ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech - Four Year Degree Course

(Applicable for the Batches Admitted from 2020-21)

R-20

(Choice Based Credit System)

NEC
NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

Kotappakonda Road, Yellamanda (P),
Narasaraopet - 522 601, Guntur Dist.,
Andhra Pradesh, INDIA.

R20
Academic Regulations, Course Structure and Syllabus

B. TECH.
Electronics & Communication Engineering
(4 Year Program)

NEC
NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)

Kotappakonda Road, Yellamanda (Post), Narasaraopet – 522601, Guntur District, AP.
Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada, Code: 47,
Accredited by NBA & NAAC A+ Grade, RTA Approved Pollution Test Centre,
ISO 9001: 2015 Certified Institution
Phone: 08647-239905 **Website: www.nrtec.in**

Vision and Mission of the Institute

Vision:

To emerge as a **Centre of excellence** in technical education with a blend of effective **student centric teaching learning** practices as well as **research** for the transformation of **lives and community**.

Mission:

M1: Provide the best class infrastructure to explore the field of engineering and research

M2: Build a passionate and a determined team of faculty with student centric teaching, imbibing experiential, innovative skills

M3: Imbibe lifelong learning skills, entrepreneurial skills and ethical values in students for addressing societal problems

Vision and Mission of the Department

Vision:

To emerge as a **centre of excellence** in Electronics and Communication Engineering through **student centric education** and **research focus** to cater the current and future needs of **society**.

Mission:

M1: To provide best infrastructure for empowering the students with quality education to motivate them towards higher studies and **research**

M2: To provide qualified and experienced faculty for **student centric teaching** in order to mould the students as successful professionals in modern Electronics industry

M3: To inculcate leadership qualities, professional etiquette, **ethical values** and **social** responsibilities

Programme Educational Objectives (PEOs):

The graduates of the programme are able to

PEO1: Demonstrate successful professional careers with strong fundamental knowledge in mathematics, science and engineering to meet real time requirements of industry.

PEO2: Learn continuously with a focus on advanced emerging trends in the field of ECE and allied to meet the societal needs.

PEO3: Pursue higher education leading to masters and research programmes for knowledge dissemination in profession.

Program Specific Outcomes (PSOs):

PSO1: Design and develop IoT applications using Raspberry Pi, Arduino and other advanced processors.

PSO2: Design and synthesize various circuits using latest hardware and EDA tools.

PSO3: Design and analyse modern communication systems to meet the present and future needs of industry with cost effective solutions.

ACADEMIC REGULATIONS R-20 FOR B.TECH

(Applicable for the students of B.Tech admitted from the academic year 2020-21)

CURRICULAR FRAMEWORK FOR REGULAR, MINORS AND HONORS B.TECH PROGRAMMES OF ALL BRANCHES

1. PREAMBLE

The rapid transformation in every sphere of life is augmenting the need to prepare the present fast-paced generation to adapt to the changing knowledge & skill requirement on a life-long basis, in the fields of science, engineering, technology and humanities to influence society positively. The future looks up to multi-disciplinary, competent leaders who are Information and Communication Technology ready and driven by strong ethical values.

NEC envisions to nurture knowledge, skills, and attitude and values of the aspiring youth to enable them to become global citizens and towards that process, the institution has evolved a flexible integrated academic curriculum.

NEC introduced Outcome Based Education (OBE) and Choice Based Credit System (CBCS), which emphasized on honing the skills and knowledge of the graduates.

The Engineering curriculum is revised with an objective to fill the gaps in the existing curriculum with reference to skill development. The revised curriculum underwent a reorganization making the engineering education enshrined with skill development ecosystem to suit the industry's needs and to ensure the graduates employability.

The curriculum mandates students to take up five skill courses, Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature. The students are also given the option of choosing between skill courses offered by the college and a certificate course offered by industry, a professional body, APSSDC or any other accredited body.

Another major change brought in the curriculum is the introduction of B.Tech with Honors or a B.Tech. with a Minor. This is to give an opportunity for the fast learners to earn additional credits either in the same domain or in a related domain, making them more proficient in their chosen field of discipline or be a graduate with multidisciplinary knowledge and job ready skills.

2. PROGRAMS OFFERED BY THE COLLEGE

Narasaraopeta Engineering College (NEC) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) for the following branches of Engineering.

S. No.	Name of the Program	Program Code
1.	Civil Engineering	01
2.	Electrical and Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science and Engineering	05
6.	Information Technology	12
7.	CSE (Artificial Intelligence and Machine Learning)	42
8.	CSE (Artificial Intelligence)	43
9.	CSE(Data Science)	44
10.	CSE (Cyber Security)	46

3. ELIGIBILITY FOR ADMISSION

The total seats available as per the approved intake are grouped into two categories viz. category A and Category B with a ratio of 70:30 as per the state government guidelines vide G.O No.52.

The admissions for category A and B seats shall be as per the guidelines of Andhra Pradesh State Council for Higher Education (APSCHE) in consonance with government reservation policy.

a. Under Category A: 70% of the seats are filled through EAPCET counselling.
b. Under Category B: 30% seats are filled based on 10+2 merits in compliance with guidelines of APSCHE

Eligibility for Admission - Under Lateral Entry Scheme (LES)

Students with diploma qualification have an option of direct admission into 2nd year B. Tech. (Lateral Entry Scheme). Under this scheme 10% seats of sanctioned intake will be available in each course as supernumerary seats. Admissions to this three-year B.Tech. Lateral entry Programme will be through ECET.

4. AWARD OF THE DEGREE:

For Regular and LES (Lateral Entry Scheme) **students**

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

(a) Pursues a course of study in not less than four and not more than eight academic years for regular students. For LES students, pursue a course of study for not less than three academic years and not more than six academic years counted from the academic year of admission.

(b) He/she shall forfeit their seat in B. Tech course and their admission stands cancelled after eight academic years for regular students and six academic years for LES students starting from the academic year of admission.

(c) Registers for 160 credits and must secure all the 160 credits for Regular students. Registers for 121 credits and must secure all the 121 credits for LES students

(d) 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 160/121 credits and meet other specified requirements in the appropriate section of this document.

(e) A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

Academic Calendar

For all the eight/six semesters a common academic calendar shall be followed in each semester by having sixteen weeks of instruction, one week for the conduct of practical exams and with two weeks for theory examinations. Dates for registration, sessional and end semester examinations shall be notified in the academic calendar of every semester. The schedule for the conduct of all the curricular and co-curricular activities shall be notified in the planner.

4. Assigning of Credits:

1 Hr. Lecture (L) per week - 1 credit

1 Hr. Tutorial (T) per week - 1 credit

1 Hr. Practical (P) per week - 0.5 credits

2 Hours Practical (Lab)/week - 1 credit

5. Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

A three-week induction program for first year B.Tech students is to be held in zero semester. Regular classes will start after the induction program.

The objectives of the program are as follows:

1. Assimilation in the ethos and culture of the institution
2. Exposure to a larger vision of life
3. Bonding among students and teachers
4. Learning a creative skill in arts
5. Regular lifestyle and professional discipline
6. Special assistance for needy students for improving proficiency in English and Mathematics

The above objectives will be achieved through the following activities:

1. Physical activity: Yoga, Mild Exercise, Games and sports etc.
2. Creative arts: Painting, Photography, music, dance etc.
3. Literary activity: General reading, writing summaries, debating, enacting a play etc.
4. Human Values: Discussion/Lectures in small groups of students with a faculty member
5. Lectures by eminent people: From industry, entrepreneurs, public life, social activists, alumni.

6. Exposure to department/branch, Innovation, Exploring Engineering.

6. DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in each semester shall be evaluated subject – wise with a maximum of 100 marks for Theory and 50 marks for Mini Project/Practical Training/Internship/ Research Project/ Community Service Project. The Project Work shall be evaluated for 200 marks.

THEORY

For all theory subjects consisting of 5 units of syllabus in each subject, the assessment shall be for 30 marks through internal evaluation and 70 marks through external end semester examination of 3 hours duration.

INTERNAL EVALUATION

Internal evaluation is based on two **Cycles** of **examinations**. Each **Cycle** consists of three components.

1) **Assignment Test – 1 (A1)**:

   A1 will be conducted after the completion of 1st unit of syllabus. 5 or 6 questions will be given to students before 1 week of the commencement of the test. On the day of the test, each student will be given two questions at random. A1 will be evaluated for 05 marks.

2) **Quiz - 1(Q1)**:

   After the completion of the first two and half Units of syllabus (first half of the syllabus), along with the descriptive test, an online quiz test will be conducted for 20 marks and scaled down to 10 marks.

3) **Descriptive Test – 1(D1)**:

   Along with the Q1, a descriptive test will be conducted for 25 marks and scaled down to 15 marks. Two 10 marks questions from each of Unit-1 & Unit-2, and one 5 marks question from the first half of 3rd unit will be given.

Cycle–I final marks = A1 (05 marks) + Q1 (10 marks) + D1 (15 marks) = 30 marks

In the similar manner, Cycle–II Examination will be conducted as follows:

A2 test will be conducted after 3.5 units of syllabus (covering syllabus from 2.5 to 3.5 units)

After the completion of the 5th unit of Syllabus, Q2 and D2 will be conducted. For D2, one 5 marks question will be given from the second half of the third unit, two 10 marks questions will be given each from units 4 and 5.

Cycle–II final marks = A2 + Q2 + D2 = 30 Marks.

Final internal marks will be computed as **80 % of best cycle marks + 20% of least cycle marks.**

EXTERNAL EVALUATION

The semester end examinations will be conducted for 70 marks consisting of five questions carrying 14 marks each. Students have to answer all the questions. One question from each of the 5 units and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

PRACTICALS

INTERNAL EVALUATION

For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows:

Day to day work - 5 marks,

Record-5 marks and

Internal laboratory test -5 marks.

EXTERNAL EVALUATION

For practical subjects there shall be an external examination at the end of the semester for 35 marks in the presence of an external examiner. The examination duration is 3 hours.

DRAWING SUBJECTS

For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing etc.,) and estimation, the distribution shall be 30 marks for Internal Evaluation and 70 marks for End Examination. There shall be two internal tests in a semester.

The 30 internal marks will be evaluated as follows:

Cycle–I:
Internal Test : 15 marks. (1½ hour duration)
Day – to – day work: 15 marks (evaluation of charts)

In the Similar manner, **Cycle–II examination will be conducted for 30 marks**
The sum of 80% of the best and 20% of the least of two internal tests shall be considered.

Mandatory Course (M.C): Environmental Sciences/NSS/NCC, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these

subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only SATISFACTORY(S)/NOT-SATISFACTORY (F) will be specified.

- There shall be 05 Professional Elective courses and 04 Open Elective courses. All the Professional & Open Elective courses shall be offered for 03 credits, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0-0) or (2-1-0) and for all minors /honors, it shall be (4-0-0). 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.

- All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

- The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

- Students shall undergo mandatory summer Internship/Community Service Project for a minimum of 4 to 8 weeks duration at the end of second and third year of the Programme.

- There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain courses and the remaining one shall be a soft skills course.

- Undergraduate Degree with Honors/Minor shall be issued by the Institute to the students who fulfill all the academic eligibility requirements for the B.Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students. The regulations/guidelines are separately provided. Registering for Honors/Minor is optional.

- **Assessment:** The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory, 50 marks for practical subject. The distribution shall be 30% marks for Internal Evaluation and 70% marks for the End Semester Examinations. A student has to secure not less than 35% of marks in the end semester examination and minimum 40% of marks in the sum total of internal and end semester examination marks to earn the credits allotted to each course.

Internship/ Community Service Project (1.5 Credits):

It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydal and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme.

Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 4 to 8 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted from the institute to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department; supervisor of the internship and a senior faculty member of the department.

A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. It shall be evaluated for 50 external marks at the end of the semester. A student shall secure a minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted.

Internship/Community Service Project will be evaluated at the end of the semester for 50 marks (Record/Report: 20 marks and Viva-voce: 30 marks) along with laboratory end examinations in the presence of external and internal examiner. There are no internal marks for the Internship/Community Service Project.

Major Project **(12 credits):**

Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be

evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

MOOCS (1.5 Credits):

Meeting with the global requirements, to inculcate the habit of self-learning and in compliance with AICTE/ UGC guidelines, MOOC (Massive Open Online Course) have been introduced. Students have to complete an on-line course to fulfill the academic requirement of B.Tech course. Students can start registering for the course from II Year I semester. The student must register for the MOOCs course as per the academic credit requirements mentioned in the Course structure offered by NPTEL with the approval of the Head of the Department. The student will be awarded the credits given in the curriculum only after the submission of the certificate. Students must submit the NPTEL Pass certificate with required credits before the end of 3rd Year 2nd Semester.

In case the student is unable to submit an NPTEL certificate with required credits by the end of 3rd Year 2nd Semester, the student is required to submit 2 MOOCs Certificates from the reputed organizations approved by the concerned HOD before the commencement of 4th Year 1st Semester examinations.

Skill Oriented Courses (2 Credits)

1. For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.
2. Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.
3. A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements.
4. 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 departmental committee.

5. The Board of Studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.

6. If a student chooses to take 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 to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the departmental committee.

Evaluation: The job oriented skill courses may be registered at the college or at any accredited external agency as approved by departmental committee. A student shall submit a record/report on the on the skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner. There are no internal marks for the job oriented skill courses.

Curricular Framework for Honors Programme

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

2. A student shall be permitted to register for Honors program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3^{rd} semester results after the commencement of the 4^{th} semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Honors Programme registration active.

3. 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.

4. 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).

5. 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 8/12weeks as recommended by the Departmental committee.

6. 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.

7. The concerned departmental committee 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 departmental committee. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the departmental committee. 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 per the guidelines approved by the departmental committee. .

8. The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

9. 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 be mentioned 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.

10. In case a student fails to meet the SGPA 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.

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

Curricular Framework for Minor Programme:

1. a) 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

b) 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.

2. 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, Robotics, VLSI etc.

3. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

4. There shall be no limit on the number of programs offered under Minor. The Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

5. 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.

6. 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 8 SGPA (Semester 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 8 SGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

7. 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).

8. 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.

9. 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.

10. Student can opt for the Industry relevant minor specialization as approved by the concerned Departmental committee. Students 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 a course completion certificate. The Departmental committee 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.

11. A committee should be formed at the level of the College/department to evaluate the grades/marks given by external agencies to a student which are approved by the concerned Departmental committee. 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.

12. 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.

13. In case a student fails to meet the SGPA 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.

14. 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.

PASS MARK CRITERIA

A student shall be deemed to have satisfied the pass mark, if he secures not less than 35% of marks in the end examinations and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together as detailed below.

On passing a course of a program, the student shall earn the credits as assigned to that course.

S.No	Category of Subject	Max. Marks	Internal Marks	External Marks	External pass %	External pass mark	Over all pass %	Over all pass mark
1	Theory/ Drawing	100	30	70	35	25	40	40
2	Practical	50	15	35	35	12	40	20
3	Internship/Skill development courses/Community service project	50	-	50	40%	20	40	20
4	Project Work	200	60	140	35	49	40	80
5	MOOCs(Credit Course)	Certificate must be submitted before the end semester examinations of that semester in which MOOCS course is offered.						

11. Attendance Requirements:

a) A student is eligible to write the end semester examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.

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

d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

f) A stipulated fee shall be payable towards condonation of shortage of attendance to the college. Students availing condonation on medical ground shall produce a medical certificate issued by the competent authority.

g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.

h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

i) For induction programme attendance shall be maintained as per AICTE norms.

j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

18. Promotion Rules:

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

b) A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

c) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

d) For LES, point C is only applicable

19. Grading:

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Marks Range	Level	Letter Grade	Grade Point
≥ 90	Outstanding	A+	10
80-89	Excellent	A	9
70-79	Very Good	B	8
60-69	Good	C	7
50-59	Fair	D	6
40-49	Satisfactory	E	5
< 40	Fail	F	0
-	Absent	AB	-
-	Malpractice	MP	-

Calculation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \Sigma (C_i \times G_i) / \Sigma C_i$$

Where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

Where 'Si' is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. SGPA & CGPA will be calculated for those candidates who have passed all the subjects in that or up to that semester respectively.

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

vi. *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.

vii. As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.75) x 10

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. degree, he/she shall be placed in one of the following:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.75 (With No subject failures)
First Class	≥ 6.75 (With subject failures)
Second Class	≥ 5.75 & < 6.75
Pass Class	≥ 5.0 & < 5.75

20. Gap - Year:

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at institute level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

REVALUATION

1. Students can submit the application for revaluation, along with the prescribed fee for revaluation of his answer script(s) of theory subject(s) as per the notification issued by the Controller of Examinations.
2. The Controller of Examinations shall arrange for revaluation of such answer script(s).
3. An evaluator, other than the first evaluator shall revaluate the answer script(s).

SUPPLEMENTARY EXAMINATIONS: A student who has failed to secure the required credits can appear for a supplementary examination, as per schedule announced by the College authorities.

MALPRACTICE IN EXAMINATIONS: Disciplinary action will be taken in case of malpractice during Mid/End examinations as per the rules framed by the College.

MINIMUM INSTRUCTION DAYS

The minimum instruction days for each semester shall be 90 working days.

There shall be no branch transfer after the completion of the admission process.

WITHHOLDING OF RESULTS

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

TRANSITORY REGULATIONS

Discontinued or detained candidates are eligible for readmission as and when next offered. A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the subjects in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such subjects in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of first year shall join the autonomous batch of first year first semester. Such students shall study all the subjects prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of first year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Transfer candidates (from non-autonomous college affiliated to JNTUK)

A student who is following JNTUK curriculum, transferred from other college to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Transfer candidates (from an autonomous college affiliated to JNTUK)

A student who has secured the required credits up to previous semester as per the regulations of other autonomous institutions shall also be permitted to be transferred to this college.

A student who is transferred from the other autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the

appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of studies.

The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he has transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Scope

1. The academic regulations should be read as a whole, for the purpose of any interpretation.
2. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
3. The college may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the date notified by the College Authorities.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

➢ The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.

➢ Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder:

	Nature of Malpractices/ Improper conduct	**Punishment**
	If the candidate:	
1(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the college.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and to be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work

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

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

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

OTHER MATTERS:

1. Physically challenged candidates who have availed additional examination time and a scribe during their intermediate / EAMCET examinations will be given similar concessions on production of relevant proof / documents.
2. The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

GENERAL:

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Where ever the words ‘’he’’ ‘’him’’ ‘’his’’, occur in the regulations, they include ‘’she’’, ’’her’’, ’’hers’’.
3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

ANNEXURE-I

COMMUNITY SERVICE PROJECT

……Experiential learning through community engagement

As per the decision of the concerned department BoS

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 4 to 8 weeks of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- 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

- Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.

- Each class/section should be assigned with a mentor.

- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty incharge.

- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.

