Addressing,Network Address Translation (NAT)**IPv6 Addresses**: Structure,Address Space

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP)

UNIT 5:

Application layer:

Domain name system (DNS), E-mail, File Transfer Protocol (FTP), www and HTTP

TEXT BOOKS:

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGrawHill, 2017
2. Computer Networks, 6th Edition, Andrew S. Tanenbaum, Pearson New International Edition, 2021.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India, 2007

REFERENCE BOOKS:

1. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
2. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20BM6O01:: STRESS AND WORK LIFE MANAGEMENT				

UNIT-I

Understanding stress**:** Meaning – Symptoms – Works Related Stress – Individual Stress –Reducing Stress – Burnout. Setting to Stress- Stress: Meaning - Approaches to stress, Good Stress Vs Bad Stress, The individual and work.

UNIT-II

Common stress factors time & career plateauing**:** Time Management – Techniques – Importance of planning the day – Time management schedule – Developing concentration – Organizing the Work Area – Prioritizing – Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say „No

UNIT-III

Introduction to Work-Life Balance - Importance of Work-Life Balance - Benefits of Work-Life Balance to Employees - Benefits of Work-Life Balance for Organization - Effects of Poor Work-Life Balance on Employees - Relation between Work-Life Balance & Stress - Outline for Work-Life Balance Planning- Approaches to Work-Life Balance planning - Process of Work-Life Balance - Steps of Work-Life Balance Planning

UNIT-IV

Work place humour**: Developing** a sense of Humour – Learning to laugh – Role of group cohesion and team spirit – Using humour at work – Reducing conflicts with humour.

UNIT-V

Self-development: Improving Personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Meditation for peace – Yoga for Life. Organization and Stress Management - Recognize the signs, Approaches to the problem, Providers Assistance.

References

1. Cooper, Managing Stress, Sage, 2011
2. Waltschafer, Stress Management, Cengage Learning, 4th Edition 2009.
3. Jeff Davidson, Managing Stress, Prentice Hall of India, New Delhi, 2012.
4. Juan R. Alascal, Brucata, Laurel Brucata, Daisy Chauhan. Stress Mastery. Pearson
5. Argyle. The Psychology of Happiness. Tata McGraw Hill. 2012
6. Bartlet. Stress – Perspectives & Process. Tata McGraw Hill. 2012
7. Handbook on Work–Life Balance-A New Approach, 2017, Dr. C Swarnalatha,Mrs.S. Rajalakshmi,Lulu Press.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20BM6O02:: BANKING AND INSURANCE				

Unit I

Origin of banking: Definition, Types of deposits, Origin, and growth of commercial banks in India. India‟s Approach to banking Sector Reforms, International security standards in banking, Global Financial Crisis and India‟s banking Sector.

UnitII

Introduction to E-Banking-Impact of Information Technology on Banking Changing Financial Environment and IT as a strategic response Hardware and Software.

Unit III

Delivery Channels-ATM, EFTPOS, Phone Banking, Internet Banking, SMS Banking, Mobile Banking, Credit/Debit Cards, Smart Cards E-Commerce-Secure Electronic Transfer (SET), Payment Gateways (Credit card/Debit cards), Authentication of payments, etc.

Unit IV

Principles and Practice of Insurance-Introduction to Risk and Insurance, Types of Insurance-General and Life, Basic principles of General and Life Insurance,

Unit V

General insurance products, underwriting concepts, standard conditions and warranties with respect to Fire, Marine, Motor, Engineering and Miscellaneous products.

REFERENCE BOOKS:

1. Agarwal, OP, Banking & Insurance, Himalaya Publishing House, Mumbai
2. George E Rejda, Principles of Risk Management & Insurance, Pearson Education, New Delhi
3. Balachandran S., General Insurance, Insurance Institute of India, Mumbai
4. Arthur C., William Jr., Michael Smith, Peter Young, Risk Management and Insurance, Tata McGraw Hill Publishing Company, New Delhi
5. Tripathy Nalini Prava & Prabir Pal, Insurance Theory & Practice, Prentice Hall of India Pvt. Ltd., New Delhi
6. Balachandran S., Life Insurance, Insurance Institute of India, Mumbai

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20MA6O01 :: OPERATION RESEARCH				

COURSE OUTCOMES: Students can able to
CO1: Formulate the resourcemanagement problem andidentify appropriate methods to solve them. [K3]
CO2: Applytransportation model to optimize the industrial resources. [K3]
CO3: Solve sequencing problems using operation research techniques. [K3]
CO4: Apply thereplacement model to increase the efficiency of the system. [K3]
CO5: Apply theinventory and queuingmodel to increase the efficiency of the system. [K4]

UNIT—I
LINEAR PROGRAMMING:
Introduction-General formulation LPP- Formulation of LP problems - Graphical solution –Slack and Surplus and Artificial variables-simplex method (simple problems) - artificial variable techniques – twophase method, Big-M-method(simple problems) –Concept of Duality-general rules for converting any primal into its dual.

UNIT – II
TRANSPORTATION PROBLEM:
Introduction-mathematical formulation-Feasible, Basic Feasible and Optimum solution -Methods for initial basic feasible solution to transportation problem-optimal Test by u, v method(MODI)-Degeneracy in Transportation problems –.Unbalanced Transportation problems.

UNIT – III
SEQUENCING PROBLEM:
Introduction –Johnson‟s Algorithm for n jobs 2 machines- Optimal Solution for processing n jobs through two machines- processing n jobs through three machines - processing n jobs through m machines - processing two jobsthrough m machines

UNIT – IV
REPLACEMENT PROBLEMS:
Introduction – replacement policy for items whose maintenance cost increases with time, and money value is constant – Money value, present worth Factor and Discount Rate- replacement policy when maintenance cost increases with time and money valuechanges with constant rate – Individual Replacement Policy-group replacement of items that fail completely.

UNIT – V
WAITING LINES:
Introduction- transient and steady states-Probability Distributions in Queening systems-Kendall‟s notation for Representing Queening models- Single channel-Poisson arrivalsExponential service times-with infinitepopulation model (M/M/1: FIFO/∞/∞)

INVENTORY:
Introduction – types of inventory models – Costs involved in Inventory problems-Variables in inventory problem-Classification of Inventory Models-Concept of EOQ-The EOQ model without shortage – Quantity Discounts-purchase inventory models with one price break - purchase inventory models with two price breaks- purchase inventory models with any number of price breaks-shortages are not allowed.

TEXT BOOKS:

1. Operations Research / S.D.Sharma, Ramnath co,Meerut
2. Operations Research, P.K.Gupta, D.S.Hira,S.Chand

REFERENCE BOOKS:

1. Operations Research /A.M.Natarajan,P.Balasubramani, A.Tamilarasi/PearsonEducation.
2. Operations Research / R. Pannerselvam, PHI Publications.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6O01 :: INTRODUCTION TO CLOUD COMPUTING				

Course Outcomes:
Upon completion of the course, it is expected that students will be able to:

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

2. Learn the key and enabling technologies that help in the development of the cloud.

3. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

4. Explain the core issues of cloud computing such as resource management and security.

5. Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of the cloud.

UNIT-I:

Introduction: Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics, Elasticity in Cloud – On-Demand Provisioning.

UNIT-II:

Cloud Enabling Technologies: Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish-Subscribe Model, Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery.

UNIT-III:

Cloud Architecture, Services And Storage: Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, IaaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers, S3.

UNIT-IV:

Resource Management And Security In Cloud: Inter-Cloud Resource

Management, Resource Provisioning and Resource Provisioning Methods, Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.

UNIT-V:

Cloud Technologies And Advancements: Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation.

TEXT BOOKS:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Morgan KaufmannPublishers.

2. Cloud Computing: Implementation, Management and Security, Rittinghouse, John W., and James F. Ransome, CRCPress.

REFERENCES:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Tata McgrawHill.

2. Cloud Computing - A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, Tata McGrawHill.

3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), George Reese, O'Reilly.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6O02 :: E-COMMERCE				

COURSE OUTCOMES

After the completion of the course, the students are able to

1. Define the fundamentals E-commerce framework.
2. Explain the basics of Consumer Oriented Electronic models.
3. Distinguish different electronic payment systems and their issues.
4. Demonstrate Inter-organizational and intra-organizational electronic commerce.
5. Explain advertising and marketing on the Internet, consumer search and resource discovery and key multimedia concepts.

UNIT-I

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT-II

Consumer Oriented Electronic commerce - Mercantile Process models, Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT-III

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks. Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT-IV

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT-V

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

TEXT BOOKS:

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

REFERENCES BOOKS:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, TharamDillon,Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
3. Electronic Commerce – Gary P.Schneider – Thomson.
4. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol GuyericoTraver.

VISEMESTER: JOB ORIENTED ELECTIVE- II	L	T	P	C
	3	-	-	3
20CS6J01:: AWS CLOUD PRACTITIONER				

Course outcomes:

After completing this course, students should be able to

CO1: Define AWS cloud and identify the Global Infrastructure components of AWS.
CO2: Demonstrate when to use Amazon EC2, AWS Lambda and AWS Elastic Beanstalk.
CO3: Differentiate Storage Services and demonstrate when to use AWS Database services.
CO4: Demonstrate Networking and Content Delivery Services.
CO5: Understand the Cloud economics and security.

UNIT 1:

CLOUD CONCEPTS OVERVIEW – Introduction to cloud computing, Cloud service models, Cloud computing Deployment models, Advantages of the cloud, Introduction to AWS.
AWS GLOBAL INFRASTRUCTURE OVERVIEW: AWS GLOBAL INFRASTRUCTURE, AWS Services and Service categories

UNIT 2:

COMPUTE – Compute services overview, Amazon EC2, Amazon EC2 pricing models, Benefits, use cases, four pillars of cost optimization, Container services, Introduction to AWS Lambda, Benefits of Lambda, Introduction to AWS Elastic Beanstalk, Benefits.

UNIT 3:

STORAGE: Amazon Elastic Block Store (EBS), Amazon Simple Storage Service (Amazon S3), Amazon Elastic File System (Amazon EFS), Amazon Simple Storage Service Glacier (Amazon S3 Glacier).

DATABASES: Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon RedShift, Amazon Aurora.

UNIT 4:

Networking and Content Delivery: Networking Basics, Amazon VPC, VPC Networking, VPC SECURITY, Amazon ROUTE-53, Amazon Cloud Front

UNIT 5:
CLOUD ECONOMICS AND BILLING: Fundamentals of pricing, AURI,PURI, NURI,Total cost of Ownership (TOC).
AWS CLOUD SECURITY: AWS Shared Responsibility Model, AWS IAM (Identity and Access Management),Elastic Load Balancing (ELB), Amazon CloudWatch.

Web references and AWS LMS portal :

https://aws.amazon.com/ec2
https://aws.amazon.com/ecs/
https://aws.amazon.com/about-aws/global-infrastructure/

VISEMESTER: JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6J02:: SOFTWARE TESTING TOOLS				

COURSE OUTCOMES:

At the end of the course, students are able to

CO1: Learn Manual testing techniques and software test levels
CO2: PracticeJava Programme for Selenium and Test frame works
CO3: Learn Apache JMeter and Building a JMeter Test Plan
CO4: Running Multiple Scripts with JMeter and Different Types of JMeter Test Plans
CO5: Practicing JIRA and Test Management In JIRA (Using Zephyr Plug-in)

UNIT-I:

Manual Testing: Software Development Life Cycle (Requirements Gathering, Analysis and Planning, Software Design, Coding/Implementation, Testing, and Release and Maintenance Phase)

Software Test Levels (Unit Testing, Integration Testing, System Testing, and Acceptance Testing)
Software Test Types
Software Test Design Techniques
Software Test Life Cycle
Software Documents
Software Testing Standards
Software Testing certification/s

UNIT-II:

'Selenium with Java': Java Programme for Selenium (Data Types, Variables, Operators, Control Flow, Strings, Arrays, IO, Methods, Exception Handling, and Object-Oriented Programming.)

- Selenium WebDriver (Web/HTML Elements, Inspecting Web Elements, Locating Elements, Selenium WebDriver API commands, Wait statements, and Page Object Model.)
- TestNG Testing Framework (Create Test cases, Prioritise Test cases, Grouping Test Cases, Batch Testing, and Generating Test Results.)
- Automation Framework

UNIT-III:

JMeter:

- Introduction to Apache JMeter
- Elements of JMeter Test Plan
- Building a JMeter Test Plan
- Recording Tests Using JMeter
- Enhancements in Test Scripts

UNIT-IV:

JMeter Result Analysis

- Running Multiple Scripts with JMeter
- Different Types of JMeter Test Plans
- JMeter Distributed (Remote) Testing
- JMeter Functions, Variables and Regular Expressions
- JMeter Best Practices

UNIT-V:

Jira Tool Syllabus:

- Introduction of JIRA
- Getting started with JIRA
- Test Management In JIRA (Using Zephyr Plug-in)
- Defect Management In JIRA
- Advanced Search Using JQL
- Generating Reports In JIRA

Web references:

https://www.lambdatest.com/blog/selenium-with-java/
https://www.gcreddy.com/2021/09/apache-jmeter-syllabus.html
https://www.javatpoint.com/jira-tutorial

VI SEMESTER: JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6J01:: FULL STACK DEVELOPMENT				

Course Outcomes:

At the end of the course, students will be able to
CO1: Identify the Basics concepts of Web Page and Markup Languages
CO2: Develop web Applications using Scripting languages and Frameworks
CO3: Creating and Running Applications using PHP
CO4: Creating First Controller Working with and Displaying in AngularJS and Nested Forms with ng-form
CO5: Working with the Files in React JS and Constructing Elements with Data

Unit- 1: HTML

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols- The World Wide Web-HTTP request message-response message-Web clients Web Servers. Markup Languages: XHTML, an introduction to HTML, History, Versions, Basics, XHTML Syntax and semantics some fundamentals of HTML Elements-Relative URLs-Lists-Tables-Frames-Forms-HTML 5.0

Unit- 2: Cascading Style Sheets (CSS)

Style Sheets: CSS-Introduction to Cascading Style Sheets- Features-Core Syntax-Style Sheets and HTML-Style Rule Cascading and Inheritance- Text Properties-Box Model Normal Flow Box Layout beyond the Normal Flow-CSS3.0, Introducing to Java Script, JavaScript basics, JavaScript objects, JSON.

Unit- 3: PHP

Introduction to PHP, Language Basics, Functions, Strings, Arrays. MYSQL Installation, Accessing MySQL Using PHP, Form Handling, Cookies, Sessions, and Authentication, Tables, Inserting Data into Tables, Selecting Data from a Table, Updating Table, Deleting data from Table, Webpage creation.

Unit- 4: Angular JS

Introducing Angular JS, Starting out with Angular JS, Basic AngularJS, Directives and Controllers, AngularJS Modules, Creating First Controller, working with and Displaying, Arrays, more Directives, working with ng-repeat, Unit Testing in AngularJS, Forms, inputs and Services, Working with ng-model, Working with Forms, Leverage Data-Binding and Models, Form Validation and States, Error Handling with Forms, ngModelOptions, Nested Forms with ng-form, Other Form Controls.

Unit- 5: React JS

Introduction to react, Obstacles and Roadblocks, keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, React DOM, Children, Constructing Elements with Data, React Components, DOM Rendering , Factories.

TEXT BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
3. Brad Green, Shyam Seshadri, AngularJS, Up and Running Enhanced Productivity with Structured Web Apps, Publisher O'Reilly Media
4. Alex Banks, Eve Porcello,Learning React, Functional Web Development with React and Redux Publisher O'Reilly Media

REFERENCE BOOKS:

1. Bert Bates, Kathy Sierra,Head First Java, 2nd Edition Publisher O'Reilly Media, Inc

VI SEMESTER: JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6J02:: BLOCK CHAIN TECHNOLOGY				

Course Outcomes

After the completion of the course, the students are able to

CO1 Discover secure and efficient transactions with crypto-currencies

CO2 Experiment with cryptocurrency trading and crypto exchanges

CO3 Explain bitcoin usage and applications

CO4 Develop a private block chain environment and develop a smart contract on Ethereum

CO5 Build the hyper ledger architecture and the consensus mechanism applied in the hyperledger

Unit-I

CRYPTOCURRENCY AND BLOCKCHAIN- INTRODUCTION:

Blockchain- An Introduction, Distinction between databases and blockchain, Distributed ledger. Blockchain ecosystem - Consensus Algorithms & Types, Blockchain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain - Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains

Unit-II

CRYPTO CURRENCIES: Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies - Digital Signatures - Cryptocurrency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks

Unit-III

BITCOIN: Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem

Unit-IV

ETHEREUM: The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain- Deploying contract from web and console

Unit-V

HYPERLEDGER: Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Block chain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants

TEXT BOOKS

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018

2. Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016

ONLINE REFERENCES

1. https://www.coursera.org/learn/ibm-blockchain-essentials-for-developers

2. https://museblockchain.com/

3. https://www.provenance.org/

4. https://www.coursera.org/learn/blockchain-basics

5. https://steemit.com/

6. https://101blockchains.comhttps://followmyvote.com/

SEMESTER-VI	L	T	P	C
	-	-	3	1.5
20EC6L01:: MICROPROCESSORS AND MICROCONTROLLERS LAB				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Write ALP for Arithmetic operations (K3)

CO2: Explain 8086 interfacing with different peripherals and implement programs (K2).

CO3: Write Programs in 8051(K3).

CO4: Write Programs in ARM CORTEX M3 PROCESSOR using KEIL MDK ARM (K3).

LIST OF EXPERIMENTS (Minimum of TEN Experiments has to be performed):

PART-A (Minimum of FIVE Experiments has to be performed)

8086/8051 Programs

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic operations.
4. Unpacked BCD to ASCII
5. String manipulations, sorting and searching
6. Counters and Time Delay

PART-B (Minimum of THREE Experiments has to be performed)

Peripherals and Interfacing Experiments

1. Traffic light controller
2. Stepper motor control
3. Key board and Display
4. Serial interface and Parallel interface
5. A/D and D/A interface and Waveform Generation

PART-C (Minimum of TWO Experiments has to be performed)

Conduct the following experiments using ARM CORTEX M3 PROCESSOR using KEIL MDK ARM

1. Write an assembly program to multiply two 4-bit binary numbers.
2. Write an assembly program to find the sum of the first 10 integer numbers.
3. Write a program to toggle LED every second using timer interrupt.

Equipment Required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module
6. DAC module
7. Stepper motor module
8. Keyboard module
9. LED, 7-Segment Units
10. Digital Multimeters
11. Bread Boards
12. KEIL MDK ARM

ONLINE TOOL:

http://vlabs.iitb.ac.in/vlabs-dev/labs/8051-Microcontroller-Lab/labs/exp1/simulation.php

SEMESTER-VI	L	T	P	C
	-	-	3	1.5
20EC6L02 :: VLSI DESIGN LAB				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Describe the fundamental concepts of hardware description language (HDL).(K1)

CO2: Compare and simulate combinational and sequential digital circuits using Modelsim&

Xilinx – VHDL language.(K4)

CO3: Explain the Read and Write operations of RAM and Arithmetic and Logical units.(K2)

CO4: Develop different logic gates and logic cells using the microwind tool.(K3)

Minimum Twelve Experiments 8 from Part-A and 4 from Part-B to be conducted:

PART-A

1. Develop VHDL Programs in different models for all logic gates.
2. Write the VHDL Programs for half adder and full adder.
3. Explain the operation of both binary encoder and binary decoder using HDL programs.
4. Construct 32:1 multiplexer using 8:1 multiplexers and write VHDL program.
5. Implement (7, 4) Hamming code generator and develop VHDL program for it.
6. Verify the outputs for different input combinations in 4 bit comparator using VHDL program.
7. Simulate the operation of D- Flip-flop in behavioral model VHDL Program.
8. Design and develop HDL program for 3-bit Johnson counter.
9. Explain the operation of 4 bit counter using the structural model VHDL Program.
10. Demonstrate PIPO Shift register operation using mixed model VHDL Program.
11. Universal shift register operation explanation using VHDL Program.
12. VHDL program for verifying different operations of 16*4 RAM.
13. Stack and Queue implementation using 16*4 RAM by VHDL Program.
14. Perform both Arithmetic and Logical operation using ALU and develop VHDL Program.

PART-B

1. Sketch the Layout of the Invertor using Microwind tool.
2. Develop the layout of Universal gates using Microwind tool.
3. Design XOR gate layout using Microwind tool.
4. Construct Half Adder Layout using Microwind tool.
5. Draw the Layout of 2:1 Mux usingMicrowind tool.
6. D- flip-flop layout design using Microwind tool.

EQUIPMENT REQUIRED FOR LABORATORIES:

1. XILINX ISE/ XILINX VIVADO/MICROWIND/MENTOR GRAPHICS TOOLS
2. CPLD & FPGA Trainer Kits

ONLINE TOOL:

https://vlsi-iitg.vlabs.ac.in/

SEMESTER-VI	L	T	P	C
	-	-	3	1.5
20EC6L03:: MICROWAVE AND OPTICAL COMMUNICATIONS LAB				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Summarize about different types of modes in wave guides and characteristics (K2)

CO2: Interpret different types of components which are used in microwave communication.(K3)

CO3: Understand the optical fiber components such as sources, detectors and amplifiers. (K2)

CO4:Describe the key features of optical fiber, and describe various types of optical fibres and coupling losses (K1)

PART-A

1. Reflex Klystron Characteristics.
2. Negative Resistance characteristics of Gunn Diode.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. Microwave Frequency Measurement.
6. VSWR Measurement (LOW & HIGH).
7. Radiation Pattern of Horn antenna
8. Measurement of scattering parameters of E-Plane Tee.
9. Measurement of scattering parameters of Magic Tee.

PART-B

1. Characteristics of Light Emitting Diode.
2. Characteristics of LASER.
3. Study of Propagation loss in Optical fiber.
4. Measurement of Data rate for Digital Link.
5. Measurement of NA.
6. Setting up Fiber Optics voice link using Frequency Modulation.

Additional Experiments:

1. Characteristics of Microwave Crystal Detector.
2. Frequency Modulation and Demodulation using Fiber Optic Link.
3. Study of Rise time and fall time distortion in an optical link
4. Data Communication through Fiber Optic link using RS232.

ONLINE TOOL:

http://eem-iitd.vlabs.ac.in/experiments.html

SEMESTER-VI	L	T	P	C
	1	-	-	2
20HS6S01:: ADVANCED COMMUNICATION SKILLS LAB				

At the end of the course, students will be able to prepare themselves for their career which may require them to listen and speak in English both for their professional and interpersonal communication in the globalized context.

Course objectives

- Analyzing a topic of discussion and relating to it.
- Planning and executing an assignment creatively.
- Presenting ideas coherently within a stipulated time.
- Communicating ideas effectively in prescribed oral activities.
- Applying relevant writing formats for resumes and presentations.
- Facing interviews with confidence.

Course outcomes

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

- Gather ideas and organize information relevantly and coherently
- Participate in group discussions and face interviews with confidence
- Write a Resume with covering letter
- Make oral presentations and public speaking
- Take part in social and professional communication.

SYLLABUS

The following course content is prescribed for the **Advanced English Communication Skills Lab:**

UNIT I
Communication Skills

- Introduce Yourself
- JAM
- J2M

➢ Identifying one‟s career objective, projecting strengths and skills, organization of ideas within given time.

UNIT II
Interaction Skills

- Body Language
- Role- Plays

➢ Students start a conversation - Respond appropriately and relevantly in different situations with right body language.

UNIT III
Oral Skills

- Presentations
- Public Speaking

➢ Planning preparation and presentation - organization of ideas with clarity , coherence and style.

UNIT IV

Writing Skills

- Covering Letter
- Resume Writing

➢ To communicate the ideas relevantly and coherently in writing.

UNIT V

Team Work Skills

- Group Discussion

➢ Dynamics of Group Discussion - Modulation of voice, Body language , relevance , fluency and coherence.