- TheCommunity Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- 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.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

- The Community Service Project is a twofold one –

    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

        - Agriculture
        - Health
        - Marketing and Cooperation
        - Animal Husbandry
        - Horticulture
        - Fisheries
        - Sericulture
        - Revenue and Survey

- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities

- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY

SERVICE PROJECT

The following is the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA-533003, Andhra Pradesh (India)

For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing & Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

I B.TECH., I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Linear Algebra and Calculus	R20CC1102	BS	2	1	0	30	70	100	3
2	Engineering Chemistry	R20CC1103	BS	3	0	0	30	70	100	3
3	Technical and Communicative English-I	R20CC1101	HS	3	0	0	30	70	100	3
4	Engineering Graphics	R20EC1108	ES	1	0	4	30	70	100	3
5	Problem solving using C	R20CC1105	ES	3	0	0	30	70	100	3
6	Soft Skills and Communication Skills Lab-I	R20CC11L1	HS	0	0	3	15	35	50	1.5
7	Engineering Chemistry Lab	R20CC11L5	BS	0	0	3	15	35	50	1.5
8	Problem solving using C Lab	R20CC11L2	ES	0	0	3	15	35	50	1.5
Total				**12**	**1**	**13**	**195**	**455**	**650**	**19.5**

I B.TECH., II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Differential Equations and Vector Calculus	R20CC1201	BS	2	1	0	30	70	100	3
2	Applied Physics	R20CC1205	BS	3	0	0	30	70	100	3
3	Problem Solving using Python	R20EC1217	ES	3	0	0	30	70	100	3
4	Network Analysis	R20EC1215	ES	3	0	0	30	70	100	3
5	Data Structures	R20CC1210	ES	3	0	0	30	70	100	3
6	Data Structures Lab	R20CC12L11	ES	0	0	3	15	35	50	1.5
7	Applied Physics Lab	R20CC12L10	BS	0	0	3	15	35	50	1.5
8	Problem Solving using Python Lab	R20EC12L1	ES	0	0	3	15	35	50	1.5
9	Constitution of India (Zero Credit Course)	R20CC12MC2	MC	2	0	0	-	-	-	0
Total				**16**	**1**	**9**	**195**	**455**	**650**	**19.5**

II B.TECH. – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Numerical Methods and Transformations	R20CC2101	BS	2	1	0	30	70	100	3
2	Electronic Devices and Circuits	R20EC2102	PC	3	0	0	30	70	100	3
3	Signals and Systems	R20EC2103	PC	2	1	0	30	70	100	3
4	Switching Theory and Logic Design	R20EC2104	PC	3	0	0	30	70	100	3
5	Linear Control Systems	R20EC2105	PC	3	0	0	30	70	100	3
6	Electronic Devices and Circuits Lab	R20EC21L1	PC	0	0	3	15	35	50	1.5
7	Signals and Systems Lab	R20EC21L2	PC	0	0	3	15	35	50	1.5
8	Digital Logic Design Lab	R20EC21L3	PC	0	0	3	15	35	50	1.5
9	Design of Systems using Arduino and Raspberry Pi Lab	R20EC21SC1	SC	0	0	4	-	50	50	2
10	Environmental Studies (Non-Credit Course)	R20CC21MC1	MC	2	0	0	-	-	-	0
Total				**15**	**2**	**13**	**195**	**505**	**700**	**21.5**

II B.TECH. – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Internet of Things	R20EC2202	ES	3	0	0	30	70	100	3
2	Analog and Digital Communications	R20EC2203	PC	3	0	0	30	70	100	3
3	Electronic Circuits and Pulse Circuits	R20EC2204	PC	3	0	0	30	70	100	3
4	Electromagnetic Waves and Transmission Lines	R20EC2205	PC	3	0	0	30	70	100	3
5	Technical and Communicative English-II	R20CC2201	HS	3	0	0	30	70	100	3
6	Internet of Things Lab	R20EC22L1	ES	0	0	3	15	35	50	1.5
7	Analog and Digital Communications Lab	R20EC22L2	PC	0	0	3	15	35	50	1.5
8	Electronic Circuits and Pulse Circuits Lab	R20EC22L3	PC	0	0	3	15	35	50	1.5
9	Design and Simulation of Electronic Circuits	R20EC22SC1	SC	0	0	4	-	50	50	2
	Total			**15**	**0**	**13**	**195**	**505**	**700**	**21.5**
	Honors / Minor course			**4**	**0**	**0**	**30**	**70**	**100**	**4**
10	Summer Internship / Community Service Project (Mandatory)	**To be evaluated in III B.Tech. – I Semester**								

III B.TECH. – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Linear & Digital IC Applications	R20EC3101	PC	3	0	0	30	70	100	3
2	Antennas and Wave Propagation	R20EC3102	PC	3	0	0	30	70	100	3
3	Digital Signal Processing	R20EC3103	PC	3	0	0	30	70	100	3
4	Open Elective – I		OE	3	0	0	30	70	100	3
	i. Principles of Signals, Systems & Communications (Other than ECE)	R20EC3104								
	ii. Introduction to Data Science	R20EC3105								
5	Professional Elective–I:		PE	3	0	0	30	70	100	3
	i. Electronic Measurements and Instrumentation	R20EC3106								
	ii. Data Communication and Computer Networks	R20EC3107								
	iii. Statistical Methods in AI	R20EC3108								
	iv. Signals and Transform Techniques	R20EC3109								
6	DSP Lab	R20EC31L1	PC	0	0	3	15	35	50	1.5
7	LDICA Lab	R20EC31L2	PC	0	0	3	15	35	50	1.5
8	Embedded Systems and Robotics Lab	R20EC31SC3	SC	1	0	2	-	50	50	2
9	Professional Ethics and Human Values	R20CC31MC01	MC	2	0	0	-	-	-	0
10	Summer Internship/ Community Service Project	R20CC31IN	PR	0	0	0	-	50	50	1.5
	Total			**17**	**0**	**10**	**195**	**505**	**700**	**21.5**
Honors /Minor course				**4**	**0**	**0**	**30**	**70**	**100**	**4**

III B.TECH., – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Micro wave and Optical communications	R20EC3201	PC	3	1	0	30	70	100	3
2	VLSI Design	R20EC3202	PC	3	0	0	30	70	100	3
3	Microprocessors and Microcontrollers	R20EC3203	PC	3	0	0	30	70	100	3
4	Professional Elective - II:		PE	3	0	0	30	70	100	3
	i. Data Acquisition and Transmission	R20EC3204								
	ii. Satellite Communications	R20EC3205								
	iii. Introduction to Machine Learning	R20EC3206								
	iv. Digital Image Processing	R20EC3207								
5	Open Elective – II		OE	3	0	0	30	70	100	3
	i. Fundamentals of Image Processing (Other than ECE)	R20CC2OE07								
	ii. Global Positioning System (GPS)	R20CC2OE08								
6	MP&MC Lab	R20EC32L1	PC	0	0	3	15	35	50	1.5
7	VLSI Lab	R20EC32L2	PC	0	0	3	15	35	50	1.5
8	MW&OC Lab	R20EC32L3	PC	0	0	3	15	35	50	1.5
9	English Employability Skills	R20CC32SC1	SC	1	0	2	0	50	50	2
10	Essence of Indian Traditional Knowledge	R20CC32MC1	MC	2	0	0	-	-	-	0
	Total			**17**	**1**	**13**	**195**	**505**	**700**	**21.5**
Honors/Minor course				**4**	**0**	**0**	**30**	**70**	**100**	**4**

IV B.TECH., – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Professional Elective - III:		PE	3	0	0	30	70	100	3
	i. PC based Instrumentation	R20EC4101								
	ii. Cellular and Mobile Communication	R20EC4102								
	iii. Introduction to Deep Learning	R20EC4103								
	iv. Speech Processing	R20EC4104								
2	Professional Elective - IV:		PE	3	0	0	30	70	100	3
	i. Bio Medical Instrumentation	R20EC4105								
	ii. Radar Systems	R20EC4106								
	iii. Soft Computing Techniques	R20EC4107								
	iv. DSP Architectures	R20EC4108								
3	Professional Elective - V:		PE	3	0	0	30	70	100	3
	i. Analytical Instrumentation	R20EC4109								
	ii. Advanced communication Technologies	R20EC4110								
	iii. Edge Computing	R20EC4111								
	iv. Multimedia Signal Processing	R20EC4112								
4	Open Elective – III		OE	3	0	0	30	70	100	3
	i. Introduction to Micro Processors & Micro Controllers (Other than ECE)	R20CC3OE07								
	ii. Nano Electronics	R20CC3OE08								
5	Open Elective - IV:		OE	3	0	0	30	70	100	3
	i. Introduction to Embedded Systems (Other than ECE)	R20CC4OE07								
	ii. Embedded and Real time Operating System	R20CC4OE08								

6	Humanities and Social Science Elective: i. Business Management Concepts for Engineers	R20CC4101	HSSE	3	0	0	30	70	100	3
	ii. Entrepreneurship and Innovation	R20CC4117								
7	Python Programming for Deep Learning/Mobile App Development	R20EC41SC1	SC	1	0	2	0	50	50	2
8	Internship/ Community Service Project	R20CC41IN	PR	0	0	0	-	50	50	1.5
9	MOOCS	R20CC41MC	PE	-	-	-	-	-	-	1.5
	Total			**17**	**0**	**6**	**195**	**505**	**700**	**23**
Honors/Minor course				**4**	**0**	**0**	**30**	**70**	**100**	**4**

IV B.TECH. – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Internship and Project Work	R20CC42PW	PR	0	0	0	60	140	200	12

S.No.	Year/Sem	HS	BS	ES	PC	PE	OE	HSE	PR/Semi/ Intern	Skill-OC	TOTAL
1	I-I	4.5	7.5	7.5	-	-	-	-	-		19.5
2	I-II	-	7.5	12	-	-	-	-	-		19.5
3	II-I	-	3	-	16.5	-	-	-	-	2	21.5
4	II-II	3	-	4.5	12	-	-	-	-	2	21.5
5	III-I	-			12	3	3	-	1.5	2	21.5
6	III-II	-	-	-	13.5	3	3	-	-	2	21.5
7	IV-I	-	-	-	-	9	6	3	3	2	23
8	IV-II	-	-	-	-	-	-	-	12	-	12
9	TOTAL (Actual) CREDITS	7.5	18	24	54	15	12	3	16.5	10	160

S.No.	Course Work-Subject areas	Credits (as per AICTE)	Credits (as per NEC-ECE)
1	Humanities and Social Sciences (HS)	12	7.5
2	Basic Sciences (BS)	25	18
3	Engineering Sciences (ES)	24	24
4	Professional Core (PC)	48	54
5	Professional Elective (PE)	18	15
6	Open Elective (OE)	18	12
7	Skill Oriented Courses (Skill-OC)	-	10
8	Humanities and Social Science Elective (HSE)	-	3
9	Project/seminar/Internship (PRC)	15	16.5
10	Mandatory Courses (MC)	Non-Credit	Non-Credit
	Total Credits	160	160

LIST OF HONORS

POOL-1: DIGITAL SIGNAL PROCESSING

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S.No.	Subject	Sub Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Adaptive Signal Processing	R20ECHN01	3	1	0	30	70	100	4
2	Bio- Medical Signal Processing	R20ECHN02	3	1	0	30	70	100	4
3	Wavelet Theory	R20ECHN03	3	1	0	30	70	100	4
4	Multirate Systems And Filter Banks	R20ECHN04	3	1	0	30	70	100	4
5	Mathematical methods for signal processing	R20ECHN05	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-2: INTEGRATED CIRCUITS AND SYSTEMS

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	CMOS Analog IC Design	R20ECHN06	3	1	0	30	70	100	4
2	CMOS Digital IC design	R20ECHN07	3	1	0	30	70	100	4
3	Design for Testability	R20ECHN08	3	1	0	30	70	100	4
4	System on Chip	R20ECHN09	3	1	0	30	70	100	4
5	Low Power VLSI Design	R20ECHN10	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-3: COMMUNICATION ENGINEERING:

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Software Defined Radio	R20ECHN11	3	1	0	30	70	100	4
2	Global Navigational Satellite Systems	R20ECHN12	3	1	0	30	70	100	4
3	Cognitive Radio	R20ECHN13	3	1	0	30	70	100	4
4	5G Communications	R20ECHN14	3	1	0	30	70	100	4
5	Optical Networks	R20ECHN15	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-4: INSTRUMENTATION AND CONTROL SYSTEMS

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Adaptive Control Systems	R20ECHN16	3	1	0	30	70	100	4
2	Digital Control Systems	R20ECHN17	3	1	0	30	70	100	4
3	Process Control Instrumentation	R20ECHN18	3	1	0	30	70	100	4
4	Transducers & sensors	R20ECHN19	3	1	0	30	70	100	4
5	Intelligent & Smart Instrumentation	R20ECHN20	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

LIST OF MINOR SUBJECTS

Any four of the following subjects which are not chosen earlier are to be considered for Minor Degree

S. No.	Subject	Sub Code	L	T	P	Internal Marks	External Marks	Total Marks	Credits
1	Electronics Devices and Circuits	R20CCMN24	4	0	0	30	70	100	4
2	Digital Electronics	R20CCMN25	4	0	0	30	70	100	4
3	Fundamentals of Signals Processing	R20CCMN26	4	0	0	30	70	100	4
4	Principals of Communications	R20CCMN27	4	0	0	30	70	100	4
5	Computer Architecture and Organization	R20CCMN28	4	0	0	30	70	100	4
6	Introduction to Microcontrollers	R20CCMN29	4	0	0	30	70	100	4
7	Introduction to Embedded Systems	R20CCMN30	4	0	0	30	70	100	4
8	Internet of Things	R20CCMN31	4	0	0	30	70	100	4
9	Basics of VLSI Design	R20CCMN32	4	0	0	30	70	100	4
10	Introduction to Wireless Sensor Networks	R20CCMN33	4	0	0	30	70	100	4

I B.TECH., I SEMESTER
COURSE STRUCTURE
&
SYLLABUS

I B.TECH., I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Linear Algebra and Calculus	R20CC1102	BS	2	1	0	30	70	100	3
2	Engineering Chemistry	R20CC1103	BS	3	0	0	30	70	100	3
3	Technical and Communicative English-I	R20CC1101	HS	3	0	0	30	70	100	3
4	Engineering Graphics	R20EC1108	ES	1	0	4	30	70	100	3
5	Problem solving using C	R20CC1105	ES	3	0	0	30	70	100	3
6	Soft Skills and Communication Skills Lab-I	R20CC11L1	HS	0	0	3	15	35	50	1.5
7	Engineering Chemistry Lab	R20CC11L5	BS	0	0	3	15	35	50	1.5
8	Problem solving using C Lab	R20CC11L2	ES	0	0	3	15	35	50	1.5
Total				**12**	**1**	**13**	**195**	**455**	**650**	**19.5**

I B. TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	1	0	30	70	100	3
Code: R20CC1102	LINEAR ALGEBRA AND CALCULUS						

COURSE OBJECTIVES:

1. Understanding basic concepts of linear algebra (systems of linear equations, matrix calculus).
2. To become proficiency in solving computational problems of linear algebra.
3. To acquire knowledge on mean value theorems in calculus.
4. Familiarization about the techniques in calculus and multivariate analysis.

COURSE OUTCOMES:

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

1. Solve the system of linear equations.
2. Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors.
3. Relate the results of mean value theorems in calculus to Engineering problems.
4. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
5. Compute the area and volume by interlinking them to appropriate double and triple integrals.

SYLLABUS:

UNIT-I: LINEAR SYSTEMS OF EQUATIONS (10 hours)

Rank of a matrix - Echelon form, Normal form, Solution of linear systems, Direct Methods, Gauss elimination, Gauss Jordon and Gauss Seidal Methods. Solutions of linear simultaneous equations: LU decomposition.

Application: Finding the current in a electrical circuit, Traffic flow

UNIT – II: EIGENVALUES AND EIGENVECTORS (12 hours)

Eigenvalues, Eigenvectors, Properties, Cayley - Hamilton Theorem(without proof), Quadratic forms, Reduction of quadratic form to canonical form, Rank, Positive definite, negative definite, semi definite, index, signature.

Application: Finding powers and inverse of a square matrix using Cayley Hamilton's Theorem.

UNIT – III: MEAN VALUE THEOREMS (8 hours)

Review on limits and continuity, Mean Value theorems (without proofs): Rolle's Theorem, Lagrange's theorem, Cauchy's theorem, Taylor's (Generalized mean value) theorem, increasing and decreasing functions, Maxima and minima of function of single variable.

UNIT- IV: PARTIAL DIFFERENTION (8 hours)

Function of two or more variables, Partial derivatives, Total derivatives, change of variables, Jacobian - functional dependence, Taylor's theorem for Two variables. Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT-V: MULTIPLE INTEGRALS **(10 hours)**

Double and triple integrals, Change of Variables, Change of order of Integration, volume. Application: Momenta of Inertia.

TEXT BOOK :

1. Dr. B.S. Grewal, "*Higher Engineering Mathematics*", 43rd Edition, Khanna Publishers, 2012.
2. B.V. Ramana, "Higher Engineering Mathematics", 32nd Edition, McGraw Hill Education, 2018.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "*Engineering Mathematics*", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.
2. Kreyszig E, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley, Singapore, 2001.
3. Greenberg M D, "*Advanced Engineering Mathematics*", 2nd Edition, Pearson Education, Singapore, Indian Print, 2003.
4. Peter V. O'Neil, *"Advanced Engineering Mathematics"*, 7th Edition, Cengage Learning, 2011.
5. Bhavanari Satyanarayana, Pradeep Kumar T.V. & Srinivasulu D, "Linear Algebra and Vector Calculus", Studera Press, New Delhi, 2017.

I B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC1103	ENGINEERING CHEMISTRY						

COURSE OBJECTIVES:

- To analyze water for its various parameters and its significance in industrial and domestic allocations.
- To acquire the knowledge on types of polymers, fuels and their applications.
- To provide information on exciting advanced materials available in engineering.
- To apply the electrochemical principles, understand the fundamentals of corrosion and development of different techniques in corrosion control.
- To learn the importance of engineering materials used in daily life and industry.

COURSE OUTCOMES:

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

CO 1: Analyze the suitable method of water treatment depending on the quality treatment. -**Analyzing**

CO 2: Compare different types of polymers, fuels and their importance-**Analyzing**

CO 3: Utilize the advanced materials as engineering materials and apply them in domestic and industrial life-**Applying**

CO 4: Distinguish electrical energy sources and importance of corrosion science-**Analyzing**

CO 5: Identify different types of engineering materials and applications in engineering. -**Applying**

SYLLABUS:

UNIT-I: WATER CHEMISTRY

Characteristics of water: Sources, Impurities–Hardness & its units–Industrial water characteristics– Softening of water by external treatment methods (Lime soda process, Zeolite and Ion exchange process)–Numerical problems on lime soda process–Desalination of brackish water (Reverse osmosis and Electro dialysis).

Water analysis techniques: Alkalinity–hardness (Complexo-metric)–Break point chlorination–Free chlorine–DO–BOD and COD.

UNIT-II: POLYMERS AND FUEL CHEMISTRY

Polymers: Introduction to polymers–Chain growth (free radical, ionic)–Step growth polymerization–Coordination polymerization–Copolymerization with specific examples–Thermoplastics and thermosets–Plastic moulding methods (Compression & Injection moulding)–Rubbers–Natural rubber–Processing–Vulcanization.

Fuels-Types of fuels–Calorific value–Numerical problems based on calorific value–Analysis of coal–Liquid fuels–Refining of petroleum–Cracking of heavy oil–Knocking and anti knocking agents–Octane and cetane values.

UNIT-III: CHEMISTRY OF ADVANCED MATERIALS

Nano materials: Introduction–Sol-gel method & Chemical reduction method of preparation – Characterization by BET method and TEM methods–Carbon nano tubes and fullerenes: Types–Preparation–Properties and Applications.

Liquid crystals: Introduction–Types–Applications.

Composite materials: Introduction–Definition–Types–Applications–Cermets.

UNIT-IV: ELECTROCHEMISTRY AND CORROSION

Electrochemistry: Galvanic cells–Single electrode potential–Reference electrodes–Electrochemical series–Batteries (primary, secondary and fuel cells)–Applications of secondary batteries in E-vehicles.

Corrosion: Causes and effects of corrosion–Theories of corrosion (chemical and electrochemical corrosion)–Factors effecting corrosion–Corrosion control methods–Cathode protection–Sacrificial anodic, Impressed current methods–Surface coatings–Methods of application on metals (Hot dipping, Galvanizing, Tinning, Cladding, Electroplating, Electroless plating)–Organic surface coatings–Paints–Constituents and their functions–Pigment Volume Concentration.

UNIT-V: CHEMISTRY OF ENGINEERING MATERIALS

Lubricants: Introduction–Mechanism of lubrication–Classification of lubricants–Properties and testing of lubricating oils.

Cement & Refractories: Manufacture–Setting and hardening of cement–Failures of cement–Slag cement–Refractory: Introduction–Classification and properties of refractories.

TEXT BOOKS:

1. Shikha Agarwal, "**Engineering Chemistry**", ISBN 1107476410, 2nd Edition, Cambridge University Press, New Delhi, (2019).
2. O.G. Palana, "**Engineering Chemistry**", ISBN 0070146101, Tata McGraw Hill Education Private Limited, New Delhi, (2009).
3. B. Rama Devi, Ch. Venkata Ramana Reddy, Prashantharath, "**Text Book of Engineering Chemistry**", ISBN 9789353500511, Cenage Learning India Pvt. Ltd, (2016).

REFERENCE BOOKS:

1. P.C. Jain and M. Jain "**Engineering Chemistry**", ISBN 8187433175, 15/e, Dhanpat Rai & Sons, Delhi, (2015).
2. B.S Murthy and P. Shankar, "**A Text Book of NanoScience and NanoTechnology"**, University Press (2013).
3. K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry"**, Pearson India Edn services, (2016).
4. S.S. Dara, "**A Textbook of Engineering Chemistry"**, ISBN 8121932645, S.Chand Publisher, (2010)

WEB REFERENCES:

1. URL: https://www.youtube.com/watch?v=CWOJW4357Bg
2. URL: https://www.youtube.com/watch?v=H1Y1oxQ5eUA&t=627s
3. URL: https://www.youtube.com/watch?v=1xWBPZnEJk8
4. URL: https://www.youtube.com/watch?v=p9yPXdT0k48&t=225s
5. URL: https://www.youtube.com/watch?v=xb_xndPe4n0&t=390s

E-BOOKS:

1. "**Engineering Chemistry**" (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan.

I B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC1101	TECHNICAL AND COMMUNICATIVE ENGLISH - I						

COURSE OBJECTIVES:

- To enable the engineering students develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course.

COURSE OUTCOMES:

Learners are able to

- **CO1**: Infer explicit and implicit meaning of a text, recognize key passages; raise questions and summarize it **(Apply-3).**
- **CO2**: Compose paragraphs, essays, emails, letters, reports, resume and transfer information into tables, Pie and bar diagrams. **(Creating-5).**
- **CO3**: Build grammatically correct sentences using a variety of sentence structures **(Apply3).**
- **CO4**: Enhance word power and usage of lexicons **(Apply3).**

Teaching Methodology:

The methodology of teaching will be chalk and talk, PPT, audio-visual, flipped class and activity based teaching.

SYLLABUS:

UNIT-I

Hours of Instruction per unit: 8

1. **A Drawer full of Happiness**

a. **Listening** : Dialogues, Task based listening activities.

b**. Speaking** : Asking and answering general questions.

c. **Reading** : Skimming, Scanning.

d. **Writing** : Punctuations, Paragraphs.

e. **Grammar & Vocabulary** : Nouns, Adjuncts,
GRE Vocabulary,
Technical Vocabulary.

UNIT-II

Hours of Instruction per unit: 8

2. Nehru's Letter to daughter Indira on her Birthday

a. **Listening** : Individual and pair based listening to the audio track.

b**. Speaking** : Discussion in pairs / small groups on specific topics.

c. **Reading** : Identifying sequence of ideas; recognising verbal techniques.

d. **Writing** : Summarising, Paraphrasing.

e. **Grammar & Vocabulary** : Articles, Adjectives, Prepositions
Verbal Competence,
Synonyms & Antonyms,
Analogy,
GRE Vocabulary,
Technical Vocabulary.

UNIT-III

Hours of Instruction per unit: 8

3. Stephen Hawking- Positivity 'Benchmark'

a. **Listening** : Listening for global comprehension and summarising.

b**. Speaking** : Discussing specific topics in pairs (or) small groups and reporting the discussion, Complaining, Apologising.

c. **Reading** : Reading between the lines, Critical reading for evaluation.

d. **Writing** : Official Letter writing, E-Mail etiquette, General Netiquette, Covering Letter & Resume writing.

e. **Grammar & Vocabulary** : Phrasal verbs, Verbs, Tenses (Present, Past & Future), Concord: Subject-Verb Agreement,
Verbal reason,
Using equivalents,

Word associations,
GRE Vocabulary,
Technical Vocabulary.

UNIT-IV

Hours of Instruction per unit: 8

4. Like a Tree, Unbowed: Wangari Maathai- Biography

a. **Listening** : Making predictions while listening to conversations (or) transactional dialogues.

b**. Speaking** : Role plays for practice of conversational English in academic contexts (formal and informal) .

c. **Reading** : Information transfer (Tables, Bar Diagrams, Line Graphs, Pie Diagrams)

d. **Writing** : Interpreting visual information, Statement of Purpose (SOP)

e. **Grammar & Vocabulary** : Gender inclusive language (Gendered Noun, Gender-neutral Noun), Quantifying expressions, Adjectives, Adverbs, Degrees of comparison,
GRE Vocabulary,
Technical Vocabulary.

UNIT-V

Hours of Instruction per unit: 8

5. "Stay Hungry, Stay Foolish"- Rushmi Bansal

a. **Listening** : Identifying key terms, understanding concepts, interpreting the concepts.

b**. Speaking** : Formal oral presentations on topics from academic contexts.

c. **Reading** : Reading comprehension, The RAP strategy for in-depth reading, Intensive reading and extensive reading.

d. **Writing** : Academic proposals, Poster presentation.

e. **Grammar & Vocabulary** : Reported Speech, Reporting verbs for academic purposes,

Corrections of sentences,

GRE Vocabulary,

Technical Vocabulary.

TEXTBOOKS:

1. INFOTECH ENGLISH, Maruthi Publications, Guntur- 522001.

REFERENCES:

1. Raymond Murphy, *Murphy's English Grammar,* Cambridge University Press 2004
2. Meenakshi Raman, Sangeeta Sharma, *Technical Communication: English Skills for Engineers*, Oxford University Press, 2009
3. Michael Swan, *Practical English Usage,* Oxford University Press, 1996

Online Sources:

1. www.enchantedlearning.com
2. https://www.englisch-hilfen.de/en/
3. https://www.bbc.co.uk/learningenglish/
4. https://in.usembassy.gov/education-culture/american-spaces/american-space-new-delhi/collection/
5. https://www.talkenglish.com/speaking/basics/speaking_basics_ii.aspx
6. https://www.englishclub.com/speaking/
7. https://agendaweb.org/listening-exercises.html
8. https://www.esolcourses.com/content/topicsmenu/listening.html
9. https://www.esl-lab.com/
10. https://www.eagetutor.com/eage-fluent-english-speaking-search-p.htm?gclid=EAIaIQobChMIpr-F5OzH7QIVChsrCh1kBAkzEAMYASAAEgINpfD_BwE
11. https://www.myenglishpages.com/site_php_files/reading.php
12. https://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

I B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	0	4	30	70	100	3
Code: R20EC1108	ENGINEERING GRAPHICS						

COURCE OBJECTIVES:

- The students to use drawing instruments and to draw polygons, engineering Curves & engineering scales.
- The students use to make orthographic projections, projections of points, simple lines & projections of the lines inclined to both the lines.
- The students use to draw the projections of the plane inclined to both the plane.
- The students use to draw the projections of solids & development of surfaces.
- The students use to draw conversion of isometric views to orthographic views vice versa and to learn basic drawing commands in auto cad.

COURSE OUTCOMES:

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

CO 1: **construct** the geometrical shapes of regular polygons, Engineering Curves, and scales.
CO 2: **illustrate** the orthographic projections, projections of points, and lines.
CO 3: **construct** the projection of planes inclined to both the planes.
CO 4: **construct** the projection of solids for engineering applications.
CO 5: **analyse** the conversion of isometric views to orthographic views vice versa.

SYLLABUS:

UNIT– I

The basic concepts in engineering drawing: introduction to engineering drawing instruments, lettering and dimensioning practice. Geometrical constructions- Constructing regular polygons by general methods.

Curves used in engineering practice: Introduction to **conic** sections, construction of ellipse, parabola, hyperbola by eccentricity method. Construction of ellipse by - Arcs of circles Method, Concentric Circles Method and Oblong Method, & parallelogram methods.

UNIT–II

Orthographic projections- introduction to type of projections, first angle and third angle projections. Projection of points: Principles of orthographic projection – Convention – First angle projections, projections of points.

Projections of straight lines: Projections of straight lines parallel to both the planes, parallel to one plane and inclined to the other plane. Lines inclined to both the planes - Projections of straight lines inclined to both the planes- determination of true lengths, angle of inclination and traces.

UNIT–III

Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT-IV

Projections of Solids: introduction to projections of solids, types of solids: prisms, pyramids, cones and cylinders –simple positions and the axis inclined to one of the planes.

UNIT-V

Introduction of isometric views, isometric projections & orthographic projections. Conversion of isometric views to orthographic views and orthographic views to isometric views.
Introduction to Auto CAD- practice on draw, edit & modify commands using Auto CAD.
TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications.
2. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers.
3. Engineering Drawing & Graphics by K.Venu gopal, New age international Publishers.

REFERENCE BOOKS:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers.
2. Engineering Drawing by Basant Agarwal & CM. Agarwal, Tata McGraw Hill Publishers.

Web References:
https://nptel.ac.in/courses/112103019/17

E-Books:
https://www.pdfdrive.com/textbook-of-engineering-drawing-e28918244.html

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
CODE: R20CC1105	PROBLEM SOLVING USING C						

COURSE OBJECTIVES:

- To know the basic problem solving process using Flow Charts and algorithms.
- To understand the basic concepts of control structures in C.
- To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
- To use the concepts of structures, unions, files and command line arguments in C.

COURSE OUTCOMES:

After completion of this course, the students would be able to:

CO1: Develop algorithms and flow charts for simple problems. [K3]
CO2: Utilize suitable control structures for developing code in C. [K3]
CO3: Make use of functions and arrays in developing modular programs. [K3]
CO4: Make use of structures and pointers to write well-structured programs. [K3]
CO5: Make use of file Operations in C programming for a given application. [K3]

SYLLABUS:

UNIT I

Introduction to Algorithms and Programming Languages: Algorithm – Key features of Algorithms – Some more Algorithms – Flow Charts – Pseudo code – Programming Languages – Generation of Programming Languages – Structured Programming Language.

Introduction to C: Structure of C Program – Writing the first C Program -Compiling and Executing C Programs - Using Comments – Keywords – Identifiers – Basic Data Types in C – Variables – Constants – I/O Statements in C - Operators in C -Programming Examples – Type Conversion and Type Casting.

UNIT II

Decision Control and Looping Statements: Introduction to Decision Control Statements – Conditional Branching Statements – Iterative Statements – Nested Loops – Break and Continue Statement – Goto Statement.

Functions: Introduction – using functions – Function declaration/ prototype – Function Definition – function call – return statement – Passing parameters – Scope of variables –Storage Classes – Recursive functions – Recursion vs Iteration.

UNIT III

Arrays: Introduction – Declaration of Arrays – Accessing elements of the Array – Storing Values in Array – Calculating the length of the Array – Operations on Array — Two Dimensional Arrays –Operations on Two Dimensional Arrays.

Strings: Introduction – Reading Strings – Writing Strings – String Manipulation functions -Array of Strings.

UNIT IV

Pointers: Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers – Passing Arguments to Functions using Pointer, Dynamic Memory Allocation.

Structure, Union, and Enumerated Data Types: Introduction – Nested Structures –Arrays of Structures – Structures and Functions – Self-referential Structures – Union –Enumerated Data Types.

UNIT V

Files: Introduction to Files – Using Files in C – Reading Data from Files – Writing Data To Files – Detecting the End-of-file – Error Handling during File Operations – Accepting Command Line Arguments – Functions for Selecting a Record Randomly - Remove –Renaming a File – Creating a Temporary File

TEXT BOOKS:

1. Reema Thareja**, "**Programming in C**"**, First **edition,** OXFORD University Press 2018.

REFERENCE BOOKS:

1. REEMA THAREJA, "Introduction to C programming" OXFORD UNIVERSITY PRESS
2. Rachhpal Singh, "Programming in C", kalyani publishers.
3. E Balagurusamy, "computing fundamentals & c programming", isbn 978-0-07- 066909-3, Tata McGraw-Hill, Second Reprint, 2008.
4. Ashok N Kamthane, "Programming with ANSI and Turbo C", Pearson Edition Publications, 2002.

5. Dennis Richie and Brian Kernighan, "The C programming Language", 2nd edition.

WEB REFERENCES:

1. http://cprogramminglanguage.net/
2. http://lectures-c.blogspot.com/
3. http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
4. http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

I B. TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20CC11L1	SOFT SKILLS AND COMMUNICATION SKILLS LAB-I						

COURSE OBJECTIVES:

- To build confidence in the students to communicate effectively in English.
- To strengthen the oral communication skills to enable them to interact with the people in various social situations.
- To enable the learners improve pronunciation with the knowledge of phonetics.
- To provide exposure to students to soft skills like Goal Setting, Time Management, Interpersonal Skills, and Intra Personal Skills.

COURSE OUTCOMES:

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

CO1: Communicate effectively with good pronunciation, overcoming mother tongue influence in academic and professional environment.

CO 2: Listen and comprehend several accents of English Language

CO 3: Take part in various conversations/discourses using formal and informal expressions.

CO 4: Adapt soft skills successfully in personal and professional life.

SYLLABUS:

UNIT– I

a. Introduction to Phonetics.
b. Listening - TEDx Talks (https://www.ted.com/talks/ashweetha_shetty_how-education-helped-me-rewrite-my-life?language-en#t-623369)
c. Self-Introduction

UNIT–II

a. Pronunciation Rules & Common Errors in Pronunciation.
b. Listening -TEDx Talks(https://www.youtube.com/watch?v=Dk20-E0yx_s)
c. Role Play

UNIT–III

a. Situational Dialogues (Inviting, Accepting and Declining Invitations)
b. Listening - TEDx Talks (https://www.youtube.com/watch?v=IgAnj6r1O48)
c. JAM

UNIT-IV

a. Situational Dialogues (Commands, Instructions and Requests)
b. Listening -TEDx Talks(https://youtu.be/SKvMxZ284AA)
c. Telephonic Etiquette.

UNIT-V

a. Time Management.
b. Goal Setting.
c. Interpersonal Skills & Intra personal skills.

TEXT BOOKS:

"Strengthen Your Communication Skills", Maruthi Publications, 2013.

REFERENCE BOOKS:

1. Meenakshi Raman, Sangeeta Sharma, *Technical Communication: Principles and Practice*, Oxford University Press, 2015
2. J.D.O Conner, *Better English Pronunciation,* Cambridge University Press 1980.
3. T.Balasubramanian, "*A Text Book of English Phonetics for Indian Students"*, Macmillan,1981
4. Penny ur *Grammar Practice Activities,* Cambridge University Press, 2010.
5. Mark Hancock, *Pronunciation in Use*, Oxford University Press 2007.
6. K. R Lakshmi Narayanan, T. Murugavan, *Managing Soft Skills*,Scitech Publications, 2010.
7. K V S G Murali Krishna, K V K K Prasad, *Placement and Personality Development,* Second Edition, Reem Publications Pvt. Limited, 2012
8. Shiv Khera, *You can Win*, Bloomsbury Publication, 2014
9. Stephen R. Covey, *The 7 Havits of Highly Effective People,* Free Press, 1989

I B.TECH.- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20CC11L5	ENGINEERING CHEMISTRY LAB						

COURSE OBJECTIVES:

- To provide the students with a solid foundation in chemistry laboratory required to solve the engineering problems.
- To expose the students in practical aspects of the theoretical concepts.
- To train the students on how to handle the instruments.

COURSE OUTCOMES:

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

CO 1: Develop and perform analytical chemistry techniques to address the water related problems (hardness, alkalinity, Chlorine, DO)-**Creating**

CO 2: Explain the functioning of different analytical instruments-**Applying**

CO 3: Compare viscosity and surface tension of different oils-**Analyzing**

CO 4: Measure molecular/system properties such as strength of solutions, conductance of Solutions and acid number of lubricating oils, etc-**Evaluating**

LIST OF EXPERIMENTS:

Introduction to chemistry laboratory–Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis, Qualitative analysis etc.

1. Estimation of NaOH using standard HCl solution
2. Determination of hardness of water sample by EDTA method
3. Determination of alkalinity of water sample
4. Determination of Dissolved Oxygen content of water sample by Winkler's method
5. Determination of Dissolved Chlorine by Mohr's method
6. Estimation of Fe^{+2} by using $KMnO_4$
7. Preparation of phenol formaldehyde resin/Urea formaldehyde
8. Conductometric titration between strong acid and strong base
9. Determination of viscosity of a liquid by Ostwald's viscometer
10. Determination of surface tension of a liquid by Stalagnometer
11. Determination of moisture content present in given coal sample

12. Determination of acid value of an oil

VIRTUAL LABS:

1. Soil Analysis- Determination of pH of soil
2. Water analysis - Determination of Physical parameters

TEXT BOOKS:

1. N.K Bhasin and Sudha Rani "Laboratory Manual on Engineering Chemistry" 3/e, Dhanpat Rai Publishing Company (2007).
2. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B "Vogel's Quantitative Chemical Analysis" 6/e, Pearson publishers (2000).
3. Sudharani, "Lab manual on Engineering Chemistry" Dhanpat Rai Publications, Co., New Delhi. (2009).

WEB REFERENCES:

1. URL: https://vlab.amrita.edu

I B. TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
CODE: R20CC11L2	PROBLEM SOLVING USING C LAB						

COURSE OBJECTIVES:

- The purpose of this course is to introduce to students to the field of language. The students will be able to enhance their analyzing and problem solving skills and use the same for writing programs in C.

COURSE OUTCOMES:

After completion of this C Programming Lab, students would be able to:

CO1: Study, analyze and understand logical structure of computer programming and different constructs to develop programs in C Language. [K4]

CO2: Compare and contrast various data types and operator precedence. [K2]

CO3: Analyze the use of conditional and looping statements to solve problems associated with conditions and repetitions. [K4]

CO4: Analyze simple data structures, use of pointers and dynamic memory allocation techniques. [K4]

CO5: Make use of functions and file I/O operations in developing C Programs. [K3]

SYLLABUS:

EXERCISE 1

Construct Flowcharts for the following through Raptor:

i) Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.

ii) Calculate simple and compound interest for various parameters specified by the user.

iii) Calculate the average of n numbers.

EXERCISE 2

a) Write a C Program to calculate the area of triangle using the formula
Area = $\sqrt{(s*(s-a)*(s-b)*(s-c)}$ where s= (a+b+c)/2.

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

c) Write a C Program to swap two numbers without using a temporary variable.

EXERCISE 3

a) Write a C program to find the roots of a quadratic equation.

b) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. Consider the operators +,-,*, /, % and use Switch Statement.

EXERCISE 4

a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.
b) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

EXERCISE 5

a) Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user.
b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.
c) Write a C Program to check whether the given number is Armstrong number or not.

EXERCISE 6

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to input two m x n matrices, check the compatibility and perform addition and multiplication of them.

EXERCISE 7

a) Write a C Program to find sum of following series for a given n value.
   i. 1+(1+2)+(1+2+3)+(1+2+3+4)+(1+2+3+4+5)+...+(1+2+...+n).
   ii. 1+(2+2)+(3+3+3)+(4+4+4+4)+…+(n+n+n+n..+n).
b) Write a C Program to display following patterns for a given n value

   i.
```
    1
   2  2
  3  3  3        if n =3
```

   i.
```
    1
   2 2
  3 3 3
   2 2
    1          if n=3.
```

EXERCISE 8

Draw a flow chart using Raptor and write C programs that use both recursive and non-recursive Functions for the following

i) To find the factorial of a given integer.
ii) To find the GCD greatest common divisor of two given integers.

EXERCISE 9

a) Write a C Program to find Fibonacci sequence.
b) Write C programs illustrating call by value and call by reference concepts.

EXERCISE 10

Write C Programs for the following string operations without using the built in functions - to concatenate two strings

a) To append a string to another string
b) To compare two strings

EXERCISE 11

Write C Programs for the following string operations without using the built in functions

a) To find whether a given string is palindrome or not
b) Write a C Program to count number of occurrences of each character in a given string. Example: if input 'APPLE' then output is 'A count 1, P count 2, L count 1, E count 1'

EXERCISE 12

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

i. To insert a sub-string in to given main string from a given position.
ii. To delete n Characters from a given position in a given string.
iii. To replace a character of string either from beginning or ending or at a specified location

EXERCISE 13

a) Write a C Program to Implement Taylor series method
b) Write a C Program to Implement Euler's method
c) Write a C Program to Implement Runge Kutta method

EXERCISE 14

a) Write C Program to reverse a string using pointers
b) Write a C Program to compare two arrays using pointers
c) Write a C program to swap two numbers using pointers

EXERCISE 15

a) Write the following C Programs using Dynamic memory management functions.
   i. Accept size of array from user then read n elements into two arrays and store sum of those two arrays in third array, display three arrays using pointers.
   ii. User will specify data type and data to store, use generic pointer to store that data and display given input.

EXERCISE 16

Examples which explores the use of structures, union and other user defined variables

EXERCISE 17

a) Write a C program which copies one file to another.
b) Write a C program to count the number of characters and number of lines in a file.
c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

EXERCISE 18

Virtual Lab: http://cse02-iiith.vlabs.ac.in/ /

Any three programs must be submitted with result from the above link.

* At the end of the semester the student has to submit a Mini-Project on Computer Programming. The list of Mini-Projects is available in the department.

TEXT BOOKS:

1. Reema Thareja, " Programming in C", OXFORD.
2. The C programming Language by Dennis Richie and Brian Kernighan 2nd ed.

REFERENCE BOOKS:

1. Dr.E.Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill Education.
2. Hanly, "Problem Solving and Program Design in C", Koffman, 7th ed, PEARSON.
3. Forouzan, Gilberg, Prasad ,"C Programming, A Problem Solving Approach", CENGAGE.
4. Programming in C, Second Edition by Ashok N.Kamthane, Pearson.

I B.TECH., II SEMESTER
COURSE STRUCTURE
&
SYLLABUS

I B.TECH., II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Differential Equations and Vector Calculus	R20CC1201	BS	2	1	0	30	70	100	3
2	Applied Physics	R20CC1205	BS	3	0	0	30	70	100	3
3	Problem Solving using Python	R20EC1217	ES	3	0	0	30	70	100	3
4	Network Analysis	R20EC1215	ES	3	0	0	30	70	100	3
5	Data Structures	R20CC1210	ES	3	0	0	30	70	100	3
6	Data Structures Lab	R20CC12L11	ES	0	0	3	15	35	50	1.5
7	Applied Physics Lab	R20CC12L10	BS	0	0	3	15	35	50	1.5
8	Problem Solving using Python Lab	R20EC12L1	ES	0	0	3	15	35	50	1.5
9	Constitution of India (Zero Credit Course)	R20CC12MC2	MC	2	0	0				0
Total				**16**	**1**	**9**	**195**	**455**	**650**	**19.5**

I B.TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	1	0	30	70	100	3
CODE: R20CC1201	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS						

COURSE OBJECTIVES:

1. To formulate and solve first order ordinary differential equations.
2. To solve second order differential equations of various kinds.
3. To find the solution of first order linear and non-linear partial differential equations.
4. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

COURSE OUTCOMES:

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

1. Apply first order ordinary differential equations to real life situations.
2. Identify and apply suitable methods in solving the higher order differential equations.
3. Solve the partial differentiation equations.
4. Interpret the physical meaning of different operators as gradient, curl and divergence.
5. Estimate the work done against a field, circulation and flux using vector calculus.

SYLLABUS:

UNIT I: DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE (10 hours)

Linear-Bernoulli's-Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling, Law of natural growth and decay, Orthogonal trajectories, Electrical circuits.

UNIT-II: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (10 hours)

Finding the complementary functions, Inverse operator, Rules for finding the particular integrals, Method of variation of parameters. Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients.
Application: L-C-R Circuit problems.

UNIT – III: FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS (10 hours)

Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange's) equations.

UNIT- IV: VECTOR DIFFERENTIATION (8 hours)

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT- V: VECTOR INTEGRATION (10 hours)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

TEXT BOOKS:

1. Dr. B.S. Grewal, "*Higher Engineering Mathematics*", 43rd Edition, Khanna Publishers, 2012.
2. B.V.Ramana, "Higher Engineering Mathematics", 32nd Edition, McGraw Hill Education, 2018.
3. Bhavanari Satyanarayana, Pradeep Kumar T.V. & Srinivasulu D, "Linear Algebra and Vector Calculus", Studera Press, New Delhi, 2017.

REFERENCES:

1. Kreyszig E, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley, Singapore, 2001.
2. Greenberg M D, "*Advanced Engineering Mathematics*", 2nd Edition, Pearson Education, Singapore, Indian Print, 2003.
3. Peter V. O'Neil, *"Advanced Engineering Mathematics"*, 7th Edition, Cengage Learning, 2011.
4. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "*Engineering Mathematics*", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.