UNIT VI

Interview Skills

➢ Pre-interview planning, opening strategies, answering strategies, interview through tele and video conference.

Reference Books:

1. Ashraf Rizvi- Effective Technical Communication - McGraw Hill Education- 2017.

2. MadhaviApte - A Course in English Communication – Prentice - Hall of India- 2007.

3. Dr. ShaliniVerma - Body Language – Your Success Mantra- S. Chand- 2006.

4. Sunita Mishra &C.Murali Krishna- Communication Skills for Engineers - Pearson Education - 2007.

SEMESTER-VI	L	T	P	C
	2	-	-	-
20BM6M01:: PROFESSIONAL ETHICS AND INTELLECTUAL PROPERTY RIGHTS				

COURSE OUTCOMES:

Students are able to

CO1.Identify the professional roles played by an engineer and illustrate the process of Social experimentation
CO2.Determine Engineer‟s responsibilities and rights towards the society
CO3.Analyze various aspects of Intellectual Property Rights and recognize the process of protecting the copyrights
CO4.Describe the registration process of Patents and trademarks and also demonstrate the concept of trade secrets and cybercrimes

UNIT-I
ENGINEERING ETHICS:
Importance of Engineering Ethics-–Professional and Professionalism –Professional Roles to be played by an Engineer –Professional Ethics.

UNIT-II
ENGINEERING AS SOCIAL EXPERIMENTATION :
Role of engineering in knowledge society- Knowledge acquired – Conscientiousness – Relevant Information Engineers as Managers, Consultants, and Leaders.
ENGINEERS' RESPONSIBILITY FOR SAFETY AND RISK: Role and importance of Safety and risk Types of Risks –Threshold Levels for Risk– Risk Benefit Analysis.

UNIT-III
ENGINEERS' RESPONSIBILITIES AND RIGHTS:
Collegiality-Conflict of Interest-solving conflict problems – Ethical egoism-Collective bargaining - Confidentiality-Acceptance of Bribes/Gifts--Occupational Crimes-industrial espionage-Whistle Blowing types of whistle blowing.

UNIT IV
INTELLECTUAL PROPERTY AND COPY RIGHTS:
Introduction to Intellectual Property Law - Types of Intellectual Property – Infringement, Copyrights: Introduction to Copyrights – Principles of Copyright – Rights Afforded by Copyright Law –Copyright Formalities and Registration.

UNIT-V
PATENTS AND TRADEMARKS:
Introduction to Patent Law –Rights under Patent Law – Patent Requirements – Patent Application Process and Granting of Patent – Double Patenting – Patent Cooperation Treaty. Trademarks:Introduction to Trade Mark – Trade Mark Registration Process – Trade Markmaintenance – Likelihood of confusion

TEXT BOOKS:
1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar- "Engineering Ethics and Human Values" by PHI Learning Pvt. Ltd-2009.
2. Deborah E.Bouchoux, "Intellectual Property". Cengagelearning , NewDelhi, BS Publications (Press)
3. PrabhuddhaGanguli,„ Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi

SEMESTER-VII: PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20EC7E01: OPTO ELECTRONIC DEVICES				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Understand the basics of solid-state physics(K2)

CO2: Describe the basics of display devices and lasers(K1,K2)

CO3: Observe the knowledge about optical detection devices(K1,K2)

CO4: Explain the design of optoelectronic modulator and integrated circuits(K2,K3)

UNIT-I: 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:

Introduction, Photo Luminescence, Cathode Luminescence, Electro 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:

Thermal detectors, Photon devices- Photo emissive detectors, Photo conductive detectors, Photo-multipliers (PMT), Image intensifiers, Photo diodes- PIN & APD, Photo transistors. Detector Performance, Design of detector arrays: CCD, Solar cells.

UNIT-IV: OPTOELECTRONIC MODULATOR: Basic principles, Polarization, birefringence. Electro-optic Modulators- electro optic effect, integrated optical modulator, EO materials. Kerr modulators, scanning and switching.

Magneto Optic Modulators: Faraday effect, Accusto-optic Modulators, Magneto-optic modulators.

UNIT-V: OPTO ELECTRONIC ICs AND ADVANCED TECHNOLOGIES:

Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers-fabrication process of Optoelectronic integrated transmitter circuit.

Introduction to LI-FI Technology-working and applications, Flexible and wearable organic optoelectronic devices, Carbon Nano Tubes (CNT) based opto electronic devices.

TEXT BOOKS:

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall ofIndia,2017.
2. Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw- Hill International Edition, 2019.

REFERENCES:

1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India,2015.
2. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall, 2016.

E-REFERENCES:

1. https://www.researchgate.net/publication/320222765_optoelectronic_Devices_and_Materials
2. https://www.science.gov/topicpages/f/future+optoelectronic+devices

SEMESTER-VII: PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20EC7E02: ASIC DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Understand the basics of ASICs and various logic cells (K2)
CO2: Explain the programmable ASICs and its architecture (K2)
CO3: Apply Logic Synthesis, PlacementandRouting (K3)
CO4: Describe the System-on-Chip (SoC) (K1)

UNIT-I: INTRODUCTION

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

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: PROGRAMMABLEASICARCHITECUTRE

Architecture and configuration of Artix / Cyclone and Kintex Ultra Scale / Stratix FPGAs – Micro-Blaze / Nios-based embedded systems – Signal probing techniques.

UNIT-IV: LOGIC SYNTHESIS, PLACEMENTANDROUTING

Logic synthesis - Floor Planning Goals and Objectives, Measurement of Delay in floor planning, Floor planning tools,I/O and Power planning, Clock planning, Placement Algorithms, Routing: Global routing, Detailed routing,Special routing.

UNIT-V: SYSTEM-ON-CHIPDESIGN

SoC Design Flow, Platform-based and IP-based SoC Designs, Basic Concepts of Bus-Based Communication Architectures, High-performance filters using delta-sigma modulators, SOCs for real-time applications.

TEXT BOOKS:

1. M.J.S.Smith, " Application - Specific Integrated Circuits", 3rd edition, Pearson,2015.
2. Steve Kilts, “Advanced FPGA Design,”1st edition, WileyInter-Science, 2017.

REFERENCES

1. Roger Woods, John McAllister, Dr.Ying Yi, Gaye Lightbod, “FPGA-based Implementation of Signal Processing Systems”, 1st edition,Wiley,2017.
2. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", 1st edition,Mc Graw Hill, 2015.

E-REFERENCES

1. https://www.einfochips.com/blog/asic-design-flow-in-vlsi-engineering-services-a-quick-guide/
2. https://www.javatpoint.com/verilog-asic-design-flow.

SEMESTER-VII: PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20EC7E03: SPEECH PROCESSING				

OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Illustrate the speech production system and describe the time domain methods.(K1,K3)

CO2: Describe the frequencydomain methods in speech processing (K1)

CO3: Explain the linear predictive analysis of speech processing.(K2)

CO4: Develop various speech enhancement techniques.(K3)

UNIT- I: SPEECH PRODUCTION:
Speech signal; Speech Production process: Lungs, Larynx and Vocal folds, Vocal tract; Acoustic Phonetics: Vowels, Diphthongs, Semi vowels, Nasals, Unvoiced fricatives, Voiced fricatives, Voiced and unvoiced stops; Acoustic theory of speech production; Digital model for speech signals.

UNIT-II: TIME DOMAIN METHODS FOR SPEECH PROCESSING: Time domain parameters of Speech signal, Methods for extracting the speech parameters (Energy, Average Magnitude, Zero crossing Rate), Silence Discrimination using Zero crossing Rate and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

UNIT-III:FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING: Short-Time Fourier Transform (STFT), Sampling the STFT in Time and Frequency, The Speech Spectrogram, homomorphic speech analysis: homomorphic systems for convolution, Definition of the Cepstrum and complex Cepstrums, pitch extraction using homomorphic speech processing.

UNIT-IV: LINEAR PREDICTIVE ANALYSIS OF SPEECH: Linear prediction of speech, auto correlation, formulation of Linear prediction coding equations, Solution of Linear prediction coding equations, Levinson Durbin recursion, Application of Linear prediction coding parameters: Pitch detection using Linear prediction coding parameters, Deriving acoustic parameters PLPs, LPCCs, and MFCCs from LPCs

UNIT-V:SPEECH ENHANCEMENT: Nature of Interfering Sounds; Speech Enhancement (SE) Techniques: Basic principles of Spectral Subtraction; Wiener Filtering; Wiener filtering for noise reduction; Statistical-Model-based method: Maximum-likelihood estimator for speech enhancement; Applications of speech enhancement.

TEXT BOOKS
1. Lawrence R. Rabiner and Ronald W. Schafer, "Introduction to Digital Speech Processing" now Publishers Inc. Hanover, USA, 2007.
2. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Ed., PE, 2008.
3. Philipos C. Loizou, "Speech Enhancement" 2ndEdition, CRC Press, Taylor & Francis Group, 2013

REFERENCES
1. Douglas O Shaughnessy, "Speech Communications Human and Machine" 2nd Edition, IEEE Press, 2000.
2. Speech and Audio Signal Processing, Processing and Perception of Speech and Music- Ben Gold and Nelson Morgan, Wiley- India Edition, 2006.

SEMESTER-VII: PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20EC7E04: TELECOMMUNICATION SWITCHING NETWORKS				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1:Explain the basic switching system and the operation of various switching techniques. (K2, K3)

CO2:Analyze the signaling techniques like routing, transmission plans, numbering plans and charging plans in telephone networks.(K2)

CO3:Describe layered network architecture and various types of data networks and analyze ISDN and BISDN.(K1)

CO4: Illustrate DSL and SONET and study respective networks and frame transmissions involved.(K2)

UNIT-I: TELECOMMUNICATIONS TRANSMISSION:

Basic Switching System, Simple Telephone Communication, evolution of switchingsystems –Strowger switching systems, cross bar switching, Electronic Switching – Space Division Switching, Time Division Switching, Combination Switching, Control of Switching Systems: Call processing functions, common control, stored program control.

UNIT-II: 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, Network Traffic load and parameters, Grade of service and blocking probability.

UNIT-III: DATA NETWORKS:

Data transmission in PSTNs, Data Rates in PSTNs, Modems, Switching Techniques for data Transmission, Circuit Switching, Store and Forward Switching Data communication Architecture, ISO-OSI Reference Model, LAN, MAN, WAN, Repeaters, Bridges, Routers and Gateways.

UNIT-IV: **INTEGRATED SERVICES DIGITAL NETWORKS:**

Motivation for ISDN, New services, Network and Protocol architecture, Transmission Channels, User Network Interface, signaling, Numbering and Addressing, Service characterization, Interworking, ISDN standards, Broadband ISDN, Voicedata Integration.

UNIT-V:DSL TECHNOLOGY:

ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS.

SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries and Higher rate of service.

TEXTBOOKS:

1. ThiagarajanVishwanathan,“Telecommunication Switching Systems and Networks”;PHI Publications, 2015.
2. J.E.Flood,“TelecommunicationsSwitching,TrafficandNetworks”,PearsonEducation,2012.

REFERENCES

1. Wayne Tomasi, “Advanced Electronic Communications System”, PHI,2014
2. Behrouz A Frouzan, “Data Communication and networking”, 4th Edition, Tata McGraw Hill.

E-REFERENCES

1.www.wikipedia.com
2.www.slideshare.com

SEMESTER-VII : PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20EC7E05: ANALOG IC DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Determinethe significance of different biasing styles and apply them in designing analog ICs. (K1,K3)

CO2: Observe the functionality of Current Mirrors, Current Sinks, Differential amplifiers and Current amplifiers. (K1,K2)

CO3: Describe the basic building blocks of analog ICs like current mirrors, current sources, current sinks, two-stage CMOS Power amplifiers and comparators. (K2)

CO4: Identify and understand the characterization of different types of analog Comparators (K1)

UNIT-I: BASICS OF ANALOG IC DESIGN :

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT-II:MOS DEVICES AND MODELING: The MOS Transistor, Passive Components-Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling -Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT–III: COMPARATORS: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, DiscreteTime Comparators.

UNIT–IV:CMOS AMPLIFIERS: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures, Mismatch-offset cancellation techniques, Reduction of Noise by offset cancellation techniques, Alternative definition of CMRR.