I B. TECH—II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC1205	APPLIED PHYSICS						

COURSE OBJECTIVES:

- To impart knowledge in basic concepts of wave optics, fiber optics, properties of solid crystal materials and magnetic materials, acoustics, superconductors.
- To familiarize the applications of materials relevant to engineering field.

COURSE OUTCOMES:

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

CO 1: Interpret the experimental evidence of wave nature of light and interference in thin films, Diffraction grating and Polarization in various fields. (**K2)**
CO 2: Analyse and understand various types of lasers & optical fibers. **(K4)**
CO 3: Identify the crystal structures and XRD techniques. **(K3)**
CO 4: Apply the magnetic materials in engineering field. **(K3)**
CO 5: Identify the various applications of semiconductors in engineering field. **(K3)**

SYLLABUS:

UNIT– I

Interference & Diffraction: Introduction -Interference in thin films by reflection – Newton's rings, introduction to diffraction – difference between Fresnel's and Fraunhofer diffraction - Fraunhofer diffraction at single slit (qualitative) - Diffraction grating.

Polarization: Introduction – Types of Polarization – Double refraction – Nicol's prism-Quarter wave plate and Half Wave plate

UNIT–II

Lasers: Introduction – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Population inversion – Ruby laser – Helium Neon laser-Applications.

Fiber Optics: Introduction- Principle of optical fiber - Acceptance angle – cone - Numerical Aperture-Applications

UNIT–III

Crystallography : 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 and planes in crystals – Miller indices – Separation between successive (h k l) planes – Bragg's law.

UNIT-IV

Electromagnetic Fields: Gauss divergence theorem - Stokes theorem (Quantitative) – Fundamental laws of electromagnetism – Maxwell's Electromagnetic Equations.

Magnetic materials: Magnetic Susceptibility- Magnetic permeability –Classification of Magnetic materials – Dia, Para, and Ferro – Hysteresis Loop- Soft and Hard magnetic materials – Applications- Superconductivity- Properties, Meissner effect - Type-I and Type-II super conductors.

UNIT-V

Quantum Mechanics: Introduction –de-Broglie's concept of Matter waves – Physical significance of wave function - Schrodinger Time Independent wave equations – Particle in a one dimensional potential box.

Semiconductor Physics: Origin of energy band formation in solids- classification of materials into conductors, semiconductors and insulators, Intrinsic and Extrinsic semiconductor- Hall Effect.

TEXT BOOKS:

1. A.J. Dekker, "Solid state Physics", ISBN 10: 0333918339 / ISBN 13: 9780333918333, Mc Millan India Ltd, First edition, 2000.
2. M.N. Avadhanulu & P.G. Kshirasagar, "A text book of Engineering Physics", ISBN 81-219-0817-5, S. Chand publications, First Edition, 2011.
3. P. K. Palanisamy, "Engineering Physics", ISBN: 9788183714464, Scitech Publishers, 4th Edition, 2014
4. M.R. Srinivasan, "Engineering Physics", ISBN978-81-224-3636-5, New Age international publishers, 2nd Edition,2014

REFERENCE BOOKS:

1. Charles Kittle, "Introduction to solid state physics" ISBN: 9788126578436, Willey India Pvt.Ltd, 5TH edition, 2012.
2. M.Arumugam, "Applied Physics", ISBN: 81-89638-01-7, Anuradha Agencies, 4th edition, 2013.
3. D.K.Bhattacharya, "Engineering Physics", ISBN: 0198065426, 9780198065425, Oxford University press, 2nd edition, 2010.
4. Sanjay D Jain and Girish G Sahasrabudhe "Engineering Physics", University Press ISBN: 8173716781,1st edition, 2010.
5. B.K.Pandey & S. Chaturvedi "Engineering Physics" ISBN: 8131517616, Cengage Learning, 1st edition, 2012.

WEB REFERENCES:

1. http://link.springer.com/physics
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

E-BOOKS:

1. http://www.peaceone.net/basic/Feynman
2. http://physicsdatabase.com/free-physics-books
3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html

I B.TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
CODE: R20EC1217	PROBLEM SOLVING USING PYTHON						

COURSE OBJECTIVES:

- To teach problem solving through flow charting tool-Raptor.
- To elucidate problem solving through python programming language.
- To introduce function oriented programming paradigm through python.
- To train in development of solutions using modular concepts.

COURSE OUTCOMES:

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

CO 1: Outline the computer system concepts and the flowcharts using raptor to solve the given problems.

CO 2:. **S**ummarize the fundamental concepts of python programming.

CO 3: Interpret object oriented and event driven programming in python.

CO 4: Apply the suitable data structures to solve the real time situational problems.

SYLLABUS:

UNIT-I

Introduction to computers: algorithms; modern computer systems: hardware architecture, data representation in computers, software and operating system.

Flowchart design though raptor: Flowchart symbols, input/output, assignment, operators, conditional if, repetition, function and sub charts.

UNIT-II

Introduction to python: Numbers, strings, variables, operators, expressions, statements, string Operations& Methods, math function calls, Input/output statements, conditional if, while and for loops

UNIT-III

Functions: user defined functions, parameters to functions, recursive functions, and lambda function.

Event driven programming: Turtle graphics, Turtle bar chart, Widgets, key press events, mouse events, timer events.

UNIT-IV

Data structures: List- list methods & functions, Tuple-tuple methods & functions, Dictionaries-dictionary methods & functions, traversing dictionaries. Sets-methods & functions, Files

UNIT-V

OOP: class, object, methods, constructors, inheritance, inheritance types polymorphism, operator overloading , abstract classes, exception handling.

TEXT BOOKS:

1. Fundamentals of Python: First Programs ,Kenneth Lambert
2. Allen B. Downey, "think python: how to think like a computer scientist",2nd edition, O'reilly,2016

REFERENCE BOOKS:

1. Python Programming : A modern approach, vamsi kurama,pearson.
2. Learning python, Mark Lutz , Orielly.
3. Core python programming, W.Chun, pearson.
4. Introduction to python, Kenneth A. Lambert, Cengage.

WEB RESOURCES:

1. https://raptor.martincarlisle.com/
2. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
4. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
5. https://www.cse.msu.edu/~stockman/ITEC/Scratch/BGC2011Scratch-Rev1.pdf
6. https://nostarch.com/scratchplayground
7. http://fusecontent.education.vic.gov.au/9f79537a-66fc-4070-a5ce-e3aa315888a1/scratchreferenceguide14.pdf

I B.TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
CODE: R20EC1215	NETWORK ANALYSIS						

COURSE OBJECTIVES:

- To make understand the concepts of Electric Circuits, Network Theorems and the transients.
- To impart the concept of steady state and applying phasor analysis to AC circuits and analysing magnetic coupled circuits.
- To familiarize resonant circuits, two port network parameters.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:
CO 1: Analyze the basics of electrical circuits with nodal, mesh analysis and network theorems.
CO 2: Apply Laplace Transform for steady state and transient analysis
CO 3: Analyze the phasor representation for ac circuits and magnetic coupled circuits.
CO 4: Describe resonance circuits, two port network parameters and their interconnections.

SYLLABUS:

UNIT – I: NTRODUCTION TO ELECTRICAL CIRCUITS

Electric charge and current, Electric energy and potential, Network elements classification, Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Y to Δ & Δ to Y conversion, Problem solving using Kirchhoff‘s laws, Mesh analysis and Nodal analysis.

UNIT – II: A.C. FUNDAMENTALS

Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor, Phase angle, Phasor representation, Addition and subtraction of phasors. Concept of self, mutual inductance, co-efficient of coupling, dot convention rules and analysis of simple circuits – simple problems.

UNIT – III: STEADY STATE ANALYSIS OF A.C. CIRCUITS & THEOREMS

Response to sinusoidal excitation - pure resistance, pure inductance, pure capacitance, impedance concept, series RL, RC and RLC circuits, parallel RL, RC and RLC with complex impedance and phasor notation. Thevinin‘s, Norton‘s, Superposition, Max Power Transfer theorems, simple problems.

UNIT – IV: RESONANCE & TWO PORT NETWORKS

Series resonance, Parallel resonance, concept of band width and Q factor. Z-parameters, Y parameters, Transmission line parameters, H-parameters, Relationship between parameter sets.

UNIT – V: TRANSIENT ANALYSIS

First order differential equations, homogeneous and non-homogeneous equations, evaluating initial conditions, RL circuit, RC circuit with DC excitation, second order differential equations, applications of Laplace transform to electrical circuits, problem only on DC excitation.

TEXT BOOKS:

1. M E Van Valkenburg, "Network Analysis ", 3rd Edition, Prentice Hall of India, 2000.
2. K. Satya Prasad and S Sivanagaraju, "Network Analysis", Cengage Learning
3. William Hayt and Jack E.Kimmarle, "Engineering Circuit Analysis", 6 thEdition , TMH.

REFERENCES:

1. C.L.Wadhwai, "Network Analysis and Synthesis", 4th edition, New Age Publications, 2016.
2. Sudhakar. A. and Shyammohan, S. P., "Circuits and Network", Tata McGraw-Hill New Delhi, 1994.

WEB REFERENCES:

1.URL: https://nptel.ac.in/courses/106105154/2
2.URL : https://nptel.ac.in/courses/117106108/

E-BOOKS:

1. http://hguywilliams.net/images/documents/library/Elec/bec.pdf

I B.TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
CODE: R20CC1210	DATA STRUCTURES						

COURSE OBJECTIVES:

1. Comprehensive knowledge of data structures and exposure to recursive algorithms, searching and sorting techniques
2. Apply stack and queue data structures for logical operations
3. Analyze Linked-list representation models in various types of applications
4. Implementation of trees in various forms, orientation on graphs, representation of graphs, graph traversals

COURSE OUTCOMES:

After completion of this course the student should be able to

CO1: Analyze sorting and searching algorithms. [K4]
CO2: Analyze elementary data structures such as stacks, queues and linked lists. [K4]
CO3: Compare and contrast various forms of trees. [K4]
CO4: Build graph data structures and various graph traversal techniques. [K3]

SYLLABUS:

UNIT - I

Introduction to Data Structures and Algorithms: Basic Terminology, Elementary Data Structure Organization, Classification of Data structures, Operations on Data structures, Abstract Data Type.
Recursion: Pseudocode, Recursive examples, Factorial, GCD implementation, Fibonacci numbers, Tower of Hanoi.

UNIT - II

Searching and Sorting: Introduction to Searching, Linear Search, Binary Search, Introduction to Sorting, Bubble sort, Insertion sort, Selection sort, Merge sort, Quick sort and Heap Sort.

UNIT - III

Stacks: Introduction to stacks, Array Representation of stacks, Operations on stack, Linked representation of stacks, Applications of stacks, evaluation of a postfix expression, conversion of infix expression into a postfix expression.
Queues: Introduction, Array Representation of Queues, Linked representation of Queues, Circular Queues, Applications of queues.

UNIT - IV

Linked Lists: Introduction, Basic terminologies, Linked lists versus Arrays, Memory allocation and De-allocation for a linked list, single linked list, Circular linked, Doubly linked list. (Searching, inserting, Deleting and displaying operations for all Linked Lists)

UNIT – V

Trees: Introduction, Basic Terminology, Types of Trees, Expression Trees, Traversing a Binary Tree, Pre-order Traversal, In-order Traversal, Post-order traversal, Level order traversal**,** constructing a Binary Tree from Traversals**,** Binary Search Trees, operations on Binary Search Trees, AVL Trees.

Graphs: Introduction, Graph Terminology, Directed Graphs, Representations of Graphs, Graph Traversal algorithms, Breadth- First Search Algorithm, Depth-First-Search Algorithm.

TEXT BOOKS:

1. Data Structures using C,Reema Thareja, Oxford, Second Edition, 2014 (UNITS: I, II, III, IV, V & VI).
2. Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage (UNIT: I).

REFERENCE BOOKS:

1. Data Structures and Algorithms, 2008,G.A.V.Pai, TMH.
2. Data Structure with C, Seymour Lipschutz, TMH.
3. Data structures and algorithm analysis in C, 2/e, Mark Allen Weiss.

WEB RESOURCES:

1. nptel.ac.in/courses/106102064/1
2. nptel.ac.in/courses/106103069

I B.TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
CODE: R20CC12L11	DATA STRUCTURES LAB						

COURSE OBJECTIVES:

1. The purpose of this course is to develop skills to design simple linear and nonlinear data structures.
2. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem.
3. It enables them to gain knowledge in practical applications of data structures.

COURSE OUTCOMES:

After the completion of this course the student should be able to

CO1: Develop various algorithms using recursive and non-recursive functions. [K3]
CO2: Experiment with linear data structures. [K3]
CO3: Apply Tree traversal techniques in various applications. [K3]

SYLLABUS:

EXERCISE 1

a) Write a recursive C program which computes the n^{th} Fibonacci number, for appropriate values of n.
b) Write recursive C programs for the following
   i) Factorial of a given number
   ii) GCD Computation
   iii) Towers of Hanoi

EXERCISE 2

a) Write a C program that use both recursive and non-recursive functions to perform linear search.
b) Write a C program that use both recursive and non-recursive functions to perform binary search.

EXERCISE 3

a) Write a C program to implement Bubble sort.
b) Write a C program to implement Insertion sort.
c) Write a C program to implement Selection sort.

EXERCISE 4

a) Write a C program to implement Quick sort.
b) Write a C program to implement Merge sort.
c) Write a C program to implement heap sort.

EXERCISE 5

a) Write a C program to implement Stack operations using arrays
b) Write a C program to implement Queue operation using arrays.
c) Write a C program to convert infix expression into postfix expression using stack.

EXERCISE 6

a) Write a C program to implement Stack operation using Linked list.
b) Write a C program to implement Queue operations using Linked lists.

EXERCISE 7

a) Write a C program to implement the following operations on a singly Linked using functions
   i) Insertion
   ii) Deletion
   iii) Displaying
   iv) Reversing

EXERCISE 8

a) Write a C program to implement following Operations on a Binary Tree
   i) Create
   ii) In-order traversal
   iii) Pre-order traversal
   iv) Post-order traversal

b) Write a C program to implement following Operations a Binary Search Tree
   i) Create
   ii) Insert
   iii) Delete

I B.TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code:R20CC12L10	APPLIED PHYSICS LAB						

COURSE OBJECTIVES:

To impart physical measurement skills and make the students understand coherence between theoretical and practical knowledge.

COURSE OUTCOMES:

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

CO1: Apply the principles of physics in engineering field. (K3)

CO2: Utilize the modern engineering physics techniques and tools in real time applications. (K3)

CO3: Analyze the characteristics, usage and the behaviour of materials. (K4)

LIST OF EXPERIMENTS:

1. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
2. Determination of wavelength of a source-Diffraction Grating-Normal incidence
3. Newton's rings –Radius of Curvature of Plano Convex Lens.
4. Determination of thickness of thin wire- Air wedge method
5. Determination of wavelength of Laser Source-single slit diffraction.
6. Determine the Numerical aperture of an optical fiber.
7. Melde's experiment – Transverse and Longitudinal modes.
8. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
9. Verification of laws of stretched string by using Sonometer.
10. Calculate the energy loss in a given ferromagnetic material by plotting B-H Curve.
11. Energy Band gap of a Semiconductor p - n junction.
12. Characteristics of Thermistor – temperature coefficient.

TEXT BOOKS:

1. Engineering Physics Lab Manual by Dr.Y. Aparna & Dr.K.Venkateswarao (V.G.S.Book links).
2. Physics Practical Manual, Lorven Publications
3. S. Balasubramanian , M.N. Srinivasan " A Text book of Practical Physics"- S Chand Publishers, 2017.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=NDsSPtL9dyQ
2. https://www.youtube.com/watch?v=9agoJRCnu4w
3. https://www.youtube.com/watch?v=bv-lLJreyCU
4. http://vlab.amrita.edu/index.php

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
CODE: R20EC12L1	PROBLEM SOLVING USING PYTHON LAB						

COURSE OBJECTIVES:

- To introduce programming through Visual programming tool - Scratch
- To teach problem solving through Flow charting tool - Raptor
- To elucidate problem solving through python programming language
- To introduce function-oriented programming paradigm through python
- To train in development of solutions using modular concepts
- To teach practical Pythonic solution patterns

COURSE OUTCOMES:

Student should be able to

CO 1: Create interactive visual programs using Scratch. [K6]
CO 2: Develop flowcharts using raptor to solve the given problems. [K6]
CO 3: Develop Python programs for numerical and text based problems. [K6]
CO 4: Develop graphics and event based programming using Python. [K6]

LABORATORY EXPERIMENTS:

WEEK-1:

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, and Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.

WEEK-2:

3. Construct flowcharts to
   a. calculate the maximum, minimum and average of N numbers
   b. Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
4. Construct flowcharts with separate procedures to
   . a) calculate simple and compound interest for various parameters specified by the user
   b) Calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user

WEEK-3:

5. Construct flowcharts with procedures to
   a)generate first N numbers in the Fibonacci series
   b) Generate N Prime numbers
6. Design a flowchart to perform Linear search on list of N unsorted numbers(Iterative and recursive)

WEEK-4:

7. Design a flowchart to perform Binary search on list of N sorted numbers(Iterative and recursive)
8. Design a flowchart to determine the number of characters and lines in a text file specified by the user

WEEK-5:

9. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
10. Design a Python script to determine if a given string is a Palindrome using recursion

WEEK-6:

11. Design a Python script to sort numbers specified in a text file using lists.
12. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format (0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
13. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.

WEEK-7:

14. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
15. Design a Python Script to convert a given number to words

WEEK-8:

16. Design a Python Script to convert a given number to roman number.
17. Design a Python Script to generate the frequency count of words in a text file.

WEEK-9:

18. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
19. Design a Python script to generate statistical reports(Minimum, Maximum, Count, Average, Sum etc) on public datasets.

WEEK-10:

20. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.
21. Write a Python program to convert a given tuple of positive integers into an integer.

WEEK-11:

22. Write a Python program to remove the intersection of a 2nd set from the 1st set.
23. Design a Python script on oop's concepts: Class variables and instance variable

    i) Robot ii) ATM Machine

WEEK-12:

24. Write a Python program to create a dictionary grouping a sequence of key-value pairs into a dictionary of lists.
25. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.

TEXT BOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs".
2. Allen B. Downey, "think python: how to think like a computer scientist",2nd edition, O'reilly,2016

REFERENCE BOOKS:

1. Python programming : A modern approach, vamsi kurama,pearson.
2. Learning python, Mark Lutz , Orielly.
3. Core python programming, W.Chun, pearson.
4. Introduction to python, Kenneth A. Lambert, Cengage.

WEB RESOURCES:

1. https://raptor.martincarlisle.com/
2. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
4. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
5. https://www.cse.msu.edu/~stockman/ITEC/Scratch/BGC2011Scratch-Rev1.pdf
6. https://nostarch.com/scratchplayground
7. http://fusecontent.education.vic.gov.au/9f79537a-66fc-4070-a5ce-e3aa315888a1/scratchreferenceguide14.pdf

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	-	-	-	0
CODE: R20CC12MC2	CONSTITUTION OF INDIA						

COURSE OBJECTIVES:

1. To train students in understanding the basic structure of Indian Constitution
2. To aware the students about the role of constitution in a democratic society
3. To prepare students to live better and happily with other fellow beings through the application of Fundamental Rights in their lives.
4. To know about the powers of Union Government and State Government

COURSE OUTCOMES:

CO1: Examine salient features of Indian Constitution and live accordingly in society & interpret the meaning of Fundamental Rights of State Policy

CO2: Discover various aspects of Union Government legislation and live up to the expectations of the rules.

CO3: Critically examine State Government legislation and improve your living standards by following the rules strictly

CO4: Examine powers and functions of local bodies such as Municipalities and Panchayats and, take advantage of available resources for better living

CO5: Analyze the powers and functions of Election Commission and The Union Public Service Commission and decide upon it for safe and secured life.

SYLLABUS:

UNIT-I: INTRODUCTION TO INDIAN CONSTITUTION & FUNDAMENTAL RIGHTS

Meaning of the term Indian Constitution –Preamble- Constituent Assembly- Salient Features of Indian Constitution. Fundamental Rights -Fundamental Duties -The Directive Principles of State Policy.

UNIT-II: UNION GOVERNMENT

Union Government -Union Legislature (Parliament) -Lok Sabha and Rajya Sabha (with Powers and Functions) -Union Executive -President of India (with Powers and Functions) -Prime Minister of India (with Powers and Functions) -Union Judiciary (Supreme Court) -Jurisdiction of the Supreme Court

UNIT-III: STATE GOVERNMENT

State Government -State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) -Powers and Functions of the State Legislature -State Executive-Governor of the State (with Powers and Functions) -The Chief Minister of the State (with Powers and Functions) -State Judiciary (High Courts)

UNIT-IV: LOCAL SELF GOVERNANCE

Powers and functions of Municipalities, Panchyats, ZP's and Co – Operative Societies

UNIT-V: SOVEREIGN BODIES:

Election Commission of India (with Powers and Functions) -The Union Public Service Commission (with Powers and Functions)

TEXT BOOKS:

1. Introduction to constitution of India, Durga Das Basu, Lexis Nexis Publications
2. Constitution of India by Professional Book Publishers
3. The Constitution of India by Arun K Tiru vengadam, Blooms bury publishers.
4. The constitution of India by PM Bakshi, Universal law publishing co
5. The Constitution of India by S.R. Bhansali, Universal law publishing co

II B.TECH., I &II SEMESTER,
COURSE STRUCTURE
&
SYLLABUS

II B.TECH. – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Numerical Methods and Transformations	R20CC2101	BS	2	1	0	30	70	100	3
2	Electronic Devices and Circuits	R20EC2102	PC	3	0	0	30	70	100	3
3	Signals and Systems	R20EC2103	PC	2	1	0	30	70	100	3
4	Switching Theory and Logic Design	R20EC2104	PC	3	0	0	30	70	100	3
5	Linear Control Systems	R20EC2105	PC	3	0	0	30	70	100	3
6	Electronic Devices and Circuits Lab	R20EC21L1	PC	0	0	3	15	35	50	1.5
7	Signals and Systems Lab	R20EC21L2	PC	0	0	3	15	35	50	1.5
8	Digital Logic Design Lab	R20EC21L3	PC	0	0	3	15	35	50	1.5
9	Design of Systems using Arduino and Raspberry Pi Lab	R20EC21SC1	SC	0	0	4		50	50	2
10	Environmental Studies (Non-Credit Course)	R20CC21MC1	MC	2	0	0				0
		Total		15	02	13	195	505	700	21.5

II B.TECH. – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Internet of Things	R20EC2202	ES	3	0	0	30	70	100	3
2	Analog and Digital Communications	R20EC2203	PC	3	0	0	30	70	100	3
3	Electronic Circuits and Pulse Circuits	R20EC2204	PC	3	0	0	30	70	100	3
4	Electromagnetic Waves and Transmission Lines	R20EC2205	PC	3	0	0	30	70	100	3
5	Technical and Communicative English-II	R20CC2201	HS	3	0	0	30	70	100	3
6	Internet of Things Lab	R20EC22L1	ES	0	0	3	15	35	50	1.5
7	Analog and Digital Communications Lab	R20EC22L2	PC	0	0	3	15	35	50	1.5
8	Electronic Circuits and Pulse Circuits Lab	R20EC22L3	PC	0	0	3	15	35	50	1.5
9	Design and Simulation of Electronic Circuits	R20EC22SC1	SC	0	0	4		50	50	2
10	Internship two months (Mandatory) during summer vacation									
	Total			**15**	**0**	**13**	**195**	**505**	**700**	**21.5**
	Honors / Minor course			**4**	**0**	**0**				**4**

II B.TECH., I SEMESTER, ECE
COURSE STRUCTURE
&
SYLLABUS

II B.TECH. – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Numerical Methods and Transformations	R20CC2101	BS	2	1	0	30	70	100	3
2	Electronic Devices and Circuits	R20EC2102	PC	3	0	0	30	70	100	3
3	Signals and Systems	R20EC2103	PC	2	1	0	30	70	100	3
4	Switching Theory and Logic Design	R20EC2104	PC	3	0	0	30	70	100	3
5	Linear Control Systems	R20EC2105	PC	3	0	0	30	70	100	3
6	Electronic Devices and Circuits Lab	R20EC21L1	PC	0	0	3	15	35	50	1.5
7	Signals and Systems Lab	R20EC21L2	PC	0	0	3	15	35	50	1.5
8	Digital Logic Design Lab	R20EC21L3	PC	0	0	3	15	35	50	1.5
9	Design of Systems using Arduino and Raspberry Pi Lab	R20EC21SC1	SC	0	0	4		50	50	2
10	Environmental Studies (Non-Credit Course)	R20CC21MC1	MC	2	0	0				0
Total				**15**	**02**	**13**	**195**	**505**	**700**	**21.5**

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	1	0	30	70	100	3
Code: R20CC2101	NUMERICAL METHODS AND TRANSFORMATIONS						

COURSE OBJECTIVES:

1. To elucidate the different numerical methods to solve nonlinear algebraic equations.
2. To propagate the use of different numerical techniques for carrying out numerical integration.
3. Explore the use of Laplace transform method to solve with initial value problems of ODE.
4. To acquire fundamental Knowledge of Fourier series and Fourier Transform and able to give Fourier expansions of a given function.

COURSE OUTCOMES:

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

1. Evaluate approximating roots of polynomials and transcendental equations by different algorithms.
2. Apply Newton's forward backward and Lagrange's interpolation for equal and unequal intervals.
3. Apply different algorithms for approximating solutions of ordinary differential equation to its analytical computations.
4. Select appropriate technique of Laplace transforms in solving differential equations.
5. Relate Fourier series, integral, transforms techniques in their core.

SYLLABUS:

UNIT –I: SOLUTIONS TO ALGEBRAIC EQUATIONS AND INTERPOLATION: (10 hours)

Solution of polynomial and transcendental equations: bisection method, Regula-Falsi method and Newton-Raphson method. Finite differences, relation between operators, interpolation using Newton's, Gauss's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formulae.

UNIT –II: NUMERICAL SOLUTIONS OF ODE AND INTEGRATION: (8 hours)

Numerical Differentiation, Ordinary differential equations-Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Numerical integration- trapezoidal rule and Simpson's 1/3rd and $3/8^{th}$ rules.

UNIT-III: LAPLACE TRANSFORMATIONS: (12 hours)

Laplace transform and its properties, Transform of derivatives and integrals, Multiplication by t^n, division by t, Unit step function and unit impulse function. Transform of periodic functions, Evolutions of integrals by Laplace Transforms. Finding inverse transforms by the method of partial fractions, other methods of finding inverse Laplace Transforms, Convolution theorem(without proof), Solutions of Initial and Boundary Value Problems.

UNIT – IV: FOURIER SERIES: (10 hours)

Introduction, Euler's formulae, Periodic functions, Dirichlet's conditions, conditions for a Fourier expansion, functions of any period, functions having points of discontinuity, odd and even functions - half range series.

UNIT – V: FOURIER TRANSFORMS: (8 hours)

Fourier integral theorem (without proof), Fourier cosine and sine integrals, Fourier transform, Fourier sine and cosine transforms, properties of Fourier Transforms, convolution theorem (without proof).

TEXT BOOK:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publisher.
2. B.V.Ramana, "Higher Engineering Mathematics", 32nd Edition, McGraw Hill Education, 2018.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "Engineering Mathematics", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEditiwiley-India.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2011.

II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2102	ELECTRONIC DEVICES AND CIRCUITS						

COURSE OBJECTIVES:

1. Understand the operation and principles of P-N diode.
2. Understand various types of Special diodes, rectifiers and filters.
3. Know the working of BJT.
4. Know the need for transistor biasing and stabilization.
5. Know the working of FET and other Transistors.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Use P-N diodes in electronic circuits.
CO2: Use special diodes and rectifiers in electronic circuits.
CO3: Explore the operation of BJT and its applications.
CO4: Analyse the thermal stability of BJT.
CO5: Explore the operation of FET, other transistors and their applications.

SYLLABUS:

UNIT- I: PN JUNCTION DIODE CHARACTERISTICS:

Insulators, Semiconductors and Metals–Classification using Energy gap, Intrinsic and Extrinsic Semiconductors. P-N Junction Diode - Formation of P-N Junction, Open Circuited P-N Junction, Biased P-N Junction - Forward Bias, Reverse Bias, Current Components in PN Junction Diode, Law of Junction, Diode Current Equation - Quantitative Analysis, V-I Characteristics of Diode - Forward Bias, Reverse Bias, Breakdown in P-N Junction Diode, Temperature Dependence on V-I Characteristics, Diode Resistance-Static Resistance, Dynamic Resistance, Reverse Resistance, Diode Capacitance - Transition Capacitance, Diffusion Capacitance, Energy Band Diagram of PN Junction Diode.

UNIT- II: SPECIAL DIODES AND RECTIFIERS:

SPECIAL DIODES: Zener Diode - V-I Characteristics, Applications, Breakdown Mechanisms - Zener Breakdown and Avalanche Breakdown, Construction, Operation, Characteristics and applications of LED, LCD, Photodiode, Varactor Diode and Tunnel diode.

RECTIFIERS: Basic Rectifier setup, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Inductive and Capacitive Filters, L– Section and π- Section, Derive and compare rectifier parameters with and without filter.

UNIT- III: BIPOLAR JUNCTION TRANSISTOR (BJT):

Bipolar Junction Transistor – Types, Symbols and Operation, Transistor Current Components, Transistor Equation - Relation among I_C, I_B, I_{CBO}, Transistor Configurations - CB, CE and CC, Transistor as a switch, Transistor switching times, Transistor as an Amplifier, Characteristics of Transistor in Common Base Configuration, Common Emitter and Common Collector Configurations - Input and output characteristics, Early effect, Transistor parameters, Current amplification factor, Relation among α, β, and γ, Comparison of CB, CE and CC Configurations, Punch Through/ Reach through, Typical transistor junction voltage values, Photo Transistor.

UNIT- IV: BJT BIASING AND THERMAL STABILITY:

Need For Biasing, Operating Point, Load Line Analysis - D.C. Load Line, A.C. Load Line, Biasing - Methods, Basic Stability, Fixed Bias, Collector-to-base Bias and Self Bias, Stabilization against variations in VBE, Ic and β, Stability Factors S, S' and S'', Bias Compensation - Thermistor, Sensistor, Diode Compensation for variation in ICO, Thermal Runaway, Thermal Stability.

UNIT- V: FET & OTHER TRANSISTORS:

FET Types and Symbols - JFET and MOSFET/IGFET, JFET: N- Channel and P-Channel Construction, Operation, Characteristics - Drain and Transfer, Parameters - Drain Resistance, Amplification factor, Transconductance, Pinch-off voltage, MOSFET - Types - Depletion MOSFET - N Channel and P Channel, Enhancement MOSFET - N-Channel and P-Channel, Construction, Operation, Characteristics - Transfer and Drain Characteristics for Depletion and Enhancement Modes , Analysis of MOSFETs, Comparison between JFET and MOSFET.
SCR- Symbol, Two-Transistor version, UJT - Negative Resistance Property and Applications.

TEXT BOOKS:

1. J. Millman, C. Halkias, “Electronic Devices and Circuits”, Tata McGraw-Hill, Third edition, 2010.
2. Allen Mottershed, “Electronic Devices and Circuits”, PHI, 2011.
3. Salivahanan, N. Suresh Kumar, A. Vallavaraj, “Electronic Devices and Circuits” Tata McGraw-Hill, Second Edition, 2008.

REFERENCE BOOKS:

1. Jacob Millman, C. Halkies, C.D. Parikh, Satyabrata Jit, “Integrated Electronics”, Tata McGraw-Hill, Second Edition, 2011.
2. R.L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Publications, Eleventh Edition, 2013.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	1	0	30	70	100	3
Code: R20EC2103	SIGNALS AND SYSTEMS						

COURSE OBJECTIVES:

1. To explain about signals and perform various operations on it and to summarize the sampling
2. To build Trigonometric and Exponential Fourier series of various signals
3. To develop Fourier transforms for various signals.
4. To solve Laplace transforms and z-transforms for various signals.
5. To summarize the principle, filter characteristics, band width of a LTI Systems and

COURSE OUTCOMES:

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

CO1: Define basic signals and its operations.
CO2: Identify Trigonometric and Exponential Fourier Series of signals.
CO3: Develop Fourier Transforms for various signals.
CO4: Solve Laplace Transform and z-Transform for various signals.
CO5: Compare LTI system responses for different inputs and illustrate sampling concepts.

SYLLABUS:

UNIT- I: SIGNAL ANALYSIS & SAMPLING:

Classification of Signals: Analog, Discrete, Digital, Deterministic & Random, Periodic & Aperiodic, Even & Odd, Energy & Power signals. Basic Operations on Signals: Time-Shifting, Time-Scaling, Time-Reversal, Amplitude Scaling and Signal Addition. Elementary Signals: Unit Step, Unit Ramp, Unit Parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function, Sinc function and Signum function. Correlation, Auto correlation, Relation between Cross & Auto correlation.

Sampling: Sampling theorem, Types of Sampling: Impulse Sampling, Natural and flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing

UNIT- II: ORTHOGONAL FUNCTIONS & FOURIER SERIES:

Orthogonal Functions: Signal approximation using orthogonal functions, Mean square error, Orthogonality in complex functions.

Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet conditions, Trigonometric Fourier Series and Exponential Fourier Series, Conversion of Exponential Fourier Series from Trigonometric Fourier series.

UNIT- III: FOURIER TRANSFORMS:

Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of periodic signals. Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT- IV: LAPLACE TRANSFORMS AND Z- TRANSFORMS:

Laplace Transforms: Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of Region of Convergence (ROC), Constraints on ROC for various classes of signals, Properties of Laplace transforms, Relation between Laplace transform and Fourier transform.

Z-Transforms: Concept of Z-transform of a discrete sequence, Region of convergence in Z-Transform, constraints on ROC for various classes of signals, inverse Z-transform, properties of Z-Transforms.

UNIT-V: SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS:

Signal transmission through linear systems: System and its types: Linear & Non-Linear, Time Variant & Time Invariant, Causal & Non Causal, Static & Dynamic, Stable & Unstable. Impulse response of a linear time invariant (LTI) system and linear time variant (LTV) system, Transfer function of a LTI system, Filter characteristics of linear systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF and its characteristics.

TEXT BOOKS:

1. B.P. Lathi, “Signals, Systems and Communications”, BS Publications, 2008.
2. Simon Haykin and Van Veen, Wiley, “Signals and Systems”, Second Edition, 2003.
3. A.V. Oppenheim, A.S. Will sky and S.H. Nawab, “Signals and Systems”, PHI, Second Edition, 2013.

REFERENCE BOOKS:

1. Ramesh Babu, “Signals and Systems”, SciTech Publications, Third Edition, 2011.
2. A. Anand Kumar, “Signals and Systems”, PHI Publications, Third Edition, 2013.
3. Tarun Kumar and Rawat - SIGNALS AND SYSTEMS, Oxford Publications, 2010.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2104	SWITCHING THEORY AND LOGIC DESIGN						

COURSE OBJECTIVES:

1. To illustrate the number representation in digital electronic circuits and to convert into different representations.
2. To demonstrate the concept of Boolean algebra and minimization of Boolean expressions.
3. To design combinational logic circuits and sequential logic circuits.
4. To Construct synchronous and asynchronous state machines using flip-flops.
5. To compare various PLD's and apply the PLD concept to realize switching functions.

COURSE OUTCOMES:

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

CO1: Classify and work on different types of number systems and codes that are used in the design of digital systems.

CO2: Make use of theorems and postulates of Boolean algebra to minimize various Boolean expressions.

CO3: Construct the basic logic circuits and combinational circuits.

CO4: Apply different models of Finite State Machines for design of sequential circuits.

CO5: Utilize the concept of PLDs to realize switching functions and code converters.

SYLLABUS:

UNIT- I: NUMBER SYSTEMS & CODES:

Review of number systems – Binary, octal, Hexa decimal numbers, binary arithmetic-binary weighted and non-weighted codes, Gray codes, Ex-3 Codes, Code Conversions, Error detecting and correcting codes-Hamming codes.

UNIT- II: LOGIC OPERATIONS AND MINIMIZATION TECHNIQUES:

Logic Operations: Basic logical operations, logic gates and universal gates, Pin configurations of 74XX-IC series. Boolean postulates and theorems, representation of switching functions–standard SOP & POS forms, Minimization Techniques: Minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map representation up to 6 variables, Tabular (Quine-McCluskey) method with only 4 variables and with single function.

UNIT- III: DESIGN OF COMBINATIONAL CIRCUITS:

Introduction, Design procedure, Design of Adders, Subtractors and their applications, Encoders, Decoder, Multiplexers, Demultiplexers, code converters, Comparators. Realization of Boolean functions using decoders, multiplexers and de-multiplexers.

UNIT- IV: DESIGN OF SEQUENTIAL CIRCUITS:

Introduction, sequential circuits versus combinational circuits, classification of sequential circuits, Latches, flip-flops and their excitation requirements. Design of sequential circuits- counters and shift registers, Design of clocked sequential circuit to detect the given sequence with and without overlapping, Realization of sequential generator. Applications of counters and shift registers. Finite State Machines-Melay and Moore machines, capabilities and limitations of finite state machine. Mealy to Moore conversion and vice-versa.

UNIT- V: INTRODUCTION TO PLDs:

Introduction to PLDs, Realization of switching functions using PROM, PLA and PAL, Basics structures, comparison of PROM, PAL and PLA, Implementation of code converters, Introduction to CPLDs and FPGAs.

TEXT BOOKS:

1. M. Morris Mano, "Digital Design", PHI, Fourth Edition, 2008.
2. A. Anand Kumar, "Switching Theory and Logic Design", PHI, Pvt. Ltd, 2nd Ed, 2014.
3. Zvi Kohavi, "Switching and Finite Automata Theory", Cambridge University Press, 3rd Edition, 2009.

REFERENCE BOOKS:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition, 2010.
2. Charles H. Roth Jr, "Fundamentals of Logic Design", CENGAGE Learning, 7th Edition.
3. A. P. Godse, D. A. Godse, "Switching Theory & Logic Design", Technical publications, 2nd Edition, 2013.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2105	LINEAR CONTROL SYSTEMS						

COURSE OBJECTIVES:

This course will enable students to:

1. Learn the fundamental concepts of Control systems, mathematical models and transfer function.
2. Learn the time response analysis for various inputs and frequency response analysis.
3. Understand the basics of stability analysis of the system
4. Study the classical control design techniques.

COURSE OUTCOMES:

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

CO 1: Develop the mathematical model of a system and find its transfer function

CO 2: Understand the time response analysis and the frequency response analysis

CO 3: Determine the stability of a system in time domain and frequency domain

CO 4: Understand the classical control design techniques

SYLLABUS:

UNIT I: INTRODUCTION AND TRANSFER FUNCTION REPRENTATION:

Introduction to Control Systems: Types of Control Systems- Open loop and Closed loop control systems and their differences, Effects of feedback on systems. Mathematical models: Differential equations of Physical Systems – Mechanical Systems- translational and rotational systems, Electrical Systems.

Transfer Function Representation:

Block diagrams and signal flow graphs: Transfer functions, Block diagram Reduction and Signal Flow graphs- Reduction using mason's gain formula.

UNIT II: TIME RESPONSE ANALYSIS:

Time Response of feedback control systems: Standard test signals - Step, Ramp, Parabolic and Impulse signals, Time response of first and second order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications, Steady state response - Steady state errors and error constants.

UNIT III: STABILITY ANALYSIS IN S-DOMAIN AND ROOT LOCUS TECHNIQUE:

Stability Analysis: The concept of stability, Condition for stability, Routh's stability criterion, Routh table, Qualitative stability and Conditional stability.

Root Locus Technique: The root locus concept: construction of root loci, Effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT IV: FREQUENCY RESPONSE ANALYSIS AND STABILITY ANALYSIS IN FREQUENCY DOMAIN:

Frequency domain Analysis: Introduction to Frequency domain specifications- Resonant peak, Resonant frequency, Bandwidth, Phase margin and Gain margin.

Stability Analysis in frequency domain: Bode plots – construction, determination of frequency domain specifications and transfer function and stability analysis from Bode plots, Polar plots – construction and stability analysis, Nyquist plots – construction and stability analysis.

UNIT V: CLASSICAL CONTROL DESIGN TECHNIQUES AND STATE VARIABLE ANALYSIS:

Compensation techniques: Lag, Lead and Lead-Lag Controllers design in frequency domain, State Variable Analysis: Concept of state, State variables & State model, State model from differential equations and Transfer functions, State transition matrix and its properties, Concepts of Controllability and Observability.

TEXT BOOKS:

1. Control Systems Engineering – I. J. Nagrath and M. Gopal, New Age International Pvt. Ltd, Sixth Edition, 2017.
2. Automatic Control Systems – B.C. Kuo, John Wiley & Sons, Eighth Edition, 2003.
3. Modern Control Engineering – Katsuhiko Ogata, Pearson, Fifth Edition, 2009.

REFERENCE BOOKS:

1. Control Systems – N. K. Sinha, New Age International, Fourth Edition, 2013.
2. Control Systems – A. Anand Kumar, PHI Learning Pvt. Ltd, Second Edition, 2014.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC21L1	ELECTRONIC DEVICES AND CIRCUITS LAB						

COURSE OBJECTIVES:

1. Understand the operation of PN diode and Zener diode.
2. Identify and verify the efficiency of Half wave and Full wave Rectifiers.
3. Know the working of BJT.
4. Know the characteristics of transistor.
5. Know the UJT characteristics.

COURSE OUTCOMES:

After the completion of this course the student will able to

CO1: Understand and analyze the behavior of PN junction diode, Zener diode.
CO2: Understand the operational difference between Half wave and Full wave Rectifiers.
CO3: Identify the switching characteristics of transistor.
CO4: Analyze the characteristics of transistor.
CO5: Identify and analyze the UJT characteristics and its applications.

LIST OF EXPERIMENTS:

PART A: ELECTRONIC WORKSHOP:

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

PART B: ELECTRONIC DEVICES AND CIRCUITS:

1. P- N Junction diode characteristics
   Part A: Germanium Diode (Forward bias & Reverse bias)
   Part B: Silicon Diode (Forward bias & Reverse bias)
2. Zener diode characteristics
   Part A: V-I characteristics.
   Part B: zener diode as voltage regulator.
3. Half wave Rectifier (with and without c-filter)
4. Full wave Rectifier (with and without c-filter)
5. Switching characteristics of BJT
6. BJT Characteristics (CE configuration)
   Part A: input characteristics
   Part B: output characteristics

7. BJT Characteristics (CB configuration)
   Part A: input characteristics
   Part B: output characteristics
8. BJT Characteristics(CC configuration)
   Part A: input characteristics
   Part B: output characteristics

9. FET characteristics(CS configuration)
   Part A: Drain characteristics
   Part B: Transfer characteristics
10. UJT characteristics

EXPERIMENTS BEYOND SYLLABUS:

1. To obtain Hybrid parameters of BJT.
2. Bridge Rectifier.

VIRTUAL LAB EXPERIMENTS:

1. Zener Diode as Voltage Regulator.
2. BJT Characteristics (Common Base & Common Emitter Configuration).

II B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC21L2	SIGNALS AND SYSTEMS LAB						

COURSE OBJECTIVES:

1. To build elementary signals and implement Trigonometric and Exponential Fourier series.
2. To Construct Fourier transform, Hilbert Transform and Laplace transform of continuous time signals and properties of Fourier Transform.
3. To develop various properties of Laplace and z- transforms of continuous time signals.
4. To Identify linear time variant and linear time invariant systems.
5. To construct of various filters and about sampling.