UNIT–V: CMOS OPERATIONAL AMPLIFIERS: Design of CMOS Op-Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

TEXT BOOKS

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, 5th Edition, TMH Publications 2017 (UNITS 1,2,4,5)

2. Philip E. Allen and Douglas R. Holberg, “CMOS Analog Circuit Design”, Oxford University Press, International Second Edition/Indian Edition, 2016.(UNIT 3)

REFERENCE BOOKS

B Razavi, B., Design of Analog CMOS Integrated Circuits,2nd edition, Tata McGraw Hill, 2017.

C Gregorian, R. and Temes, G.C., “Analog MOS Integrated Circuits for Signal Processing,”, John Wiley.

E-REFERENCES:

1.https://lecturenotes.in/subject/528/analog-ic-application.ica

2..https://nptel.ac.in/courses/108/108/10819221/

SEMESTER-VII : PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20EC7E06: EMBEDDED SYSTEMS				

COURSE OUTCOMES:

After completion of the course, students are able to
CO1: Understand the basic knowledge about fundamentals of Embedded Systems (K2)
CO2: Describe various components used in Embedded systems (K1)
CO3: Understand the PIC, AVR controllers and Processors (K2)
CO4: Use the design case study of Embedded Systems(K3)

UNIT-I: Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

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

UNIT-III: Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT-IV: Overview of PIC, AVR controllers and ARM processors: Introduction to PIC family of Microcontroller. Introduction to AVR family of microcontrollers. Introduction to ARM family Processors

UNIT-V: Design Case studies: Digital clock, Battery operated smartcard reader, Automated meter reading system, Digital camera.

TEXT BOOKS:
1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill, 2017 (Unit I-V)
2. David E Simon, "An Embedded Software Primer", Pearson Education, 2015.

REFERENCE BOOKS:
1. Raj Kamal, "Embedded Systems", 3rd edition,TMH.2017.

E-REFERENCES:
1. Embedded Systems
https://archive.org/details/K.ShibuIntroductionToEmbeddedSystemsTmh2009/page/n5/mode/2up?view=theater
2. https://nptel.ac.in/courses/108102045

SEMESTER-VII: PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20EC7E07: VIDEO PROCESSING				

COURSE OUTCOMES:

After the completion of this course, Students will able to
CO1: Explain the characteristics of a Video Raster.(K3)
CO2: Compare different types of Spatial Frequency Response and Spatio-temporal Frequency Response.(K2)
CO3: Describe the characteristics of the Sampling Video in Two Dimensions. (K1)
CO4: Understand the concept of Down-Conversion and Conversion between Arbitrary Lattices, Two-Dimensional Motion Models.(K2)

UNIT 1:VIDEO FORMATION, PERCEPTION AND REPRESENTATION
Video Capture and Display Principles of Color Video, Video Cameras, working of digital camera (block diagram), camera resolution and color conversion, types of video cameras, Video Display, Composite versus Component Models. Gamma Connection, Analog Video Raster Progressive vs Interlaced scans. Characterisation of Video Raster, Spatial and Temporal Resolution, Signal Bandwidth, Multiplexing of Luminance, Chrominance and Audio.Digital Video Notation.

UNIT 2:FOURIER ANALYSIS OF VIDEO SIGNALS AND FREQUENCY RESPONSE OF THE HUMAN VISUAL SYSTEM.
Multidimensional Continuous-Space Signals and Systems.Multidimensional discrete-Space Signals and Systems.Frequency Domain Characterization of Video Signals.Spatial and Temporal Frequencies. Temporal Frequencies Caused by Linear Motion.Frequency Response of the Human Visual System Temporal Frequency Response and Flicker Perception. Spatial Frequency Response.Spatiotemporal Frequency Response.Smooth Pursuit Eye Movement.

UNIT 3: VIDEO SAMPLING
Basics of the Lattice Theory. Sampling of Video Signals Over Lattices Required Sampling Rates. Sampling Video in Two Dimensions: Progressive versus Interlaced Scans. Sampling a Raster Scan: BT.601 Format Revisited, Sampling Video in Three Dimensions, Spatial and Temporal Aliasing, Filtering Operations in Cameras and Display Devices Camera Apertures, Display Apertures.

UNIT 4:VIDEO SAMPLING RATE CONVERSION
Conversion of Signals Sampled on Different Lattices Up-Conversion. Down-Conversion, Conversion between Arbitrary Lattices, Filter Implementation and Design, and other Interpolation Approaches. Sampling Rate Conversion of Video Signals Deinterlacing.Conversion between PAL and NTSC Signals, Motion-Adaptive Interpolation.

UNIT 5: VIDEO DATA ACQUISITION AND FORMATS
Video data representation, sensors for video acquisition, Visible, IR, thermal and other forms of video data, difference between medical video and generic video, Color perception and specifications,color representation, video formats (NTSC, SECAM, PAL, VGA, QVGA, SVGA, XGA, HD, WUXGA, and QSXGA), video storage requirements, video indexing, video summarization and retrieval.
Real-Time applications-Visual Object Tracking, Deep Learning based video processing.

TEXTBOOKS :

1. J.R.Ohm "Multimedia Communication Technology", 1st edition, Springer Publication, 2013
2. David Bull et al, "Video Coding for Mobile Communications",1st edition, Academic Press, 2012

REFERENCES:

1. A.I.Bovik, "Handbook on Image and Video Processing",1st edition,Academic Press, 2014.
2. Tekalp "Digital Video Processing",2nd edition, Prentice Hall, 2014.

E-REFERENCES:

1.https://nptel.ac.in/courses/117104020
2.https://in.mathworks.com/solutions/image-video-processing/video-processing.html

SEMESTER-VII: PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20EC7E08: GLOBAL POSITIONING AND NAVIGATION SATELLITESYSTEMS				

Course outcomes:
Upon completion of this course, the student would be able to

CO1: Describe the concepts of GNSS-based positioning methods, the core components of a satellite navigation system and their purposes**.**
CO2: Estimate and represent the GPS coordinate frames and GPS orbits.
CO3: Analyze the impact of various error sources on the precision of positioning.
CO4: Dramatize the examples of their role of goods and services based on the GSP in sustainable development.

UNIT - I

Overview of GPS: Basic concept, Evaluation of GPS, GPS configuration, GPS working principle, System architecture, Space segment, Control segment, User segment, services of GPS, GALILEO satellite system, GLONASS system, Comparison of GPS, GALILEO and GLONASS,GAGAN, Applications of GPS.

UNIT - II

GPS Signals and Receivers: GPS Signal Generation, GPS Signal Characteristics, GPS Signal structure, GPS Receiver, GPS signal condition, GPS signal Acquisition**,** Anti-spoofing (AS), Selective availability.

UNIT - III

GPS coordinate frames, Time references: Earth-Centered Inertial Coordinate System, Earth-Centered Earth-Fixed Coordinate System, Geodetic System, Geocentric coordinate systems, World Geodetic System, GPS Time, UTC Generation.

UNIT - IV

GPS orbits and satellite position determination: GPS orbital parameters, description of receiver independent exchange format (RINEX)–Observation data and navigation message data parameters, GPS position determination.

UNIT - V

GPS Errors: GPS error models, GPS error sources – clock error, Ionospheric error, Tropospheric Errors, Multipath error, atmospheric delay errors, Receiver noise, Ionospheric effects on GPS signals.

TEXT BOOKS:

1. G.S. RAO, Global Navigation Satellite Systems, 2nd Edition, McGraw-Hill publications, New Delhi, 2010. (UNIT-I-V)

REFERENCE BOOKS:

1. Elliott D. Kaplan, Christopher J. Hegarty -Understanding GPSPrinciples and Applications,Second Edition,**ARTECH HOUSE, 2005**
2. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, „GPS – Theory and Practice", 4th Edition, Springer – Wien, New York , 2001.

E-REFERENCE:

1. https://www.unoosa.org/oosa/sk/ourwork/psa/gnss/gnss.html
2. https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/gps/howitworks/
3. https://www.princeton.edu/~alaink/Orf467F07/GNSS.pdf
4. https://www.euspa.europa.eu/european-space/eu-space-programme/what-gnss
5. https://www.gps.gov/systems/gnss/

SEMESTER-VII: PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20EC7E09:TELEVISION SYSTEMS AND DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Define the TV Pictures, Composite Video Signal, Receiver Picture Tubes and Television Camera Tubes.(K1)
CO2: Explain the working of Monochrome Television Transmitter and Receiver systems.(K2,K3)
CO3: Describe various Color Television systems with a greater emphasis on the PAL system.(K1,K2)
CO4: Interpret the advanced topics in Television systems and Video Engineering.(K2)

UNIT-I: INTRODUCTION:
TV Transmitter and Receivers, synchronization. Television Pictures: Geometric form and aspect ratio, image continuity, interlaced scanning, picture resolution, Composite video signal: Horizontal and vertical sync, scanning sequence. Color signal generation and Encoding: Perception of brightness and colors, additive color mixing, video signals for colors, luminance signal, color difference signals, encoding of color difference signals, formation of chrominance signals.

UNIT-II: TV SIGNAL TRANSMISSION AND PROPAGATION:
Picture Signal transmission, positive and negative modulation, VSB transmission, sound signal transmission, standard channel BW, TV transmitter, TV signal propagation, interference, TV broadcast channels, TV transmission Antennas.

UNIT-III: TV CAMERAS & PICTURE TUBES:
TV cameras: Camera tube types, Vidicon, Silicon Diode Array Vidicon, Monochrome TV camera, Color camera, CCD Image Sensors. Picture tubes: Monochromatic Picture tube, Electrostatic focusing, Beam deflection, picture tube characteristics and specifications, color picture tubes. TV standards.

UNIT- IV: COLOUR TELEVISION SYSTEMS:
NTSC colour TV system, NTSC colour receiver, limitations of NTSC system, PAL colour TV system, cancellation of phase errors. PAL-D colour system, PAL coder, chromo signal amplifier- separation of U and V signals, colour burst separation, Burst phase Discriminator, Ident and colour killer circuits, U and V demodulators, Merits and demerits of the PAL system, SECAM system, merits and demerits of SECAM system.

UNIT- V:ADVANCED TELEVISION SYSTEMS:
Satellite TV technology, Cable TV, Tele text broadcast receiver, digital television, Transmission and reception, projection television, Displays in TV receivers: Flat panel display, LED (Light Emitting Diode), LCD (Liquid Crystal Display), Organic Light Emitting Diode (OLED) and now QLED (Quantum-dot Light Emitting Diode) and IGZO (Indium Gallium Zinc Oxygen).

TEXT BOOKS:

1. R.R.Gulati, "Monochrome Television Practice, Principles, Technology and Servicing, Second edition, New Age International Publishers, 2020 (Unit I,II,IV and V)
2. R.R.Gulati "Modern Television Practice ", New age International Publisher, 2021 (Unit I,III and IV)

REFERENCES:

1. A.M Dhake, “Television and Video Engineering”, Second edition, TMH, 2017.
2. S.P.Bali, “Colour Television, Theory and Practice”, TMH, 2014.

E-RESOURCES:

1. www.nptel.ac.in
2. www.slideshare.net

SEMESTER-VII: PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20EC7E10: LOW POWER VLSI DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Estimate the power dissipation of MOS circuits (K2)

CO2: Develop the various MOS logic circuits (K3)

CO3: Describe the low-power techniques for low-power dissipation (K1)

CO4: Explain the power dissipation of ICs and develop algorithms to reduce power dissipation by software.(K2)

UNIT-I: POWER DISSIPATIONIN CMOS

Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design.

UNIT-II: POWEROPTIMIZATION

Logic level power optimization – Circuit level low power design – Gate level low power design – Architecture level low power design – VLSI subsystem design of adders, multipliers, PLL, low power design.

UNIT-III: DESIGN OF LOW POWERCMOSCIRCUITS

Computer arithmetic techniques for low power systems – reducing power consumption in combinational logic, sequential logic, memories – low power clock – Advanced techniques – Special techniques, Adiabatic techniques – Physical design, Floor planning, placement and routing.