COURSE OUTCOMES:

After completion of this course, the student will able to

CO1: Build elementary signals and implement Trigonometric Fourier series and Exponential Fourier series.

CO2: Construct Fourier, Hilbert and Laplace Transform of a continuous time signal of various signals.

CO3: Identify different properties of Fourier & Laplace Transforms.

CO4: Develop z-transform of continuous time signal and experiment with different properties of it.

CO5: Construct various filters and to draw their magnitude and phase responses.

LIST OF EXPERIEMENTS:

1. Generate Elementary Signals: Unit Step, Unit Ramp, Unit Parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function,
2. Operations of the signals(Shifting, Scaling, Addition & Multiplication)
3. Implement Trigonometric Fourier series and convert to exponential Fourier series.
4. Verify the properties of Fourier Transform for continuous Time signals.
   i. Periodicity ii. Linearity. iii. Time scaling iv. Time reversal
5. Find the Fourier transform of a square pulse. Plot its amplitude and phase spectrum.
6. Find the Hilbert transform of a sinusoidal signal. Plot its amplitude and phase spectrum.
7. Find the Laplace transform of a continuous time signal. Plot its amplitude and phase spectrum.
8. Verify the properties of Laplace Transform for continuous Time signals.
   i. Periodicity ii. Linearity iii. Time scaling iv. Time reversal
9. Find the Z- transform of a continuous time signal. Plot its amplitude and phase spectrum
10. Verify the properties of Z- Transform for continuous Time signals.
    i. Periodicity ii. Linearity iii. Time scaling iv. Time reversal
11. Implement Linear Time Variant (LTV) and Liner Time Invariant (LTI) systems.
12. Find the magnitude and phase response of low pass, high pass and band pass filter.

Experiments beyond syllabus:

1. Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew,
Kurtosis, and PSD, Probability Distribution Function
2. Extraction of Periodic Signal masked by noise using Correlation.

Virtual Lab link*:

https://play.google.com/store/apps/details?id=com.mathworks.matlabmobile

* Every experiment can be simulated virtually by using the MATLAB mobile app or using trail version of MATLAB software.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC21L3	DIGITAL LOGIC DESIGN LAB						

COURSE OBJECTIVES:

1. Verify the operations and use of logic gates.
2. Design various combinational and sequential circuits.
3. Illustrate and compare the operation of different flipflops.
4. Develop the internal circuits for different digital operations

COURSE OUTCOMES:

After successful completion of this course the student will be able to

CO1: Identify the operation of various logic gates.
CO2: Examine basic logical and arithmetic circuit operations.
CO3: Illustrate and compare the operation of different flipflops.
CO4: Develop the complex digital logic circuits including both combinational and sequential logics by using computer-aided design tools.

LIST OF EXPERIMENTS:

1. Design the Logic gates and verify its operation.
2. Design Majority gates using NAND and NOR gates.
3. Implementation of a two variable Boolean function both in SOP and POS forms.
4. Implementation and verification of Decoder circuit using logic gates.
5. Implementation and verification of 4X1 Multiplexer circuit using logic gates.
6. Implementation and verification of Full Adder circuit using logic gates.
7. Verification of the state table of SR and D Flipflop.
8. Verification of the state table of JK Flipflop.
9. Implementation of Parallel adder circuit using IC 7483
10. Verify the operation of 4 bit comparator using IC7485
11. Verify the operation of 4 bit counter using IC7493
12. Verify the read and write operations of RAM(16 X 4) using IC74189

EXPERIMENTS BEYOND THE SYLLABUS:

1. Construct 4-Bit ring counter with T- Flip- Flop and verify the truth table.
2. Design a 8–Bit right Shift Register using D- Flip- Flop and verify the truth table.
3. Design a Gray code De-coder and interface it to SRAM IC 74189 for Read operation display on 7- segment.

VIRTUAL LAB EXPERIMENTS:

1. Multiplexer using Universal Gates.
2. Demultiplexer using universal logic gate

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4		50	50	2
Code: R20EC21SC1	DESIGN OF SYSTEMS USING ARDUINO AND RASPBERRY PI LAB						

COURSE OBJECTIVES:

1. To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
2. To apply the concept of Internet of Things in the real world scenario.
3. Construct the IOT Devices.
4. Apply to develop the IOT Devices

COURSE OUTCOMES:

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

CO1: Analyze the requirements, specifications to design home automation applications.

CO2: Build smart city applications using Arduino.

CO3: Develop agricultural applications using Raspberry pi.

CO4: Influence the revolution of Internet in Mobile Devices,.

LIST OF EXPERIEMENTS:

1. a. How to install Arduino IDE.
   b. Blink the LED on and off with 500 ms time delay using Arduino UNO board.
2. Detecting obstacle with IR sensor and Arduino.
3. Find the moisture using Moisture sensor and Arduino.
4. Find the distance using ultrasonic sensor HC-SR04 and Arduino.
5. Smoke detection using MQ-2 gas sensor.
6. a. How to install of Raspbian OS on Memory card.
   b. Controlling LED with Raspberry Pi.
7. Blink the LED using LDR sensor and raspberry pi.
8. Motion detection using PIR and raspberry pi.
9. Controlling AC light using raspberry pi with Relay module.
10. Display the text using 16 X 2 LCD display module and raspberry pi.

II B.TECH – I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0				MC (0)
Code : R20CC21MC1	ENVIRONMENTAL STUDIES						

COURSE OBJECTIVES:

1. To make the students aware about the environment and it's inter–disciplinary, to familiarize the concept of ecosystem and their importance, basic understanding of the ecosystem and its diversity.

2. Overall understanding of the natural resources.

3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.

4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.

5. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities. Awareness on the social issues, environmental legislation and global treaties understanding the environmental policies and regulations.

COURSE OUTCOMES:

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

CO-1 Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web.

CO-2 Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.

CO-3 Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.

CO-4 Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management practices.

CO-5 Define Environmental policy, legislation, environmental assessment and the stages involved in EIA Environmental audit.

SYLLABUS:

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness. Institutions and people in Environment.

Ecosystems:

Definitions and concepts – Characteristics of ecosystem – Structural and functional features – Producers, consumers and decomposers and food webs – Types of ecosystems – Forests, grassland, desert, crop land, pond, lake, river and marine ecosystems – Energy flow in the ecosystem – Ecological pyramids – Ecological successions.

UNIT – II

Natural Resources: Water resources–Use and over utilization of surface and natural resourced ground water–Floods, drought, conflicts over water, dams–benefits and problems on tribal population & Environment.

Forest resources: Use and over–exploitation, deforestation.

Mineral resources: Use and exploitation, tribal & environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer–pesticide problems, water logging, salinity–concept of sustainable agricultural methods.

Energy Resources: Renewable (wind energy, tidal energy) and non renewable energy resources (Fossil fuels, coal).

UNIT – III

Biodiversity: 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-spots of biodiversity

Conservation of biodiversity: Threats to biodiversity: habitat loss, man wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity: In-Situ conservation and Ex- situ conservation.

UNIT – IV

Environmental Pollution and Control Technologies: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, and nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Good Agricultural Practices – Drip irrigation, soil erosion and desertification.

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.Covid-19- and environmental Health –Impact of the Coronavirus-Precautions and infection control

UNIT – V

Environmental Policy, Legislation and Environmental Management: Environmental ethics: Issues and possible solutions. Environmental Protection Act, Legal aspects -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.

Impact Assessment and its significance - various stages of EIA, preparation of EMP and EIS, Environmental audit, Ecotourism.

Visit to some local Polluted Site: Study of an industrially Polluted area.

TEXT BOOKS:

1. Anubh aKaushik& C. P. Kaushik, Environmental Studies,NewAge International (P) Ltd., New Delhi. Fourth edition,2014.

2. P. N. Palanisamy, P. Manikandan, A. Geetha, and K. ManjulaRani, Environmental Studies, Pearson Education, Chennai.ISBN 978-93-325-2052-3,Secondedition-2014.

REFERENCE BOOKS:

1. Deekshita Dave & P. UdayaBhaskar, Text Book of Environmental Studies Cengage Learning.
2. Shaashi Chawla, a Textbook of Environmental Studies, TMH, New Delhi.
3. Benny Joseph Environmental Studies, Tata McGraw Hill Co, New Delhi.
4. Dr.K.V.S.G. Murali Krishna, Environmental Studies VGS Publishers, Vijayawada, First Edition2016.
5. Bharucha, E. Text book of Environmental Studies, First edition, Universities Press (India) Pvt., Ltd., Hyderabad,2005.

WEB REFERENCES:

1. URL:https://www.youtube.com/watch?v=7G3eXI_DPn8
2. URL: https://www.eolss.net/sample-chapters/C09/E6-70-05-01.pdf
3. URL: https://www.youtube.com/watch?v=QuRL6NbyvEQ
4. URL: https://google/ Introduction to Environmental Studies5JM1G2
5. URL:http://www.teacherspayteachers.com/Product/Food-Chains-Trophic-Levels-and-Ecological-Pyramids-PowerPoint Click the above
6. URL:http://iadc-dredging.com/en/371/environment/ecosystem-services/ this webinar will focus on the concept of ecosystem services
7. URL: http://mocomi.com/ presents: What is Air Pollution? Air pollution is the introduction of foreign products into the atmosphere.
8. URL: https://en.wikipedia.org/wiki/green_impact_assessment

E-BOOKS:

1. .https://faculty.psau.edu.sa/.../doc-5-pdf-d78456fce3bebc84d9320fa2f9cf9e2a-original
2. https://www.researchgate.net/.../273775623_Introduction_to_Environmental_Sciences

II B.TECH., II SEMESTER, ECE
COURSE STRUCTURE
&
SYLLABUS

II B.TECH. – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Internet of Things	R20EC2202	ES	3	0	0	30	70	100	3
2	Analog and Digital Communications	R20EC2203	PC	3	0	0	30	70	100	3
3	Electronic Circuits and Pulse Circuits	R20EC2204	PC	3	0	0	30	70	100	3
4	Electromagnetic Waves and Transmission Lines	R20EC2205	PC	3	0	0	30	70	100	3
5	Technical and Communicative English-II	R20CC2201	HS	3	0	0	30	70	100	3
6	Internet of Things Lab	R20EC22L1	ES	0	0	3	15	35	50	1.5
7	Analog and Digital Communications Lab	R20EC22L2	PC	0	0	3	15	35	50	1.5
8	Electronic Circuits and Pulse Circuits Lab	R20EC22L3	PC	0	0	3	15	35	50	1.5
9	Design and Simulation of Electronic Circuits	R20EC22SC1	SC	0	0	4	-	50	50	2
	Total			**15**	**0**	**13**	**195**	**505**	**700**	**21.5**
	Honors/Minor course			**4**	**0**	**0**	**30**	**70**	**100**	**4**
10	Summer Internship / Community Service Project (Mandatory)		**To be evaluated in III B.Tech. – I Semester**							

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2202	INTERNET OF THINGS						

COURSE OBJECTIVES:

1. To present interconnection and integration of the physical world and the cyber space.
2. To demonstrate applications of Internet of Things
3. To educate building blocks and characteristics of Internet of Things
4. To build a small low cost embedded system using Arduino/Raspberry Pi or equivalent boards.
5. To apply the concept of internet of things in the real world scenario.

COURSE OUTCOMES:

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

CO1: Outline the concept of internet of things.

CO2: Analyze the requirements, specifications to design IoT applications.

CO3: Analyze domain specific applications using Arduino and Raspberry pi.

CO4: Make use of python programming to implement Internet of Things

CO5: Design IoT applications using Raspberry Pi

SYLLABUS:

UNIT- I: INTRODUCTION & CONCEPTS:

Introduction to Internet of Things, physical design of IoT, logical design of IoT, IoT enabling Technologies, IoT levels.

UNIT-II: IoT DESIGN METHODOLOGY:

Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification, IoT Level Specification, Functional View Specification, Operational View specification, Device & Component Integration and Application Development.

UNIT- III: IOT & M2M :

M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization

UNIT-IV: PROTOTYPING EMBEDDED DEVICE WITH ARDUINO & RASPBERRY PI:

Sensors, Actuators, Embedded Computing Basics- Micro Controllers, System on Chips, Choosing your Platform, Arduino – Developing (IDE, pushing code, language and debugging) on the Arduino.

Raspberry PI – Introduction, cases and Extension Board (difference between raspberry pi and beagle bone black board), Developing (operating system, programming language and debugging) on the Raspberry PI.

UNIT- V: DOMAIN SPECIFIC APPLICATIONS OF IOT:

Home Automation, Agriculture Applications, Smart City applications.

TEXT BOOKS:

1. Vijay Madisetti, ArshdeepBahga, Internet of Things A Hands-On- Approach, 2014.

REFERENCE BOOKS:

1. Matt Richardson & Shane Wallace, Getting Started with Rasperry Pi, O'Reilly (SPD), 2014.
2. Adrian McEwen, Designing the Internet of Things, Wiley Publishers, 2013
3. Daniel Kellmereit, The Silent Intelligence: The Internet of Things, 2013

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2203	ANALOG AND DIGITAL COMMUNICATIONS						

COURSE OBJECTIVES:

1. To Discuss the fundamental concepts of the Analog communication system
2. To analyze various analog modulation and demodulation techniques.
3. To construct the concepts of different pulse modulation and digital modulation techniques.
4. To apply different information theorems and capacity to digital data transmission.
5. To familiarize with the error detection and correction techniques.

COURSE OUTCOMES:

After completion of this course, the student should able to

CO1: Elaborate the basic concepts of Analog Communication Systems.
CO2: Analyze the Analog modulated and demodulated systems.
CO3: Construct different digital modulation techniques.
CO4: Analyze the fundamental concepts of information theorems and capacity.
CO5: Assess the right method of error detection and error correction for data transmission

SYLLABUS:

UNIT I: ANALOG COMMUNICATION

Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Generation of AM waves-Square law Modulator, Switching modulator, Detection of AM waves-Square law detector and Envelope detector. – Theory of Frequency and Phase Modulation.

Noise: Source of Noise – External Noise- Internal Noise- Noise Calculation.

UNIT II: RADIO TRANSMITTERS & RECEIVERS

Radio Transmitters-Function of a Transmitter, Basic Components of a Radio Transmitter, Classification of Transmitter- MW, SW, UHF and VHF, Micro Wave Transmitter, AM, FM, PM, TV, Radio broadcasting Transmitters, AM Transmitter-Low-Level Transmitter, High Level Transmitter.

Radio Receivers - Receiver Types- AM, FM, Communication, Television, Radar Receivers, and Radio Receivers, Tuned radio frequency receiver-Block Diagram of TRF Receiver, Super heterodyne receiver-Block Diagram of Super heterodyne Receiver and Advantages.

UNIT-III: DATA AND PULSE COMMUNICATION

Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques.

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM). Delta modulation

UNIT IV: DIGITAL MODULATION TECHNIQUES

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)- Minimum Shift Keying (MSK) – Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM– Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT V: SOURCE AND ERROR CONTROL CODING

Entropy, Source encoding theorem, Shannon-fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes.

TEXT BOOKS:

1. Principles of Communication Systems - Herbert Taub, Donald L Schiling, GoutamSaha, 3rd Edition, McGraw-Hill, 2008
2. Communication Systems by Simon Haykins John Wiley & Sons, 4th Edition.

REFERENCES:

1. Wayne Thomasi "Electronic communication systems fundamentals through advanced", 4th edition.
2. Communication Systems, 2E, R. P. Singh, S. D. Sapre, McGraw-Hill Education, 2008.
3. Analog and Digital Communication – K. Sam Shanmugam, Willey, 2005
4. George Kennedy and Bernard Davis, "Electronics & Communication System", TMH, 2004.

II B. TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2204	ELECTRONIC CIRCUITS AND PULSE CIRCUITS						

COURSE OBJECTIVES:

1. Analysis of single stage and multistage amplifiers
2. Concept of feedback in amplifiers and oscillators.
3. Concept of power amplifiers.
4. Concepts of linear and non-linear wave shaping.
5. Operation and design of multivibrators.

COURSE OUTCOMES:

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

CO1: Develop single stage and multistage amplifiers.

CO2: Summarize the importance of feedback in amplifiers and oscillators.

CO3: Make use of Power Amplifiers in communication systems.

CO4: Understand different linear and non-linear wave shaping circuits.

CO5: Construct different multivibrators.

SYLLABUS:

UNIT- I: TRANSISTOR AMPLIFIERS ANALYSIS:

Analysis of a transistor amplifier circuit using h-parameters, Conversion of h-parameters, Comparison of Transistor amplifier configurations. Simplified Common Emitter hybrid model, FET small signal model, Low frequency Common Source FET Amplifier, Single stage CE transistor amplifier response, Gain bandwidth product.

MULTISTAGE AMPLIFIERS:

RC coupled amplifier, High input resistance transistor circuits- Darlington pair, Bootstrapped Darlington circuit.

UNIT– II: FEEDBACK AMPLIFIERS:

Feedback principle and concept, Types of feedback Characteristics of negative feedback amplifiers, General analysis of feedback amplifiers-input resistance and output resistance, Analysis feedback amplifier- Voltage series feedback, Current shunt feedback.

OSCILLATORS:

Introduction, Oscillator principle and condition for oscillation, Types of oscillators: RC phase shift oscillator, Hartley oscillator , Crystal oscillator.

UNIT- III: POWER AMPLIFIERS:

Introduction, Class A, Class B, Class AB, Class C and Class D amplifiers, Transformer coupled push pull circuits, Complementary symmetry circuits, heat sinking.

UNIT- IV: LINEAR WAVE SHAPING:

The high pass and low pass RC circuits: Sinusoidal input, Step input, Pulse input, Square and Ramp input resonses, RC network as a differentiator and an integrator.

NON-LINEAR WAVE SHAPING:

Diode clippers, Transistor clippers, Two level clipping circuits and Emitter coupled clipper, Clamping circuits, Clamping circuit theorem.

UNIT- V: MULTIVIBRATORS:

Introduction to multivibrator, Types of multivibrator, Analysis and design of bistable multivibrator, Analysis and design of collector coupled monostable multivibrator, Application of monostable multivibrator as a voltage to time converter, Analysis and design of collector coupled astable multivibrator, Expression for time period T, Astable Multivibrator as a voltage to frequency converter, Schmitt trigger.

TEXT BOOKS:

1. Jacob Millman, Christos C Halkias, "Integrated Electronics Analog and Digital Circuits and Systems", Tata McGraw-Hill, Fifty Edition, 1991.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Publications, Eleventh Edition, 2013.
3. Pulse, Digital and Switching Waveforms – J. Millman, H. Taub and Mothiki

   S. Prakash Rao, Tata McGraw-Hill, Second Edition, 2008.

REFERENCE BOOKS:

1. Salivahanan, N. Suresh Kumar, A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw-Hill, Second Edition, 2008.
2. Robert T. Paynter, "Introductory Electronic Devices and Circuits", Pearson Education, Seventh Edition, 2006.
3. Pulse and Digital Circuits – A. Anand Kumar, PHI, Second Edition, 2005

II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC2205	EM WAVES AND TRANSMISSION LINES						

COURSE OBJECTIVES:

1. To introduce the concepts of Electrostatics and Magneto statics.
2. To understand Electromagnetic Waves and their Propagation.
3. To understand the Maxwell‘s Equations and boundary conditions.
4. To familiarize with the transmission line concepts.

COURSE OUTCOMES:

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

CO1: Apply the concepts of Electric and Magnetic Fields in different applications.

CO2: Apply Maxwell‘s equations in electromagnetics.

CO3: Understand wave propagation and derive the Wave Equations in Perfect Dielectric and Conducting Media.

CO4: Understand wave characteristics - reflection and refraction of Electromagnetic Waves in different media and analyze different transmission lines and applications.

SYLLABUS:

UNIT- I: REVIEW OF COORDINATE SYSTEMS & STATIC FIELDS

ELECTROSTATICS: Coulomb‘s Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Field Intensity due to point charge, Infinite line charge, Infinite sheet of charge, Uniformly charged sphere, Electric Potential - Electric Potential due to point charge and infinite line charge, Energy Density, Poisson‘s and Laplace‘s Equations.

MAGNETOSTATICS: Biot-Savart Law, Ampere‘s Law and Applications, Magnetic Flux Density, Magnetic Vector Potential.

UNIT- II: MAXWELL’S EQUATIONS:

Faraday‘s Law and Transformer emf, Inconsistency of Ampere‘s Law and Displacement Current Density, Continuity Equation, Maxwell‘s Equations in Differential and Integral Forms and Word Statements for static fields and time varying fields of electric and magnetic.