UNIT-IV: POWERESTIMATION

Power Estimation techniques, circuit level, gate level, architecture level, behavioral level, – logic power estimation – Simulation power analysis –Probabilistic power analysis.

UNIT-V: SYNTHESIS AND SOFTWARE DESIGN FORLOWPOWER

Synthesis for low power – Behavioral level transform –Algorithms for low power – software design for low power.

TEXT BOOKS:

1. Kaushik Roy and S.C.Prasad, “Low power CMOS VLSI circuit design”, Wiley,2015.
2. Gary Yeap, “Practical low power digital VLSI design”, Kluwer,1998.

REFERENCES

1. J.B.Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley 2014..
2. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”,Kluwer,2014.

E-REFERENCES

1. https://nptel.ac.in/courses/106105034
2. https://asic-soc.blogspot.com/p/low-power-vlsi.html

SEMESTER-VII: PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20EC7E11: PATTERN RECOGNITION AND MACHINE LEARNING				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Enumerate the basic concepts and explain the techniques of pattern recognition and machine learning (K1, K3).

CO2: Visualize with the various classification and clustering methods (K1).

CO3: Illustrate the various dimensionality reduction techniques and classifiers (K2).

CO4: Apply supervised learning and local model-based pattern recognition (K3).

UNIT-I: INTRODUCTION

Basic concepts of pattern recognition – Pattern recognition example – Main components of a PR system– Design cycle – Learning & Adaptation - Introduction to machine learning - Issues related to machine learning - Learning associations - Classification - Regression - Unsupervised learning - Supervised Learning - Learning class from examples - PAC learning - Noise, model selection and generalization - Dimension of supervised machine learning algorithm

UNIT-II: PATTERN CLUSTERING

Clustering for unsupervised learning and classification - Clustering concept - Criterion functions for clustering - Techniques for clustering - Hierarchical clustering - Partitional Clustering – Fuzzy C-means clustering – Fuzzy K-means clustering Graph-theoretic approach to pattern clustering - Density-based clustering and Spectral clustering - Validity of Clusters.

UNIT-III: PROBABILISTIC MODELS FOR CLASSIFICATION

Bayesian decision theory - Bayes classifier - Minimum error-rate classification - Normal (Gaussian) density – Discriminant functions - Decision surfaces - Maximum-Likelihood estimation - Gaussian mixture models - Expectation-Maximization(EM) method for parameter estimation; Naive Bayes classifier, Non-parametric techniques for density estimation, K-Nearest Neighbors (KNN) method, Hidden Markov Models(HMM).

UNIT-IV: DIMENSIONALITY REDUCTION TECHNIQUES & CLASSIFIERS

Principal Component Analysis, Fisher Discriminant Analysis –Independent Component Analysis - Linear Discriminant Analysis – K Nearest neighbourhood classification – distance measures - Support Vector Machine(SVM) – Kernel function - Probabilistic Neural Network (PNN) classifier.

UNIT-V: LOCAL MODELS &SUPERVISED LEARNING

Competitive learning - Adaptive resonance theory - Self Organizing Map(SOM) -Radial Basis Functions(RBF) - Ensemble learning: Bagging- Boosting-Reinforcement Learning techniques.

Artificial neural networks (ANN): different learning rules, single-layer perceptron, multi-layer neural nets, backpropagation algorithm, feed-forward networks, network training, radial basis function networks, recurrent neural networks.

TEXT BOOKS:

1. Bishop, Christopher M., “Pattern Recognition and Machine Learning”, First Edition, Springer, 2021.
2. E. Alpaydin, Introduction to Machine Learning, Prentice-Hall of India, 2021.

REFERENCES

1. G. James, D. Witten, T. Hastie and R. Tibshirani, Introduction to Statistical Learning, Springer, 2020.
2. Narasimha Murthy.M and Susheela Devi.V, „Pattern Recognition An Introduction", University Press, 2017.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_ee56/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs24/preview

SEMESTER-VII: PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20EC7E12: ADVANCED COMMUNICATION SYSTEMS				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Recognize different generation wireless technologies (K1).

CO2: Demonstrate encoding and decoding of the transmitted data (K2).

CO3: Extend the MIMO channel (K2).

CO4: Explain Multiple access Schemes (K3).

UNIT-I:INTRODUCTION TO WIRELESS COMMUNICATION

Introduction to modern wireless communication systems, Second generation wireless networks, third-generation wireless networks, fourth-generation wireless technologies.

Wireless in local loop, Blue tooth and personal area networks, overview of WIMAX Technologies, Architecture spectrum allocation.

UNIT-II:CHANNEL CODING, TURBO CODES

Channel coding: Overview of code design- Linear block codes-Cyclic Codes. Convolution codes: Trellis diagram- maximum likelihood decoding, Viterbi Algorithm, Concatenated codes, Turbocodes –Low-density parity check codes.

UNIT-III:MIMO

Multiple Antenna Communication: Narrowband MIMO Model- Parallel decomposition of MIMO - MIMO channel capacity: static and fading channel. MIMO diversity gain - Diversity/Multiplexing trade-offs –Space time modulation and coding-Frequency selective MIMO channels.

UNIT-IV:EQUALIZATION ANDMULTI-CARRIER MODULATION

Equalization and Multi carrier modulation: Equalizer noise enhancement, equalizer types, folded spectrum and ISI-free transmission, linear equalizer. Multicarrier modulation: Data transmission using multiple carriers, Multicarrier modulation with overlapping sub-channels.

UNIT-V:MULTIPLE ACCESS SCHEMES

Introduction to multiple access Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), OFDM Spread Spectrum Multiple Access, and Space Division Multiple Access. Overview of GSM, GPRS,EDGE, UMTS,CDMA 2000,HSDPAandLTE.

TEXT BOOKS:

1. Robert.W. HEATHJR.” Foundations of MIMO Communications”,1st edition, Cambridge University Press,2018.

3. Simon Haykin, Michal Mohar,” Modern wireless communications”1st edition, Pearson Education,2011.

REFERENCES

1. Brijesh Verma,“Advanced Communication Systems”, 2nd edition, S.K. Kataria&sons,2022.

2. Iti Saha Mishra, “Wireless communications and networks”, 2nd edition, McGrawHill, 2015.

E-RESOURCES

1. www.nptel.com
2. www.thelearningpoint.net

VII SEMESTER (PROFESSIONAL ELECTIVE-V)	L	T	P	C
	3	-	-	3
20EC7E13: 5G MOBILE COMMUNICATION				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Understand 5G spectrum requirement, its channel model and use cases

CO2: Familiarize with 5G architecture options and physical layer concepts

CO3: Examine the multicarrier techniques and new waveform options for 5G communication and Appraisethe current research avenues in 5G domain

CO4: Illustrate the concept of network slicing and V2V Communication.Also Interpret the Interference and Mobility management in 5G networks

UNIT-I:

5G RADIO SPECTRUM: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies.

5G CHANNEL MODEL: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling.

5G USE CASES AND SYSTEM CONCEPT: Use cases and requirements, 5G system concept.

UNIT-II:

RADIO INTERFACE ARCHITECTURE: 5G architecture options, core network architecture, RAN architecture.

5G PHYSICAL LAYER: Physical channels and signals, 5G frame structure, physical layer procedures (MIMO, Power control, link adaptation, beam forming).

UNIT-III:

5G RADIO-ACCESS TECHNOLOGIES: Access design principles for multi-user communications, multi-carrier with filtering: a new waveform, non-orthogonal schemes for efficient multiple access.

UNIT-IV:

INTRODUCTION TO 5G NETWORK SLICING: Network Slicing, E2E Slicing, SDN and NFV Slicing

VEHICULAR COMMUNICATIONS: From V2V to AV2X, key standards, VC architectures, V2X Use cases.

UNIT-V:

MOBILITY AND HANDOFF MANAGEMENT IN 5G: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.

TEXT BOOKS:

1. Afif Osseiran, Jose F Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016

2. Saad Z. Asif, “5G Mobile Communications Concepts and Technologies”, CRC Press, Taylor & Francis Group, First Edition, 2018

3. Harri Holma, Antti Toskala, Takehiro Nakamura, “5G Technology 3GPP NEW RADIO”, John Wiley & Sons First Edition,2020

REFERENCES :

1. Gordon L. Stuber, “Principles of Mobile Communication”, KLUWER ACADEMIC PUBLISHERS, 2nd Edition, 2002
2. Joseph C. Liberti, Theodore S. Rappaport, “Smart Antennas for Wireless Communications”, Prentice Hall PTR, 1999
3. Ying Zhang, “Network Function Virtualization Concepts and Applicability in 5G Networks”, John Wiley & Sons, 2018.

WEB REFERENCES :

NPTEL: https://www.youtube.com/playlist?list=PLxJYaXA6j4AbpWZmDztACJNA5vA3rvfM0

VII SEMESTER: OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CE7O01 :: SOLID WASTE MANAGEMENT				

Course Outcomes:

Students are able to

1. Recall the classification of solid waste generated.
2. Know the collection systems of solid waste of a town.
3. Analyze the importance of transfer and transport of solid waste.
4. Apply the knowledge in processing of solid waste.
5. Design treatment of municipal solid waste and landfill.

UNIT- I

Introduction to Solid Waste Management:

Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste - sampling and characterization – Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT- II

Collection of Solid Waste:

Type and methods of waste collection systems, analysis of collection system optimization of collection routes– alternative techniques for collection system.

UNIT- III

Transfer and Transport:

Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements.

UNIT- IV

Processing and Treatment:

Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT- V

Disposal of Solid Waste:

Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Text/ Reference books:

1. George Techobanoglous, Frank Kreith , Integrated Solid Waste Management- McGraw Hill Publication, 1993.
2. R.Saravanan, R.Dinesh Kumar, A.Suriya , Muncipal solid waste management, Lakshmi publications-2015.
3. Vesilind, P.A., Worrell, W., Reinhart, D.,“Solid Waste Engineering”, Cenage learning, New Delhi, 2004.

VII SEMESTER: OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CE7O02:: BUILDING PLANNING AND DRAWING				

COURSE OUTCOMES

Students are able to

1. Understand the building bye-laws, plan various buildings as per the building by-laws.
2. Plan the individual rooms with reference to functional and furniture requirements.
3. prepare different sign conventions and bonds
4. Learn the skills of drawing building elements like doors and windows.
5. Develop the skills of Drawing Plans, Sections and Elevations of different buildings.

UNIT-I

BUILDING BYELAWS AND REGULATIONS: Introduction - terminology - objectives of building Bye-laws - floor area ratio - floor space index - principles under laying building bye-laws - classification of buildings - open space requirements - built up area limitations- height of buildings- wall thickness - lightening and ventilation requirements.

UNIT -II

RESIDENTIAL AND PUBLIC BUILDINGS

Residential buildings: Minimum standards for various parts of buildings -requirements of different rooms and their grouping- characteristics of various types residential buildings.

Public buildings: Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation.

UNIT-III

SIGN CONVENTIONS AND BONDS : Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminum alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.

UNIT- IV

DOORS, WINDOWS, VENTILATORS AND ROOFS: Panelled door, panelled and glassed door, glassed windows, paneled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings.

UNIT-V

PLANNING AND DESIGNING OF BUILDINGS: Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram.

TEXT /REFERENCE BOOKS:

1. Y.S. Sane., Planning and Design of buildings, 2010.
2. Gurucharan Singh and Jagadish Singh , Planning, designing and scheduling, 2015.
3. M. Chakravarthi., Building planning and drawing, 2015.
4. „A‟ Series & „B‟ Series of JNTU Engineering College, Anantapur.
5. Shah and Kale , Building drawing, 2013.

VII SEMESTER: OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20EE7O01:: ENERGY AUDITING, CONSERVATION AND MANAGEMENT				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Understand the principles of energy audit
CO2 : Explain the role of Energy Manager and Energy Management program.
CO3 : Design a energy efficient motors and good lighting system
CO4 : Evaluate the methods to improve the power factor
CO5 : Estimate the computational techniques with regard to economic aspects.

UNIT-I : PRINCIPLES OF ENERGY AUDIT

Energy audit- definitions - concept - types of audit - energy index - cost index - pie charts – Sankey diagrams and load profiles - Energy conservation schemes and energy saving potential - Energy audit of industries-energy saving potential - energy audit of process industry - thermal power station - building energy audit– Numerical problems.

UNIT-II : ENERGY MANAGEMENT

Principles of energy management - organizing energy management program - initiating – planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions – language - Questionnaire – check list for top management.

UNIT-III : ENERGY EFFICIENT MOTORS AND LIGHTING

Energy Efficient Motors: Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit.

Lighting : lighting system design and practice - lighting control - lighting energy audit.

UNIT-IV : POWER FACTOR IMPROVEMENT AND ENERGY INSTRUMENTS

Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on p.f - p.f motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.

UNIT-V : ECONOMIC ASPECTS AND COMPUTATION

ECONOMIC ASPECTS: Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis.

COMPUTATION ASPECTS: Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

TEXT BOOKS:

1. Energy management by W.R.Murphy & G.Mckay Butter worth - Heinemann publications - 1982.
2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

REFERENCE BOOKS:

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition – 1995.
2. Energy management by Paul o‟ Callaghan - Mc-graw Hill Book company-1st edition – 1998.
   Energy management and good lighting practice : fuel efficiency- booklet12

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20ME7O01 :: BIO-MECHANICAL ENGINEERING				

COURSE OBJECTIVES: The main objectives of this course are

- To make the student familiar with the fundamentals of biomechanics.
- To gain knowledge about musculoskeletal system.
- To impart knowledge about linear kinetics and angular kinetics
- Make the student to illustrate the mathematical models used in the analysis of biomechanical systems

COURSE OUTCOMES: Students are able to

CO1: Explain about fundamentals of Bio mechanics. [K2]
CO2: Describe the mechanics of musculoskeletal system. [K2]
CO3: Relate the concept of kinetics with human motion. [K3]
CO4: Explain mechanical analysis of human motion. [K3]
CO5: Analyze human movements. [K4]

UNIT-I
INTRODUCTION TO BIOMECHANICS

Principles of mechanics in human movement, Qualitative and Quantitative Analysis, Key mechanical concepts of mechanics and basic units, Nine fundamentals of biomechanics, Nine principles for application of Biomechanics.

UNIT-II
MECHANICS OF MUSCULOSKELETAL SYSTEM

Principles of joint motions, Muscle structures, Mechanical method of muscle action analysis, Tissue loads and forces, Biomechanics of bones and ligaments, Three mechanical characters of muscle, stretch-shortening cycle (SSC).

UNIT-III
LINEAR KINETICS AND ANGULAR KINETICS

Vector analysis of angle of pull and muscle angle pull, Contact forces, Impulse-Momentum Relationship, Force-Time Principle, Work-Energy relationship, Segmental interaction principle, Torque, Equilibrium, Center of gravity and Principle of balance.

UNIT-IV
MECHANICAL ANALYSIS OF HUMAN MOTION

Linear kinematics - linear kinematic analysis, position and displacement, velocity and speed, acceleration, differentiation and integration, kinematics of running, kinematics of projectiles, equations of constant acceleration, Angular kinematics - angular motion, measurements of angles, types of angles, representation of angular motion vectors, lower extremity joint angles, relationship between angular and linear motion, angular kinematics of running.

UNIT-V
APPLICATIONS OF MEDICAL REHABITATION

Qualitative analysis of kicking technique, batting, catching, throwing techniques, injury risk assessment, equipment design for strength training, Injury mechanics, injury prevention.

TEXT BOOKS:

1. Ronald L. Huston, Principles of Biomechanics,1st edition CRC Press, 2019
2. Joseph E. Muscolino, " Kinesology", 3rd edition, Mosby, 2016.
3. Subrata Pal, "Textbook of Biomechanics", 1st edition, Springer US, 2016.

REFERENCE BOOKS:

1. Duane Knudson, "Fundamentals of Biomechanics", 2nd edition, Springer, 2013.
2. Ajay Bahl, "Basics of Biomechanics", 1st edition, Jaypee Brothers Medical Publishers, 2010.
3. Robert frost, "Applied Kinesiology", 1st edition, North Atlantic Books, 2013
4. David A. Winter, "Biomechanics and Motor Control of Human Movement", John Wiley & sons, 2009.

WEB REFERENCE:

1. https://archive.nptel.ac.in/courses/112/105/112105305/
2. https://archive.nptel.ac.in/courses/112/106/112106248/

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20EC7O01 :: INTRODUCTION TO GLOBAL POSITIONING SYSTEMS				

Course outcomes:
Upon completion of this course, the student would be able to

CO1: Describe the concepts of GPS-based positioning methods, the core components of a satellite navigation system and their purposes**.**
CO2: Estimate and represent the GPS coordinate frames and GPS orbits.
CO3: Analyze the impact of various error sources on the precision of positioning.
CO4: Dramatize the examples of their role of goods and services based on the GSP in sustainable development.

UNIT - I
Overview of GPS: Basic concept, system architecture, space segment, user segment, services of GPS, applications of GPS.
UNIT - II
GPS Signals: Signal structure, anti-spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.
UNIT - III
GPS coordinate frames, Time references: Geodetic and Geocentric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.
UNIT - IV
GPS orbits and satellite position determination: GPS orbital parameters, description of receiver independent exchange format (RINEX)–Observation data and navigation message data parameters, GPS position determination.
UNIT - V
GPS Errors: GPS error models, GPS error sources – clock error, Ionospheric error, Tropospheric Errors, Multipath error, atmospheric delay errors, Receiver noise, Ionospheric effects on GPS signals.

TEXT BOOKS:
1. G. S. RAO, Global Navigation Satellite Systems, 2nd Edition, McGraw-Hill publications, New Delhi, 2010. (UNIT-I-V)

REFERENCE BOOKS:
1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, „GPS – Theory and Practice", 4th Edition, Springer – Wien, New York ,2001. (UNIT-I-III)
2. Sateesh Gopi, "Global Positioning System: Principles and Applications", 3rd Edition, TMH, 2005. (UNIT-I-II)
3. James Ba – Yen Tsui, „Fundamentals of GPS receivers – A software Approach", 3rd Edition, John Wiley & Sons,2001. (UNIT-IV-V)
4. Elliot D. Kaplan, "Understanding GPS Principles and Applications", 2nd edition, Artech House, 2005. (UNIT-I-III)

E-REFERENCE:

1. https://www.unoosa.org/oosa/sk/ourwork/psa/gnss/gnss.html
2. https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/gps/howitworks/
3. https://www.princeton.edu/~alaink/Orf467F07/GNSS.pdf
4. https://www.euspa.europa.eu/european-space/eu-space-programme/what-gnss
5. https://www.gps.gov/systems/gnss/

VII SEMESTER: OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20EC7O02 :: REMOTE SENSING				

COURSE OUTCOMES:

After Completion of this course, students are able to

CO1: Understand the subject of satellite communication and remote sensing with the core knowledge of space and satellite, communication and international space laws.

CO2: Comprehend different remote sensing signaling techniques, capable of interpreting the signature of satellite communication from bodies like soil, vegetation and ocean.

CO3: Analyze various components used in satellite communication and remote sensing applications.

CO4: Acquire and keep abreast of designing satellite remote sensing system and also analyze the sensor datafor drawing inferences and conclusions.

UNIT I

Introduction: Historical background, International space laws, Advantages of space-based observations, Global coverage, Multi-scale observation, repeat observation immediate transmission and digital format, Source of information on remote sensing region.

UNIT II

Principles of remote sensing: Fundamentals of remote sensing signals, The electromagnetic spectrum, Terms and units of measurements, EM radiation laws, Spectral signature in the solar spectrum, vegetation reflectance, soil reflectance, water in the solar spectrum, The thermal infrared domain, characteristics of EM radiation in the thermal infrared, Thermal properties of vegetation, Soils thermal domain, thermal signature of water and snow, The microwave region, Atmospheric interaction.

UNIT III

Sensors and remote sensing satellite: Type of sensors, Resolution of sensor systems, spatial, spectral, radiometric, temporal, angular - resolution, passive sensors, photographic cameras, cross and along track - scanners, active sensors, Radar and Lidar, satellite remote missions, Satellite orbits, Landsat programs, SPOT satellites, IRS program, High-resolution commercial satellites, Polar-orbiting meteorological satellites, Terra Aqua, Geostationary meteorological satellites.

UNIT IV

Basis for interpretations of remote sensing images: Constraints in using remote sensing data, types of interpretation, Costs of data acquisitions, end-user requirements, Thematic classification, Generation of biophysical variables, Change detection, spatial patterns, organization of remote sensing project, interpretation phase, presentation of study cases.

UNIT V

Characteristics of photographic images, Feature identification, criteria for visual interpretation, Brightness, color, texture, spatial contexts, shadows, spatial patterns, shape and size, stereoscopic view, period of acquisition, elements of visual analysis, Geometric characteristics of the satellite image, Color composites, Multitemporal approaches.

TEXTBOOKS:

1. Emilio Chuvieco, “Fundamentals of Satellite Remote Sensing”, CRC press, Edition,2009.

REFERENCES:

1.C. H. Chen, "Signal Processing for Remote Sensing‖, CRC press, Edition-2007.
2. R. N Mutagi, "Satellite Communication Principles and Applications", Oxford University Press, 2016.
3. Enrico Del Re, and Marina Ruggieri, "Satellite communications and navigation systems", Springer.

VII SEMESTER: OPEN ELECTIVE - III	L	T	P	C

	3	**-**	**-**	**3**
20CS7O01 :: FULL-STACK DEVELOPMENT				

COURSE OUTCOMES:

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

CO1: Design simple web pages using markup languages like HTML and CSS.
CO2: Create dynamic web pages using DHTML and Javascript that is easy to navigate and use.
CO3: Create web pages using AngularJS.
CO4: Build web applications using Servlet and JSP.
CO5: Understand various operations on Mongo Database.

UNIT-I: HTML and CSS

HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.

CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds, CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II: Client-Side Scripting using JavaScript and DOM

Java Script: The Basics of JavaScript, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, Functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.
DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III: Angular JS

Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV: Servlet and JSP

Servlet: Servlet Basics, Need of Server Side Programming, Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives- include(), forward(), sendRedirect(), HttpServletRequest and HttpServletResponse in Servlet, Servlet and JDBC Integration.
JSP: JSP Basics, JSP Scripting Elements(Declaration, Expression, Scriptlet), Directive Elements(page, include, taglib), Action Elements(jsp:forward,jsp:include,jsp:useBean), JSP Implicit Objects.

UNIT-V Mongo DB

Introduction to Mongo DB: Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Head First Servlet and JSP
4. Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3. Pro Angular JS by Adam Freeman
4. MEAN Web Development by Amos Q. Haviv

VII SEMESTER: OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20BM7O01:: INDUSTRIAL SOCIOLOGY AND PSYCHOLOGY				

UNIT I: Industrial Sociology: Nature and Scope of Industrial Sociology-Development of Industrial Sociology, Factors of social change – the technological factors, the cultural factors, effects of technology on major social institutions, social relations in industry.

UNIT II: Group Dynamics: Concept- factors influencing individual behaviour- Work Teams & Groups, Group Behavior, Group Formation &Development, Decision Making by Individuals, Groups Decision-making process-techniques.

UNIT III: Industrial Psychology: Nature and Meaning of Industrial Psychology, Role of Industrial Psychology, Organizational Attitude, Motivation at work-Theories of Motivation (Theory X and Y, McClelland‟s Theory, Maslow‟s Need Theory, Herzberg‟s Two Factor Theory), Cultural Differences in Motivation.

UNIT IV: Organizational Design and Leadership: Organizational Design & Structure- organizational design- process, Structural differentiation, factors influencing design of organizations, Leadership-concept, types, Leadership vs. Management, Leadership Theories, Emerging issues in Leadership.

UNIT V: Organizational Conflicts and Change Management: - Causes and Consequences of Conflict-Conflict handling techniques, Managing Change, Forces for change in Organization, Resistance to change.