UNIT- III: EM WAVES:

Types of Media, Wave Propagation in Perfect Dielectrics, Lossy (General Case - conducting) media. Uniform Plane Waves – Definition, Uniform Plane Wave Propagation in Free Space, Poynting Vector and Poynting Theorem, Electric and Magnetic Boundary Conditions, Polarization, EM Wave Normal Incidence on Perfect Conductor and Dielectric, EM Wave Oblique incidence on Dielectric with Parallel and Perpendicular Polarizations, Brewster Angle, Critical Angle and Total Internal Reflection

UNIT- IV: TRANSMISSION LINES -I:
Types, Parameters, Transmission Line Equations, Primary and Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion – Condition for Distortion less and Minimum Attenuation, Loading - Types of Loading,

UNIT- V: TRANSMISSION LINES-II:
Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR,. UHF Lines as Circuit Elements; λ/4, λ/2 and λ/8 Lines.

TEXT BOOKS:

1. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, Second Edition, 2000.
2. Elements of Electromagnetics – Matthew N.O. Sadiku, Oxford Univ. Press, Third Edition, 2001.
3. Electromagnetic Waves and Transmission Lines – G. S. N. Raju, Pearson Education India, 2006.

REFERENCE BOOKS:

1. Electromagnetic Field Theory and Transmission Lines – G. Sasi Bhushana Rao, Wiley India Pvt Ltd, 2012.
2. Electromagnetics – J. D. Kraus, Keith R. Carver, TMH, Third Edition, 1984.
3. Schaum‘s Outline of Electromagnetics – J.A. Edminister, Mahmood Nahvi, TMH, Fourth Edition, 2014.
4. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan (Tech. India Publications), New Delhi, 2010.

II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC2201	TECHNICAL AND COMMUNICATIVE ENGLISH - II						

COURSE OBJECTIVES:

- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To enhance the students' proficiency in reading skills enabling them meet the academic needs of their course.
- To enable the engineering students develop their basic communication skills in English for academic and social purposes.

COURSE OUTCOMES:

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

CO1: Infer explicit and implicit meaning of a text, recognize key passages; raise questions and summarize it **(Apply-3).**

CO2: Compose paragraphs, essays, emails, letters, reports, resume and transfer information into tables, Pie and bar diagrams. **(Creating-5).**

CO3: Build grammatically correct sentences using a variety of sentence structures **(Apply3).**

CO4: Enhance word power and usage of lexicons **(Apply3).**

SYLLABUS:

UNIT– I

1. **A Proposal to Gridle the Earth, Nellie Bly**
   a) **Placement Papers**.
   b) **Reading**: Skimming for main idea, scanning for specific piece of information.
   c) **Writing**: Note – making flowed by paragraph writing, effective opening sentences, introducing the topic, key words, main idea, summarize the main idea.
   d) **Grammar and Vocabulary**: Content words and function words, verbs, nouns, adjectives and adverbs. Basic sentence structure and simple question form, framing jargon, technical vocabulary (15 words)

UNIT–II

2. **The District School As It Was by One who Went to It, Warren Burton**
   a) **Placement Papers.**
   b) **Reading**: Identifying the sequence of ideas and recognizing verbal techniques to link the ideas in a paragraph.
   c) **Writing**: Paragraph writing, using key words/phrases and organizing points in a coherent manner.
   d) **Grammar and Vocabulary**: Linkers, articles and prepositions.

UNIT–III

3. **The future of Work- Jacob Morgan**
   a) **Placement Papers**.
   b) **Reading**: Sequencing of ideas and recognizing verbal techniques to link the ideas in a paragraph.
   c) **Writing**: Paragraph writing, using key words/phrases and organizing points in a coherent manner.
   d) **Grammar and Vocabulary**: Cohesive devices, articles and prepositions.

UNIT-IV

4. **H.G.Wells and the Uncertainties of Progress, Peter J. Bowler**
   a) **Placement Papers**.
   b) **Reading**: Understand and interpret graphic elements used in texts.
   c) **Writing**: Information transfer.
   d) **Grammar and Vocabulary**: Adjectives, adverbs and antonyms.

UNIT-V

5. **Leaves from the Mental Portfolio of a Eurasian, Sui Sin Far**
   a) **Placement Papers**.
   b) **Reading:** Reading for comprehension.
   c) **Writing**: Essay writing
   d) **Grammar and Vocabulary**: Articles, prepositions, tenses, subject verb agreement and technical jargon (15 words)

TEXT BOOKS:

1. English All Round -I (Communication skills for Under Graduate Learners)– Orient Black Swan Pvt. Ltd. Publisher, 1st edition,2019

REFERENCE BOOKS:

1. Raymond Murphy, *Murphy's English Grammar,* Cambridge University Press 2004
2. Meenakshi Raman, Sangeeta Sharma, *Technical Communication: English Skills for Engineers*, Oxford University Press, 2009
3. Michael Swan, *Practical English Usage*, Oxford University Press, 1996

WEB REFERENCES:

1. https://www.grammarly.com/blog
2. https://www.englishclub.com/
3. www.nonstopenglish.com/
4. https://www.fluentu.com/blog/english/
5. https://beta.freerice.com/
6. https://prepinsta.com/cognizant/
7. https://www.geeksforgeeks.org/tcs-placement-paper-mcq-1/
8. https://www.firstnaukri.com/career-guidance/infosys-placement-papers-with-solutions-2019-firstnaukri-prep
9. https://in.usembassy.gov/education-culture/american-spaces/dostihouse-mumbai/library-services/
10. https://www.youtube.com/user/bbclearningenglish

11. https://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
12. https://englishlive.ef.com/blog/language-lab/5-simple-ways-improve-written-english/

II B. TECH- II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC22L1	INTERNET OF THINGS LAB						

COURSE OBJECTIVES:

Students will be explored to

1. Classify the latest microcontrollers with application development
2. Plan about the product design and prototyping.
3. Build interconnection and integration of the physical world and the cyber space.
4. Construct the IOT Devices.
5. Apply to develop the IOT Devices.

COURSE OUTCOMES:

After completion of this course, the student will able to

CO1: Explain the application areas of IOT ·

CO2: Influence the revolution of Internet in Mobile Devices,

CO3: Discuss about the importance of Cloud in IOT.

CO4: Justify about the importance of Sensor Networks.

CO5: Explain building blocks of Internet of Things and characteristics.

LIST OF EXPERIEMENTS

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.

2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.

3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.

4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.

5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.

6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.

7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.

8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.

9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to Thing speak cloud.

10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from Thing speak cloud.

EXPERIMENTS BEYOND SYLLABUS:

1. To install MySQL database on Raspberry Pi and perform basic SQL queries.

2. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

3. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.

4. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.

5. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

Virtual Experiments:

1. Auto desk Eagle & Microsoft Raspberay Pi Simulation.

2. Proteus.

3. Virtronics simulation.

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC22L2	ANALOG AND DIGITAL COMMUNICATIONS LAB						

COURSE OBJECTIVES:

1. To Analyze Analog Communication system modulation and demodulation techniques.
2. To design the Pulse Modulation techniques.
3. Illustrate the concept of pre-emphases and de-emphasis.
4. To categorize different digital modulation techniques
5. To Assess various channel encoding schemes

COURSE OUTCOMES:

After completion of this course, the student should able to

CO1: Design and measure performance of AM and FM communication systems.
CO2: Choose the different pulse modulation techniques
CO3: Compare pre-emphasis and de-emphasis.
CO4: Experiment with different digital modulation techniques and observe their results.
CO5: Classify various channel encoding schemes for a given data stream.

LIST OF EXPERIMENTS: (any 10 experiments can proceed)

Part-A:

1. Amplitude modulation and Demodulation
2. Frequency modulation and Demodulation
3. Pre-Emphasis and De-Emphasis
4. Sampling theorem
5. Pulse amplitude modulation and Demodulation
6. Pulse width modulation and Demodulation

Part-B:

7. Pulse code modulation
8. Delta modulation
9. Frequency shift keying
10. Phase shift keying
11. Convolution code- encoder & decoder
12. Source encoder and decoder
13. Linear block encoder and decoder
14. Binary cyclic code- encoder & decoder

EXPERIMENTS BEYOND SYLLABUS:

1. Multiple channel DSSS – spreading, dispreading, decoding etc

Virtual Labs:

1. To explore the relationship of signals in the time and frequency domain.
2. To analyze the bit error rate of M-QAM over an AWGN channel.

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC22L3	ELECTRONIC CIRCUITS AND PULSE CIRCUITS LAB						

COURSE OBJECTIVES:

1. Study the Frequency response of single stage amplifier.
2. How frequency response varies by applying negative feedback on amplifiers.
3. Working of oscillators and Power amplifier.
4. Different responses for linear and nonlinear wave shaping circuits.
5. Working of different multivibrators.

COURSE OUTCOMES:

After Completion of this course, student must be able to

CO1: Understand the effect of Frequency response of single stage amplifier.
CO2: Understand how frequency response varies by applying negative feedback on amplifiers.
CO3: Determine the efficiency of power amplifiers.
CO4: Construct high input impedance circuits.
CO5: Understand different responses for linear and nonlinear wave shaping circuits.
CO6: Design and working of different multivibrators.

LIST OF EXPERIMENTS:

I) DESIGN AND SIMULATION IN SIMULATION LABORATORY USING MULTISIM OR PSPICE OR EQUIVALENT SIMULATION SOFTWARE & VERYFING THE RESULT BY HARDWARE:

1. Single Stage CE Amplifier.
2. Voltage series feedback amplifier - Frequency response.
3. Current series feedback amplifier - Frequency response.
4. RC Phase Shift Oscillator using Transistors- Design for different frequencies.
5. Class A Power Amplifier.
6. Boot strapped emitter follower.

II) PULSE AND DIGITAL CIRCUITS -BY DESIGNING THE CIRCUIT:

1. Linear wave shaping (Diff. Time Constants, Differentiator, Integrator)
2. Non –linear wave shaping-clippers., Clampers
3. Bistable Multivibrators
4. Astable Multivibrators
5. Monostable Multivibrators
6. Schmitt Trigger

EXPERIMENTS BEYOND SYLLABUS:

1. Single tuned Amplifier
2. Boot strap sweep Circuits.

VIRTUAL EXPERIMENTS:

1. Two stage RC coupled Amplifier
2. Linear wave shaping and Nonlinear wave shaping circuits.

II B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4		50	50	2
Code: R20EC22SC1	DESIGN AND SIMULATION OF ELECTRONIC CIRCUITS						

COURSE OBJECTIVES:

The main objective of this lab is to introduce the Laboratory Virtual Instrument Engineering Workbench to

1. Construct a simple virtual instrument (VI).
2. Navigate and use pre-made Simulation Software.
3. To apply the Simulation Software for development of various applications

COURSE OUTCOMES: Upon completion of this course, students will be able to

CO1: To solve problems using Simulation Software
CO2: To develop, debug and test various electronic circuits
CO3: To use File I/O techniques.
CO4: To transfer data among parallel processes.
CO5: To use Simulation Software to create various applications

LIST OF EXPERIEMENTS:

1. Introduction to the Graphical programming environment
2. Introduction to Data Acquisition – G Approach to Hardware Integration
3. Data Acquisition – API Programming
4. Signal Processing – Acquire, Analyze & Generation
5. Signal Processing – Fourier Transform
6. Communication- Modulation and correlation
7. Digital Image Processing -Image acquisition and processing
8. Digital Image Processing - Morphology and Edge Detection
9. Machine Learning -Algorithms and Applications
10. Introduction to the Deep Learning System using Graphical Approach
11. Hand written character recognition and examples
12. Introduction to Industrial IoT Systems – Edge node
13. Industrial IoT Systems – Dashboard and cloud connectivity

III B.Tech., I Semester, ECE

R20 Course Structure

&

Syllabus

III B.TECH. – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Linear & Digital IC Applications	R20EC3101	PC	3	0	0	30	70	100	3
2	Antennas and Wave Propagation	R20EC3102	PC	3	0	0	30	70	100	3
3	Digital Signal Processing	R20EC3103	PC	3	0	0	30	70	100	3
4	Open Elective – I		OE	3	0	0	30	70	100	3
	i. Principles of Signals, Systems & Communications (Other than ECE)	R20EC3104								
	ii. Introduction to Data Science	R20EC3105								
5	Professional Elective–I:		PE	3	0	0	30	70	100	3
	i. Electronic Measurements and Instrumentation	R20EC3106								
	ii. Data Communication and Computer Networks	R20EC3107								
	iii. Statistical Methods in AI	R20EC3108								
	iv. Signals and Transform Techniques	R20EC3109								
6	DSP Lab	R20EC31L1	PC	0	0	3	15	35	50	1.5
7	LDICA Lab	R20EC31L2	PC	0	0	3	15	35	50	1.5
8	Embedded Systems and Robotics Lab	R20EC31SC3	SC	1	0	2	0	50	50	2
9	Professional Ethics and Human Values	R20CC31MC01	MC	2	0	0	-	-	-	0
10	Internship/ Community Service Project	R20CC31IN	PR	0	0	0	-	50	50	1.5
	Total			**17**	**0**	**10**	**195**	**505**	**700**	**21.5**
Honors /Minor course				**4**	**0**	**0**				**4**

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3101	LINEAR AND DIGITAL IC APPLICATIONS						

COURSE OBJECTIVES:

1. To familiarize with the functioning of various Linear ICs such as OP AMP, Timer, Voltage Controlled Oscillator and Phase Locked Loop.
2. To introduce different digital MSI ICs and memories.
3. To familiarize in digital logic families and interfacing
4. To extend logic gate concepts to realize combinational and sequential circuits.
5. To familiarize with CAD tools and writing VHDL programs

COURSE OUTCOMES: At the end of the course, Students will be able to

CO1: Recall the basics of FET, MOSFET, amplifiers, standard memories and their characteristics **[K1]**.

CO2: Extend the logic gate concept to realize basic combinational and sequential circuits for various Boolean expressions **[K2]**.

CO3: Illustrate the operation of IC 555 timer, utilization of filters, VCO, data converters and PLL in the development of various circuits **[K2]**.

CO4: Demonstrate the applications of Operational amplifier and IC 555 timer such as Adder, Subtractor, V-I, I-V converter, Differentiator, Integrator, and Triangular, Square wave generators, PWM, PPM generation respectively **[K2]**..

CO5: Make use of the computer-aided design tools for development of complex digital logic circuits **[K3]**.

SYLLABUS:

UNIT–I: OPERATIONAL AMPLIFIER AND ITS APPLICATIONS

The Operational Amplifier, Ideal Operational Amplifier, Operational Amplifier internal circuit, DC and AC characteristics, compensation techniques, Analysis of data sheets of IC 741, Op-amp applications: Adder, Subtractor, V to I and I to V converters, Sample and Hold circuit, Log and Anti log Amplifiers, Integrator and Differentiator, Triangular and Square wave generators.

UNIT–II: D-A AND A-D CONVERTERS & 555 IC TIMER

Need for D-A and A-D conversion, Basic DAC techniques, A-D converters, DAC/ADC Specifications. 555 IC Timer- Pin diagram, functional description, Monostable and Astable operation.

UNIT–III: ACTIVE FILTERS, VCO & PHASE LOCKED LOOP

Active filters, Voltage Controlled Oscillator (VCO) - IC 566- Pin diagram, Block diagram Description, 565 IC PLL- Pin diagram, block schematic, basic principle of operation.

UNIT–IV: DIGITAL LOGIC FAMILIES AND INTERFACING

Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families. Bipolar logic, TTL families, Emitter coupled logic, Comparison of CMOS, TTL and ECL.

UNIT–V: DESIGN OF COMBINATIONAL & SEQUENTIAL LOGIC CIRCUITS

Ripple adders and subtractors-74x999, 283, Design of decoders, Encoders, Priority encoder, Multiplexers, Demultiplexers, Parity circuits, Comparators, Simple Floating-Point Encoder and basic flip-flops with relevant Digital ICs, design of Counters, MSI Registers, Shift registers, bi-directional shift register, universal shift register with relevant Digital ICs.

History of VHDL, Design flow, program structure, Modeling Styles of VHDL, Example programs.

TEXT BOOKS:

1. D.Roy Choudhury, Shail B.Jain,–Linear Integrated Circuits, 4th Multi Colour Edition, New Age International (p) Ltd, 2010.
2. John F.Wakerly – Digital Design Principles & Practices, 3rdEdition, PHI/Pearson Education Asia, 2005.

REFERENCE BOOKS:

1. Ramakanth, A. Gayakwad, ―OP-Amps & Linear ICs, PHI, 1987.
2. J. Bhasker, ―VHDL Primer, 3rdEdition, Pearson Education/ PHI.
3. Atul P.Godse and Deepali A. Godse, ―Digital IC Applications, Technical Publ., Pune, 2005.
4. K. LalKishore, V.S.V.Prabhakar, –VLSI Design, I.K International publishing house, Pvt Ltd.

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3102	ANTENNAS AND WAVE PROPAGATION						

COURSE OBJECTIVES:

1. To understand the applications of the electromagnetic waves in free space.
2. To introduce radiation mechanism for understanding various forms of narrow band antennas.
3. To introduce radiation mechanism for understanding various forms of broad band antennas.
4. To familiarize with Measure various parameters of antenna,
5. To understand the concepts of wave propagation and its characteristics in atmospheric conditions.

COURSE OUTCOMES: After completion of the course, the student will be able to

CO1: Analyze the radiation mechanism and basic antenna parameters. **[K4]**
CO2: Identify the radiation mechanism in linear wire antenna. **[K3]**
CO3: Analyze the different antenna arrays. **[K4]**
CO4: Make Use of different antennas at HF, VHF and UHF frequencies and utilize the antenna measurements to know antenna's performance. **[K3]**
CO5: Identify the characteristics of wave propagation in atmosphericconditions. **[K3]**

SYLLABUS:

UNIT–I: ANTENNA FUNDAMENTALS

Introduction to Antennas, Radiation Mechanism – single wire, 2-wire, dipoles, Current Distribution on a thin wire antenna. Characteristics of Antenna- Radiation Pattern, Radiation intensity, Beam solid angle, Directivity, Gain, Polarization, efficiency, Equivalent areas, Radiation Resistance, Effective length, antenna temperature; Relation between Maximum Directivity and effective area, illustrated Problems.

UNIT–II: LINEAR WIRE ANTENNA

Retarded potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Directivity. Introduction to Antenna Theorems and Loop antennas.

UNIT–III: ANTENNA ARRAYS

Introduction, Two element arrays – different cases; N element uniform arrays- Broadside, End- fire Arrays, EFA with Increased Directivity. Principle of pattern multiplication, Binomial and Phased array.

UNIT–IV: HF, VHF, UHF ANTENNAS

Introduction, Traveling wave radiators – basic concepts, Long wire antennas, V-Antenna, Rhombic Antenna, Folded Dipole, Yagi-Uda Antenna, Helical Antenna, Micro strip antenna. Microwave antennas- Reflector antennas, Parabolic antennas, Horn Antenna, Lens Antenna.

Antenna Measurements: Radiation pattern, Gain transfer method, Absolute measurement, Directivity.

UNIT–V: WAVE PROPAGATION

Friss Free space Equation for wave Propagation, Ground wave Propagation, Space wave Propagation- Field strength calculation, Line of Sight, Duct Propagation, Tropospheric Scattering. Sky wave Propagation-Formation of Ionospheric Layers, Mechanism of Reflection and Refraction and their Characteristics, Ionospheric Abnormalities and Absorption.

TEXT BOOKS:

1. Constantine A.Balanis, "Antenna Theory: Analysis and Design", 4th Edition, John Wiley & Sons, 2016.
2. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation" –Tech India Publications, New Delhi, 2001.

REFERENCE BOOKS:

1. J. D. Kraus, R. J. Marhefka, "Antennas and Wave Propagations", 4th Edition, McGraw-Hill, 2010.
2. E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2007.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108101092/1
2. https://onlinecourses.nptel.ac.in/noc18_ee13/preview
3. https://nptel.ac.in/courses/117101056/48
4. https://www.youtube.com/watch?v=md7GjQQ2YA0

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3103	DIGITAL SIGNAL PROCESSING						

COURSE OBJECTIVES:

1. Make Enhance the analytical ability of the students in the area of signal processing.
2. Develop ability among students to observe the response of the discrete time systems for different types of discrete time sequences.
3. Demonstrate basic knowledge of Digital Signal Processing by understanding various transformations.
4. Understand different types of filters (analog/digital) and their designs.
5. Design DSP systems which are used in the area of communications and networking.

COURSE OUTCOMES: After completion of the course, the student will be able to

CO1: Analyze the signals and system in Time and Frequency domain through transformations. **[K4]**

CO2: Solve DFT and IDFT coefficients of a given discrete time sequence using Fast Fourier Transform algorithm**. [K3]**

CO3: Examine the significance of various filter structures and responses. **[K3]**

CO4: Construct the digital filter circuits for generating desired signal wave shapes. **[K4]**

CO5: Inspect the performance of a variety of windowing techniques. **[K3]**

SYLLABUS:

UNIT-I: INTRODUCTION

Review of Discrete Time Signals: Some Elementary Discrete-Time Signals, Classification of Discrete–Time Signals, Simple Manipulations of Discrete–Time Signals, Discrete Time Systems: Input-Output Description of Systems, Block Diagram Representation of Discrete-Time Systems and Classification of Discrete-Time Systems, Frequency domain representation of Discrete Time Signals and Systems, Discrete-Time Fourier Transform (DTFT): Existence of DTFT, properties of DTFT.