TEXT BOOKS:

1. Nelson, Quick and Khandelwal, ORGB: An innovative approach to learning and teaching Organizational Behaviour. A South Asian Perspective, Cengage Learning, 2012
2. Luthans, Fred, Organizational Behavior, McGraw Hill, 2008.
3. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

REFERENCES BOOKS:

1. Schneider Engno V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi,2011.
2. Ivancevich, Konopaske & Maheson, Organisational Behaviour & Management, 7th edition, Tata McGraw Hill, 2008.
3. L.M.Prasad.,Organisational Behaviour, 5th Edition, Sulthan Chand & Sons.,2014

VII SEMESTER: OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20IT7O01:: INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT				

Course Outcomes:

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

CO1: Apply the process to be followed in the software development life-cycle models.

CO2: Apply the concepts of project management & planning.

CO3: Implement the project plans through managing people, communications and change

CO4: Conduct activities necessary to successfully complete and close the Software projects

CO5: Implement communication, modeling, and construction & deployment practices in software development.

UNIT – I:

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 New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT – III:

Model-Based Software Architectures: A Management perspective and technical perspective.

Work Flows of the Process: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major milestones, Minor Milestones, Periodic status assessments.

UNIT – IV:

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

UNIT – V:

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2)

Text Books:

1. Software Project Management, Walker Royce, Pearson Education, 2005.
2. Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH.

Reference Books:

1. Software Project Management, Joel Henry, Pearson Education.
2. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

VII SEMESTER: OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20CE7O03:: INTRODUCTION TO WATERSHED MANAGEMENT				

Course Outcomes:

Students are able to

CO1: Analyze watershed characteristics to take appropriate management action.
CO2: Quantify soil erosion and design control measures.
CO3: Apply land grading techniques for proper land management.
CO4: Suggest suitable harvesting techniques for better watershed management.
CO5: Apply appropriate models for watershed management.

UNIT-I: Introduction:

Concept of watershed development, objectives of watershed development, need for watershed development, Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics.

UNIT-II: Principles of Erosion:

Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT-III: Water Harvesting:

Techniques of rainwater harvesting- rainwater harvesting from rooftop, surface flow harvesting, farm ponds and dugout ponds, percolation tanks.

UNIT-IV: Land Management:

Land use and Land capability classification, management of forest, agricultural, grassland and wild land, Reclamation of saline and alkaline soils.

UNIT-V: Watershed Modeling:

Data of watershed for modeling, model calibration and validation, advances of watershed models. Integrated and multidisciplinary approach for watershed management.

Text/ References books:

1. Abrar Yousuf and Manmohanjit Singh, „Watershed Hydrology, Management and Modeling", Taylor & Francis Ltd; 1st edition, 2021.
2. Das MM and M.D Saikia, „Watershed Management", PHI Learning Pvt. Ltd, 2013.
3. Murthy VVN, „Land and Water Management", Kalyani Publications, 2007.
4. Murthy J V S, „Watershed Management", New Age International Publishers, 2006.
5. Wurbs R A and James R A „Water Resource Engineering", Prentice Hall Publishers, 2002.

VII SEMESTER: OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20EE7O02 :: INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1 : Illustrate I/O modules of PLC systems and ladder diagrams

CO2 : Demonstrate various types of registers and programming instructions.

CO3 : Examine various types of PLC functions and its applications

CO4 : Assess different data handling functions and its applications.

CO5 : Describe the analog operations and PID modules

UNIT-I : INTRODUCTION TO PLC SYSTEMS

I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O Modules. Digital logic gates - programming in the Boolean algebra system - conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system

UNIT-II : PLC PROGRAMMING & REGISTERS

PLC Programming: Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation.

PLC Registers: Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.

UNIT-III : PLC FUNCTIONS

Timer functions & Industrial applications - counters - counter function industrial applications - Arithmetic functions - Number comparison functions - number conversion functions

UNIT-IV : DATA HANDLING FUNCTIONS

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

UNIT-V : ANALOG PLC OPERATION

Analog modules & systems - Analog signal processing - Multi-bit Data Processing - Analog output Application Examples - PID principles - position indicator with PID control - PID Modules - PID tuning - PID functions.

TEXT BOOKS:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss - Fifth Edition – PHI.
2. Programmable Logic Controllers- Programming Method and Applications –JR.Hackworth & nF.D Hackworth Jr. –Pearson - 2004

REFERENCE BOOKS:

1. Introduction to Programmable Logic Controllers- Gary A. Dunning - 3rd edition – Cengage Learning - 2005.
2. Programmable Logic Controllers –W.Bolton - 5th Edition - Elsevier publisher - 2009.

VII **SEMESTER : OPEN ELECTIVE - IV**	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**
20ME7O02 :: GREEN ENGINEERING SYSTEM				

COURSE OBJECTIVES

- To understand the basic concept of solar energy.
- To gain knowledge about renewable energy.
- To learn about the best energy-efficient systems.
- To impart knowledge about energy-efficient processes

COURSE OUTCOMES: Students are able to

CO1: Recognize the energy scenario and explain solar radiation conversion and collection phenomena. [K3]
CO2: Illustrate solar energy storage methods and applications and also explain the principles of wind energy, classification, conversion and applications [K4]
CO3: Explain the principle, classification, conversion and applications of Biomass, geothermal energy and ocean energy. [K3]
CO4: Describe the importance of energy-efficient systems and interpret the working of a few mechanical and electrical efficient systems. [K2]
CO5: Identify the need of energy efficient processes and analyze their significance in view of their importance in the current scenario and their potential future applications. [K4]

UNIT – I

INTRODUCTION: Energy chain and common forms of usable energy – Present energy scenario – World energy status – Energy scenario in India, Traditional energy systems, Renewable energy – sources and features.

SOLAR RADIATION:

Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sunshine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, types of winds, wind data measurement.

UNIT – III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, biofuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – IV

ENERGY-EFFICIENTSYSTEMS:

ELECTRICAL SYSTEMS: Energy efficient motors, energy-efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmental friendly and energy efficient compressors and pumps

GREEN BUILDINGS: Definition features and benefits.

UNIT – V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment-friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems - vegetable based cutting fluids, zero waste manufacturing.

TEXT BOOKS:

1. Sukhatme S.P. and J. K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2018.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2015.
3. Green Manufacturing Processes and Systems, Edited by J. Paulo Davim, Springer 2016.

REFERENCES:

1. Alternative Building Materials and Technologies, K. S. Jagadeesh, B.V. Venkata Rama Reddy and K. S. Nanjunda Rao, New Age International (P) Ltd.
2. Principles of Solar Engineering, Yogi Goswami, Frank Krieth and John F Kreider, Taylor and Francis
3. Non-Conventional Energy, Ashok V Desai, Wiley Eastern
4. Renewable Energy Technologies, Ramesh & Kumar, Narosa
5. Non-Conventional Energy Sources, G. D. Rai, Kanna Publishers, New Delhi, 2018.

WEB REFERENCE:

1. https://archive.nptel.ac.in/courses/112/104/112104225/
2. https://archive.nptel.ac.in/courses/105/102/105102195/

VII SEMESTER: OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20CS7O03 :: SOFTWARE TESTING TECHNIQUES				

COURSE OUTCOMES:

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

1. Design simple web pages using markup languages like HTML and CSS.
2. Create dynamic web pages using DHTML and Javascript that is easy to navigate and use.
3. Create web pages using AngularJS.
4. Build web applications using Servlet and JSP.
5. Understand various operations on Mongo Database.

UNIT-I: HTML and CSS

HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.

CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds, CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II: Client-Side Scripting using JavaScript and DOM

Java Script: The Basics of JavaScript, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, Functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.

DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III:Angular JS

Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV:Servlet and JSP

Servlet: Servlet Basics, Need of Server Side Programming, Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives- include(), forward(), sendRedirect(), HttpServletRequest and HttpServletResponse in Servlet, Servlet and JDBC Integration.

JSP: JSP Basics, JSP Scripting Elements(Declaration, Expression, Scriptlet), Directive Elements(page, include, taglib), Action Elements(jsp:forward,jsp:include,jsp:useBean), JSP Implicit Objects.

UNIT-V Mongo DB

Introduction to Mongo DB: Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Head First Servlet and JSP
4. Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3. Pro Angular JS by Adam Freeman
4. MEAN Web Development by Amos Q. Haviv

VII SEMESTER: OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20BM7O02:: BUSINESS SKILL DEVELOPMENT				

UNIT- I

Communication in Business Objectives of communication - The Process of Human Communication – Types of Communication-Written, Oral, Visual, Audio Visual - Developing Listening Skills – Types, essentials of good listening and tips.

UNIT -II

Managing Organizational Communication– Formal and Informal Communication – Intra- personal– Inter-Personal Communication-Communication Models - Johari Window, Transactional Analysis, and Social Exchange theory.Role of emotion, barriers to interpersonal communication- Gateways to effective interpersonal communication.

UNIT -III

Nonverbal communication and Body language: Kinesics, Proxemics, Paralanguage, Haptics, handshakes, Appropriate body language and Mannerisms for interviews: business etiquettes- cultural effects of communication. Communication styles.

UNIT- IV

Business Correspondence- Essentials of Effective Business Correspondence, Norms for business letters- Letter for different kinds of situations- Business Letter and Forms, Resume writing, Meeting, Telephonic Communication – Use of Technology in Business Communication.

UNIT -V

Report Writing and Presentation skills – Formal and Informal Reports-Reports and Proposals Prerequisites for effective presentation -Types and Stages of presentation – Communication skills for group discussion and interviews-interview techniques.

Text / Reference Books

1. K Bhardwaj, Professional Communication, IK Int Pub House, New Delhi
2. Rayudu, CS: “Communication”, Himalaya Publishing House, Mumbai.
3. Krizan: “Essentials of Business Communication”, Cengage Learning, New Delhi.
4. UrmilaRai& S.M. Rai, Business Communication, Himalya Publishers,
5. Dalmar Fisher: “Communication in Organizations”, JAICO Publishing House, New Delhi, 2007.
6. Paul Turner: “Organisational Communication”, JAICO Publishing House, New Delhi.
   Meenakshi Rama: “Business Communication”, Oxford University Press, New Delhi

VII SEMESTER – SKILL COURSE	L	T	P	C
	1	-	2	2
20EC7S01:: INTERNET OF THINGS LAB				

COURSE OUTCOMES:

After completion of the course, students are able to

CO1: Understand basic concepts of IOT software, hardware and sensors.
CO2: Interface various sensors with Arduino/Raspberry pi and obtain the output.
CO3: Interface Bluetooth module with Arduino/Raspberry pi and obtain the output.
CO4: Interface Wifi module with Arduino/Raspberry pi and obtain the output using cloud.

EXPERIMENTS:

1) Study the fundamentals of IOT software, hardware and other components.
2) To interface one LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON the LED every 2 seconds.
3) To interface two LEDs with Arduino/Raspberry Pi and write a program to turn ON the LEDs alternatively with a delay of 1 second.
4) To interface the LED/Push button with Arduino/Raspberry Pi and write a program to turn ON the LED when a push button is pressed
5) To interface 7 segment display with Arduino/Raspberry Pi and write a program to display numbers from 0 to 9 and alphabets from A to F in Seven segment display.
6) To interface the Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON the LED at sensor detection.
7) To interface the Ultrasonic sensor with Arduino/Raspberry Pi and write a program for obstacle detection.
8) To interface the Temperature and Humidity (DHT11) sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
9) To interface OLED with Arduino/Raspberry Pi and write a program to print the sensor readings on it.
10) To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to the smartphone using Bluetooth.
11) To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when „1"/"0′ is received from the smartphone using Bluetooth.
12) To interface the Wifi module with Arduino/Raspberry Pi and write a program to upload temperature and humidity data to Thingspeak/Blynk/other clouds.

EQUIPMENT REQUIRED FOR LABORATORIES:

1. ARDUINO KIT /NODE MCU/RASPBERRY PI with necessary sensors
2. WIFI Module (ESP 8266)
3. Necessary Sensors

ONLINE TOOL:

https://tinkercad.com

VII SEMESTER	L	T	P	C
	1	-	2	2
20EC7I01 :: INTERNSHIP II				

VIII SEMESTER	L	T	P	C
	-	-	-	8
20EC8P01 :: PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY				

IV SEMESTER (MINOR COURSES)	L	T	P	C
	3	1	-	4
20EC4N01 :: MICROPROCESSORS AND MICROCONTROLLERS				

COURSE OUTCOMES:

After completion of the course, students are able to,

CO1: Summarize architecture, instructions and addressing modes of 8086 Microprocessor (K2)

CO2: Explain 8086 interfacing with different peripherals and implement programs (K2)

CO3: Examine 8051 Microcontroller interfacing and implement programs (K1)

CO4: Understand the architecture and applications of advanced processors (K2)

UNIT-I: INTRODUCTION TO PROCESSORS

Introduction: Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, CISC and RISC architectures.

8086: Main features, pin diagram/description, 8086 microprocessor family, Architecture of 8086, Register Organization, Memory Segmentation, Memory addresses, Physical Memory Organization, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT-II: 8086 PROGRAMMING

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT-III: 8086 INTERFACING

8086 Interfacing: Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters.

UNIT-IV: 8051 MICROCONTROLLER

8051 microcontroller: Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, LCD Interfacing.

UNIT-V: ADVANCED PROCESSORS

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

Intel Processors: Recent INTEL processors-Pentium processors, i3, i5 and i7 processors.

TEXT BOOKS:

1. Douglas V Hall, SSSP Rao, Microprocessors and Interfacing – Programming and Hardware, 3rd Edition, Tata McGraw Hill Education Private Limited,2017.
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay, The 8051Microcontrollers and Embedded Systems Using Assembly and C, 2nd Edition, Pearson, 2011.
3.Joseph Yiu's,The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Third Edition, Elsevier, 2014

REFERENCES:

1.A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGraw-Hill, 2017.

2.Dr Alexander G. Dean,Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach, Published by Arm Education, Media,2017.

E-REFERENCES:

1. Microprocessors and Microcontrollers
   www.tutorialspoint.com/microprocessor/index.htm

2. Microprocessors and Microcontrollers, NPTEL
   https://nptel.ac.in/courses/108/105/108105102/

V SEMESTER(MINOR COURSES)	L	T	P	C
	3	1	-	4
20EC5N01:: ELECTRONIC DEVICES AND CIRCUITS				

COURSE OUTCOMES

Students are able to:

CO1: Explain the motion of electrons under the influence of externally applied fields and also detailed analysis of the PN junction diode, and various applications of several special semiconductor devices.

CO2: Describe the half wave and full wave rectifiers with filters and familiar knowledge about Semiconductor Devices like Diode, BJT, JFET, MOSFET & UJT, SCR, TRIAC and DIAC.

CO3: Evaluate the biasing of electronic circuits using semiconductor devices like FET and BJT, to amplify weak signals without distortion.

CO4: Discuss and Convert the BJT into its equivalent h parameter model and perform exact and approximate analysis of BJT Amplifiers and also a few applications of semiconductor devices.

UNIT-I

CONDUCTION IN SEMICONDUCTORS:

Insulators, Semiconductors and Metals classification using energy band diagrams, mobility and conductivity, Carrier concentrations in an intrinsic semiconductor, donor and acceptor impurities, drift and diffusion, charge densities in a semiconductor, Generation and recombination of charge carriers, Carrier lifetime, Hall effect, Poisson and continuity equation, law of junction, Fermi Dirac function, Fermi level in a semiconductor having impurities

UNIT- II

SEMICONDUCTOR-DIODE CHARACTERISTICS:

Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Space charge, or Transition, capacitance CT, Diffusion

Capacitance, energy band diagram of PN junction Diode.

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diodeapplications, LED, LCD, Photodiode, Varactor diode, Tunnel Diode, SCR, Construction, operation and characteristics of all the above diodes are required to be considered.

UNIT- III

RECTIFIERS AND FILTERS:

Basic Rectifier setup, Half wave rectifier, ripple factor, full wave rectifier (with and without transformer), Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L-section filter, Pi- section filter, Multiple L- section and Multiple πsection filter, and comparison.

UNIT- IV

TRANSISTOR CHARACTERISTICS:

BJT: The Junction transistor. The transistor current components, Transistor Construction, detailed study of the currents in a transistor and transistor equation.

Transistor configurations: Transistor as an amplifier, characteristics of transistor inCommon Base, Common Emitter and Common Collector configurations, punch through/ reach through, Phototransistor, typical transistor junction voltage values, UJT characters.

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types,construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- V

TRANSISTOR AND FET BIASING AND THERMAL STABILIZATION:

Need for biasing, operating point, load line analysis, BJT biasing-methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE,Ic, and β, Stability factors, (S, S', S"'), Thermistor and Sensistor Compensation, Thermal runaway, Thermal stability. Relevant problems.

FET BIASING

Introduction, Fixed-Bias configuration, Self-Bias Configuration Voltage- Divider Biasing and stabilization.Relevant problems.

UNIT- VI

SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER MODELS:

BJT: Two port network, Transistor hybrid model, determination of h-parameters,conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers,comparison of FET amplifiers.

TEXT BOOKS:

1.J. Millman, C. Halkias, “Electronic Devices and Circuits”, Tata Mc- Graw Hill, Second Edition.

2.B.P.Singh, Rekha Singh, “Electronic Devices and Circuits”, Pearson Publications, Second Edition.

3.David A.Bell , “Electronic Devices and Circuits”, Oxford University Press, Fifth Edition.

REFERENCES:

1.Salivahanan, Kumar, Vallavaraj, “Electronic Devices and Circuits”, Tata Mc-Graw Hill, Second Edition.

2.R.L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Publications, Tenth Edition.

3.BV Rao, KBR Murty, K Raja Rajeswari, PCR Pantulu, “Electronic Devices and Circuits”, Pearson, 2nd edition.

4.Jacob Millman, C. Halkies, C.D. Parikh, “Integrated Electronics”, Tata Mc-Graw Hill, 2009.

VI SEMESTER(MINOR COURSES)	L	T	P	C
	3	1	-	4
20EC6N01::DIGITAL LOGIC DESIGN				

COURSE OUTCOMES:

After completion of the course, students are able to
CO1: Describe the different types of number systems and Boolean algebra.(K1)
CO2: Explain the minimization techniques and universal gates.(K2)
CO3: Construct the logic circuits of various combinational circuits.(K3)
CO4: Explain the behavior of various sequential circuits.(K2,K4)

UNIT-I

BASICS OF DIGITAL SYSTEMS:
Introduction to Number Systems: Number base conversions, Binary to Octal, Octal to Binary, Binary to Hexadecimal, Hexadecimal to Binary, Unsigned and Signed Binary numbers.1"s and 2"s complement of binary numbers, Binary codes, Special codes like Gray codes, Excess-3 codes, Binary to Gray code and Gray code to Binary code conversion.Logic gates.

UNIT-II

SIMPLIFICATION OF BOOLEAN FUNCTIONS:
Minimization Techniques: Boolean postulates and laws, De-Morgan"s theorems, Principle of Duality, Boolean laws, Canonical and Standard forms.Min-terms, Max terms, Sum of Products (SOP) and Product of Sums (POS), Minimization of Booleanexpressions by using Boolean laws and theorems. Karnaugh map minimization: 3 and 4 variables. Design of all logic gates by using Universal gates

UNIT-III

ARITHMATIC LOGIC CIRCUITS:
Half adder, Half Subtractor, Full adder, Full Subtractor,4-bit Parallel adder, 4-bit Adder/Subtractor, Carry look ahead adder, BCD adder, Excess-3 adder, Magnitude Comparators, Code converters.

UNIT-IV

COMBINATIONAL LOGIC CIRCUITS:
Encoders, Decoders, Priority encoder, Multiplexer, De-multiplexers, Realization of Boolean functions using decoders and multiplexers.Memory devices: Random Access Memory, Read only Memory, Programmable Read only Memory, Programmable Logic Devices: Programmable Logic Array, Programmable Array Logic.

UNIT-V

SEQUENTIAL LOGIC CIRCUITS:
Latches, Flip-Flops: RS, D, JK, T and Master-Slave JK, Truth tables and Excitation tables. Flip-Flop conversions, Synchronous and Asynchronous counters, Up-Down counter, Ring counter and Johnson counter. Shift Registers: SISO, SIPO, PISO, PIPO.

TEXTBOOKS:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.

REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.

E-RESOURCES:

1. www.pdfdrive.com
2. www.booksboon.com
3. www.manybooks.com

VII SEMESTER(MINOR COURSES)	L	T	P	C
	3	1	-	4
20EC7N01::SIGNALS AND SYSTEMS				

COURSE OUTCOMES

After completion of the course, students are able to

CO1:Describe the signal fundamentals in terms of types and how to represent the various signals. (K1)

CO2:Explain the concept of Fourier series and Fourier transforms to determine the signal and system characteristics. (K2, K4)

CO3:Demonstrate the concept of sampling theorem, convolution and correlation and also signal transmission through linear systems. (K3)

CO4:Demonstrate the concept of ROC (Region Of Convergence) using Laplace and Z- Transforms to analyze the continuous and discrete-time systems. (K3, K4)

UNIT- I:INTRODUCTION TO SIGNALS AND SYSTEMS

Introduction to Signals: Continuous-time signals and Discrete-time signals- Periodic and Aperiodic signals- Even and Odd signals- Energy and Power signals- Deterministic and Random signals-Complex Exponential and Sinusoidal signals, Standard Functions - Unit impulse and Unit step &Unit ramp signal.

Systems: Continuous time systems and Discrete-time systems- Linear and Non-Linear systems- Time Invariant and Time Variant systems- Causal and Non-causal systems- BIBO system- Memory and Memoryless systems

UNIT-II:CONVOLUTIONAND CORRELATION

Convolution and Correlation: Concept of convolution, Graphical representation of convolution, Properties of Convolution like Cumulative, Associative, Distributive, Shifting, Scaling. Convolution Integral and Convolution Sum.

Cross-correlation and Auto correlation of functions, properties of correlation function with examples Relation between Auto correlation and energy signal, PSD.

UNIT-III:FOURIER SERIES AND SAMPLING

Concept of Orthogonal functions with examples. -Fourier Series Representation of Continuous-Time Periodic Signals. Deriving Fourier transform coefficients.Relation between Trigonometric coefficients and Exponential coefficient, Dirchillet conditions.

Sampling Theorem-Time domain and frequency domain statements- Reconstruction of a Signal from its sample- The Effect of under sampling (Aliasing).

UNIT-IV:CONTINUOUS-TIME TRANSFORMS:

Unilateral and bi-lateral Fourier Transform- Properties of Fourier transform, The Convolution Property, Parseval‟s Theorem, The Multiplication Property. Inverse Fourier Transform. Relation between LT and CTFT.

Laplace Transform: Unilateral and bilateral Laplace Transforms. ROC, Constraints of ROC, Laplace Transform of standard functions, Properties, Inverse Laplace Transform.Initial and Final Value Theorems.

UNIT-V:DISCRETE-TIME TRANSFORMS

Z-transform: Unilateral and bilateral z-transform, ROC, Constraints of ROC, Properties of Z-transforms, Convolution Property, Inverse z-Transform(Direct and Indirect methods). Initial and Final Value theorems, Relation between DTFT and Z-Transform.

TEXT BOOKS

1. B.P. Lathi, "Principles of Linear Systems & Signals", Oxford Press, Second Edition 2005.(UNITS - I,II&III)
2. A.V.Oppenheim, A.S.Willsky and S.H.Nawab,,Signals and Systems – 4nd Edition, Prentice-Hall India.2009 (UNITS –IV&V)

REFERENCE BOOKS

1.
1. John G. Proakis and Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PearsonEducation, 3rd edition, 2002.
2. Simon Haykin and Barry Van Veen,"Signals and Systems", John Wiley & Sons In, 2001.

E-CONTENT

1. https://nptel.ac.in/courses/117/101/117101055/
2.www.pdfdrive.com
3.https://www.tutorialspoint.com/signals_and_systems/signals_and_systems_overview.htm
4. www.booksboon.com
5. www.manybooks.com
6. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011