UNIT-II: DISCRETE FOURIER SERIES & DISCRETE FOURIER TRANSFORMS

Discrete Fourier series: Properties of Discrete Fourier Series, DFS representation of periodic sequences. DFT: Properties of DFT, Computation of DFT, Circular & Linear Convolution of Sequences using DFT. FAST FOURIER TRANSFORMS: Radix-2 Fast Fourier Transforms (FFT), Decimation in Time and Decimation in Frequency FFT Algorithms and Inverse FFT. Review of Z-Transforms

UNIT-III: REALIZATION OF IIR & FIR FILTERS

Block Diagram Representation of Linear Constant Coefficient Difference Equations. Basic structures of IIR systems: Direct form-I realization, Direct form-II realization, transposed, cascade form, parallel form. Lattice structures of IIR systems, Conversion from Lattice structure to direct form and vice-versa. Basic structures of FIR systems: Transversal structure, linear phase, Lattice structure, Polyphase Lattice structures of FIR systems, Conversion from Lattice structure to direct form and vice-versa.

UNIT-IV: IIR DIGITAL FILTERS

Analog filters approximations: Butterworth and Chebyshev, Design of IIR digital filters from analog filters, Design examples, Frequency Transformations in Analog Domain: Low pass to Low pass filter, Low pass to High pass filter, Low pass to Band pass filter, and Low pass to Band stop filter. Frequency Transformations in digital domain: Low pass to Low pass filter, Low pass to High pass filter, Low pass to Band pass filter, and Low pass to Band stop filter.

UNIT-V: FIR DIGITAL FILTERS

Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Digital Filters Using Window Techniques: Rectangular Window, Triangular or Bartlett Window, Raised Cosine Window Hanning Window, Blackman Window, Kaiser Window, Frequency Sampling Technique: Frequency Sampling Realization, Frequency Response, Design, Comparison of IIR and FIR filter.

TEXT BOOKS:

1. John G. Proakis, Dimitris G. Manolakis, ―Digital signal processing, principles, Algorithms and applications, 4th Edition, Pearson Education/PHI, 2007.
2. A.V. Oppenheim and R.W. Schaffer, ―Discrete Time Signal Processing‖, 2nd Edition, PHI, 2008.

REFERENCE BOOKS:

1. Ramesh Babu, ―Digital Signal Processing‖, SciTech Publications, 2011.
2. Andreas Antoniou, ―Digital signal processing‖, TATA McGraw Hill, 2006.
3. R S Kaler, M Kulkarni,, Umesh Gupta, ―A Text book on Digital Signal processing‖, I K International Publishing House Pvt. Ltd, 2010.
4. M H Hayes, Schaum‘s outlines, ―Digital signal processing‖, TATA Mc-Graw Hill, 2007.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=6dFnpz_AEyA&list=PL9567DFCA3A66F299
2. https://www.youtube.com/watch?v=8zbBJkw5KsM&list=PL4FA894BD6A9586E1

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3104	PRINCIPLES OF SIGNALS, SYSTEMS AND COMMUNICATIONS (Other than ECE) (OPEN ELECTIVE-I)						

COURSE OBJECTIVES:

3. To build elementary signals and implement Trigonometric and Exponential Fourier series.
4. To Construct Fourier transform, Hilbert Transform and Laplace transform of continuous time signals and properties of Fourier Transform.
3. To develop various properties of Laplace and z- transforms of continuous time signals.
4. To Identify linear time variant and linear time invariant systems.
5. To construct of various filters and about sampling.

COURSE OUTCOMES: After completion of this course, the student should able to

CO1: Explain basic concepts of signals **[K2].**
CO2: Analyze time-domain signals in frequency-domain using Fourier transforms **[K4].**
CO3: Demonstrate the concepts of linear systems **[K2].**
CO4: Illustrate various analog modulation techniques **[K2]**
CO5: Compare various digital modulation techniques **[K4].**

SYLLABUS:

UNIT-I: INTRODUCTION TO SIGNALS

Standard Signals, Signal Operations: Time Shifting, Scaling and Reversal, Classification of Signals: Analog, Digital, Discrete, Periodic and Aperiodic, Even and Odd, Energy and Power.

UNIT-II: SIGNAL ANALYSIS

Introduction to Fourier Series - Trigonometric and Exponential Fourier Series, Fourier Transform - Analysis of non-periodic functions, Fourier Transform of standard signals, Properties of Fourier Transform.

UNIT-III: LINEAR SYSTEMS

Introduction, Definition of system function, Classification of systems. Distortionless transmission, Signal bandwidth and System band width

UNIT-IV: INTRODUCTION TO COMMUNICATION SYSTEMS

Need for Modulation, Types of Modulation, Amplitude modulation- Generation of AM, Demodulation of AM, Frequency modulation, Phase modulation.

UNIT-V: PULSE MODULATION

Pulse Analog Modulation: PAM Modulation and Demodulation, PWM and PPM- modulation and demodulation, Time Division Multiplexing, Frequency Division Multiplexing.
Pulse Digital Modulation: PCM System, Differential pulse code modulation, Delta Modulation, Adaptive delta modulation and comparisons.

TEXT BOOKS:

1. R. P. Singh, S. D. Sapre, "Communication Systems - Analog and Digital, Tata McGraw Hill, Reprint 2003.
2. H. Taub and D. Schilling, "Principles of Communication Systems", TMH, 2003.
3. B.P.Lathi, "Signals systems and communication", BS Publications, 2008.

REFERENCE BOOKS:

1. Simon Haykin, John Wiley, "Communication Systems", 3rd Edition, 2008.
2. P. Ramesh Babu, R. Anandanatarajan, "Signals and Systems", Scitech Publications, 4th Edition, 2006

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: 20EC3105	INTRODUCTION TO DATA SCIENCE (OPEN ELECTIVE-I)						

COURSE OBJECTIVES:

1. To summarize the basics of Data Science.
2. To outline data collection and data pre-processing methods.
3. To outline the statistical parameters used in Data Science.
4. To illustrate model development and decision making.
5. To illustrate model evaluation by using metrics and prediction.

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

CO1: Summarize the basics of Data Science. **(K2)**
CO2: Outline data collection and data pre-processing methods. **(K2)**
CO3: Outline the statistical parameters used in Data Science **(K2)**
CO4: Illustrate model development and decision making. **(K2)**
CO5: Illustrate model evaluation by using metrics and prediction. **(K2)**

SYLLABUS

UNIT-I: INTRODUCTION

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

UNIT-II: DATA COLLECTION AND DATA PRE-PROCESSING

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT-III: EXPLORATORY DATA ANALYTICS

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

UNIT-IV: MODEL DEVELOPMENT

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

UNIT-V: MODEL EVALUATION

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

TEXT BOOKS:

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

REFERENCES:

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
2. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3106	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PROFESSIONAL ELECTIVE–I)						

COURSE OBJECTIVES:

1. List out Performance Characteristics of Different Electronic Measuring Instruments, Analysis and Calibration Techniques.
2. Describe Concepts of Passive and Active Transducers and about the description, classification & selection criterion of Transducers.
3. Review the concepts of electrical and electronics measurements with different techniques.
4. Memorize Signal Generator and Wave Analyzers for Analysis
5. Illustrate concepts of computer controlled test systems, storage elements and display instruments and Basic CRO circuits & CRO Probes, of EM Spectrum and Explain about all AC bridges and Q-meters, Design Methods and its Applications Techniques of Measurement of frequency and about measurement techniques of signals by using various types of Signal Analyzers.

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

CO1: List out Electronic Instruments, their Characteristics and use, Peculiar Errors Associated with the Instruments and how to minimize such Errors. **[K1]**

CO2: Identify with transducers, electrical and electronic instruments**. [K2]**

CO3: Apply the Principle of Operation of Electronic Measuring Instruments**. [K3]**

CO4: Illustrate various concepts of electronic instruments. Computer controlled test systems. **[K4]**

CO5: constructed Storage and display instruments for experimenting andAnalysis the working & uses of Electronic voltmeter & multimaster, Digital multimaster, Q meter **[K5]**

SYLLABUS:

UNIT-I: **BASIC MEASUREMENTS:** Functional Elements of measurement system- Examples - Characteristics of instruments: Static characteristics, Dynamic characteristics, Types of errors, sources of errors, methods of eliminating Errors, Histogram, Mean, Measure of dispersion from the mean, Range Deviation Average deviation, Standard Deviation, Variance, Bourdon Tubes.

UNIT-II: TRANSDUCERS: Classification of Transducers, Characteristics, Basic Requirements of a Transducer, Resistive Transducer, Strain Gauge, Inductive Transducer, Capacitive displacement transducer, LVDT, Load cell Transducers, Thermocouple, Thermistor, Radiation Pyrometers.

UNIT-III: ELECTRICAL MEASUREMENTS: Measurement of Voltage and Current: D'Arsonval Galvanometer, permanent magnet moving coil, permanent magnet moving iron, Dynamometer, Measurement of Resistance, Inductance and Capacitance: Wheat stone bridge, Kelvin double bridge, Wien Bridge, Hay's bridge, Maxwell bridge, Anderson bridge, Q- Meter, Schering bridge, Ohmmeter.

UNIT-IV: ELECTRONIC MEASUREMENTS: Signal generators: Function Generator, RF Signal Generator, Random Noise Generator, Sweep generators, Wave Analyzer- Harmonic, Distortion Analyzer - Spectrum Analyzer - DC & AC Voltmeters, Digital Voltmeters, Electronic Multimeters, VOM meters. Measurement of physical parameters force, pressure, velocity, humidity and Data acquisition systems.

UNIT-V: STORAGE AND DISPLAY INSTRUMENTS: Cathode Ray Oscilloscopes– CRT Circuit, Vertical Deflection System, Delay Line, Horizontal Deflection System, Oscilloscope Techniques, Special Oscilloscopes, Recorders -XY & Magnetic Tape Dot Matrix Display.

TEXT BOOKS:

1. A.K.Sawhney ‖ Electrical, Electronic measurement & Instrumentation‖, 18th Edition, Dhanpat Rai & Sons, Reprint 2010
2. Albert.D.Helfrick & William.D.Cooper, ― Modern Electronic Instrumentation & Measurement Techniques‖, PHI, 2003.

REFERENCE BOOKS:

1. E.W.Golding and F.C.Widdis ―Electrical Measurements and measuring Instruments‖, 5th Edition, AH Wheeler & Company, 1993.
2. Electronic instrumentation: H.S.Kalsi - TMH, 2nd Edition 2004.
3. Alan Morris, "Principles of Measurements & Instrumentation", 2nd Edition, PHI, 2003.
4. R. K. Rajput, ―Electronic Measurements & Implementation‖, S. Chand Pu

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3107	DATA COMMUNICATIONS AND COMPUTER NETWORKS (PROFESSIONAL ELECTIVE–I)						

COURSE OBJECTIVES:

1. To gain knowledge in network topology, reference models various transmission media and ISDN techniques.
2. To illustrate data link layer design issues, medium access sub layer protocols, routing in computer networking
3. To summarize transport layer and application layer functions.
4. To classify protocols used in different layers of the computer network
5. To understand concepts of network security, domain name service, network management protocol

COURSE OUTCOMES: After completion of the course, the student will be able to

CO1: List the different types of services, layers and switching techniques in computer networks. **[K4]**

CO2: Identify design issues of various layers in the reference model of computer networks. **[K3]**

CO3: Analyze various network topologies, transmission media and ISDN techniques. **[K4]**

CO4: Classify protocols used in different layers of the computer network. **[K4]**

CO5: Identify the concepts of network security, domain name service, network management protocol**. [K3]**

SYLLABUS:

UNIT-I: PHYSICAL LAYER

Network topologies, ISO-OSI Reference model - TCP/IP Reference model, Problems in OSI Reference model - Problems in TCP/IP Reference model. Transmission media: copper wire, twisted pair, coaxial cable and fibre optic cable - Switching techniques: circuit, message and packet switching – comparison of switching techniques - ISDN.

UNIT-II: DATA LINK LAYER

Design issues: services provided to network layer, framing techniques, flow control, error control Error detection and correction: Cyclic Redundancy Code, Elementary protocols: Unrestricted simplex protocol - simple stop-and-wait protocol - Sliding window protocols: 1-bit sliding window protocol, Go back n and Selective Repeat protocols.

UNIT-III: NETWORK LAYER

Services provided to transport layer - Communication subnet: Virtual Circuit (VC) and datagram subnets, Routing algorithms: optimality principle - Shortest path routing – Flooding - Distance vector routing - Count-to-infinity problem - Hierarchical routing - Link state routing, Broadcast routing - Multicast routing.

UNIT-IV: TRANSPORT LAYER

Transport services – Transport service primitives - Connection management: Connection Establishment protocols – Connection release protocol: two-army problem, Transport protocols - TCP protocol: TCP header format – UDP protocol: UDP header format.

UNIT-V: APPLICATION LAYER

Network security: Authentication – Cryptography – Encryption types - Substitution ciphers and transposition ciphers – DES (Data Encryption Standard) – DNS (Domain Name Service) - SNMP (Simple Network Management Protocol) model

TEXT BOOKS:

1. Andrew S Tanenbaum ―Computer Networks‖, 5th Edition, PHI, 2013.
2. Behrouz A. Forouzan ―Data Communications and Networking‖, 3rd Edition, TMH, 2002.

REFERENCE BOOK:

1. W. Stallings, ―Data and Computer Communication‖ , 10th Edition, Pearson Education, 2013.

WEB REFERENCES:

1. http://eti2506.elimu.net
2. www.mbit.edu.in

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3108	STATISTICAL METHODS IN AI (PROFESSIONAL ELECTIVE-I)						

COURSE OBJECTIVES:

1. To summarize the basics of Artificial Intelligence, Intelligent Agents and its structure for problem solving by various searching techniques.
2. To outline symbols, semantics, axioms, literals and forms.
3. To compare different reasoning and search methods used in AI.
4. To summarize Knowledge Representation techniques and knowledge acquisition stages.
5. To illustrate expert systems in AI and problem solving techniques.

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

CO1: Summarize the basics of Artificial Intelligence, Intelligent Agents and its structure for problem solving by various searching techniques. **[K2]**

CO2: Outline symbols, semantics, axioms, literals and forms. **[K2]**

CO3: Compare different reasoning and search methods used in AI. **[K2]**

CO4: Summarize Knowledge Representation techniques and knowledge acquisition stages. **[K2]**

CO5: Illustrate expert systems in AI and problem solving techniques. **[K2]**

SYLLABUS:

UNIT–I: AI HISTORY AND APPLICATIONS

Overview of AI application areas: game playing, automated reasoning and theorem proving, expert systems, natural language understanding, planning and robotics, machine learning and Alan Turing Test.

UNIT–II: SYMBOL AND SENTENCES

Semantics of the Propositional Calculus & Predicate Calculus. Inference Rules and Theorem Proving. Axioms, Literals, Horn clause & Clausal forms.

UNIT–III: REASONING

Inductive, Deductive, Abductive and Default reasoning. More examples on Resolution proof. Structures and strategies for state space search. Algorithms for Heuristic search, Heuristic evaluation functions.

UNIT-IV: KNOWLEDGE REPRESENTATION TECHNIQUES

Conceptual graphs; structured representations; frames, scripts; issues in knowledge representation: hierarchies, inheritance, exceptions. An overview of the induction methods, types and tools. Stages in Knowledge acquisition with examples. Analyzing, coding, documenting and diagramming. Scope of knowledge.

UNIT–V: EXPERT SYSTEMS

Overview of expert system technology; rule-based expert systems; Construction of ES. Components of an ES, The explanation facility, Rule-based formation and forward and backward chaining techniques for problem solving.

TEXT BOOK:

1. Artificial Intelligence - A New Synthesis by Nils J. Nilsson, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Artificial Intelligence: Strategies and techniques for complex problems solving by George Luger, Addison-Wesley, 2003.
2. Artificial Intelligence - A Modern Approach by Stuart Russell & Peter Norvig, Prentice Hall.

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3109	SIGNALS AND TRANSFORM TECHNIQUES (PROFESSIONAL ELECTIVE-I)						

COURSE OBJECTIVES:

1. To revise Fourier series and Fourier transform.
2. To discuss different transforms like Walsh, Hadamard, Haar and Slant.
3. To discuss about Continuous Wavelet Transforms.
4. To discuss about Multi Rate Analysis and DWT.
5. To discuss about special Topics like Wavelet Packet Transform, Multidimensional Wavelets.

COURSE OUTCOMES:

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

CO1: Make use of Fourier series and Fourier transform, DFT **[K3].**
CO2:.Analyze different transforms like Walsh, Hadamard, Haar and Slant **[K4].**
CO3: Model Continuous Wavelet Transforms **[K3].**
CO4: Apply Multi Rate Analysis and DWT **[K3].**
CO5: List special topics like Wavelet Packet Transform, Multidimensional Wavelets **[K1].**

SYLLABUS:

UNIT-I : 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, STFT

UNIT-II: Transforms: Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT,– definition, properties and applications

UNIT-III: Continuous Wavelet Transform (CWT): Short comings 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- B Splines, Lifting Scheme of Wavelet Generation, Multi Wavelets.

TEXT BOOKS:

1. Raghuveer M.Rao and Ajit S. Bopardikar, "Wavelet Transforms-Introduction theory and applications" Pearson Edu, Asia, New Delhi, 2003.

2. Soman. K. P, Ramachandran. K.I, “Insight into Wavelets from Theory to Practice” Printice Hall India, 1st Edition, 2004.

REFERENCE BOOKS:

1. Jaideva C Goswami, Andrew K Chan, “Fundamentals of Wavelets- Theory, Algorithms and Applications” John Wiley & Sons, Inc. Singapore, 1999.
2. Vetterli M. Kovacevic, “Wavelets and Sub-band Coding”, PJI, 1995.
3. C. Sydney Burrus, “Introduction to Wavelets and Wavelet Transforms”, PHI, 1st Edition, 1997.
4. Stephen G. Mallat,v, ”A Wavelet Tour of Signal Processing” , Academic Press, 2nd Edition
5. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, “Digital Image Processing” , TMH, 2009

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC31L1	DIGITAL SIGNAL PROCESSING LAB						

COURSE OBJECTIVES:

1. Illustrate time and frequency domain response of discrete time signals and systems.
2. Develop IIR filters and FIR filters.
3. Learn to develop the programs for the designing of filters.
4. Understand the response of an LTI system.
5. Develop the power spectrum of the sequences

COURSE OUTCOMES: After successful completion of this course, the student will be able to

CO1: Demonstrate the architecture of DSP chips – TMS 320C 5X/6X **(K2)**.

CO2: Illustrate time and Frequency domain response of signals and systems through simulation **(K2)**.

CO3: Develop IIR filters and extend it to convert into FIR filters using windowing techniques and also to obtain the frequency response **(K3)**.

CO4: Interpret the LTI system response for different types of inputs **(K3)**

CO5: Develop the power density spectrum of different sequence to analyze the power of the sequences **(K3)**

LIST OF EXPERIMENTS:

1. To Study the architecture of DSP chips – TMS 320C 5X/6X.
2. Time domain and Frequency domain Analysis of signals and systems.
3. To obtain spectrum of the discrete time sequence (without using default functions)
4. To obtain output of an LTI system (without using default functions).
5. To verify linear and circular convolution.
6. To design FIR filter (LP/HP) using windowing technique
   a) Using rectangular window
   b) Using triangular window
   c) Using Kaiser Window
7. To Implement IIR filter (LP/HP) on DSP Processors
8. To obtain frequency samples of a time sequence using FFT algorithm.
9. To obtain frequency response of analog LP/HP filters.
10. To compute power density spectrum of a sequence.

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC31L2	LINEAR & DIGITAL IC APPLICATIONS LAB						

COURSE OBJECTIVES:

1. Demonstrate applications of OP-Amp and IC 555timer
2. Classify the operation of analog filters
3. Illustrate and compare the operation of multivibrator
4. Illustrate and compare the operation of different voltage regulators
5. Develop the internal circuits for different digital operations

COURSE OUTCOMES: After successful completion, the student will be able to

CO1: Demonstrate the applications of Op-amp such as Adder, Subtractor, Comparator, Integrator and Differentiator Circuits **[K2].**

CO2: Classify the active filters such as LPF, HPF, BPF and Band Reject Filters **[K2].**

CO3: Interpret the operation of Oscillator circuits **[K2].**

CO4: Illustrate the operation of Multivibrator circuits and compare various types of voltage regulators **[K2].**

CO5: Develop the complex digital logic circuits including both combinational and Sequential logics by using computer-aided design tools **[K3].**

SECTION-I:

1. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
2. Integrator and Differentiator Circuits using IC741.
3. Active Filter Applications – LPF, HPF, BPF, Band Reject Filters.
4. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
5. IC 555 Timer – Monostable & Astable Operation Circuit.
6. Schmitt Trigger Circuits – using IC 741 and IC555.
7. Voltage Regulator
   A) Using IC723.
   B) Three Terminal Voltage Regulators – 7805, 7809, 7912.
8. 4 bit DAC using OPAMP.

EQUIPMENT REQUIRED FOR LABORATORIES:

1. RPS
2. CRO
3. Function Generator
4. MultiMeters
5. IC Trainer Kits(Optional)
6. Bread Boards
7. Components:- IC741, IC555, IC565, IC723, 7805, 7809, 7912 and other essential components.
8. Analog IC Tester

SECTION-II:

1. Realization of Logic Gates.
2. 3 to 8 Decoder-74138
3. 8*1 Multiplexer-74151 andDe-multiplexer-74155
4. -BitComparator-7485.
5. D Flip-Flop-7474
6. Counters
    A) 4 BitCounter-7493
    B) Decade Counter-7490
7. Universal shiftregister-74194/195
8. RAM (16×4)-74189 (read and write operations)

Equipment Required:

1. Xilinx ISE software-latest version
2. Personal computer with necessary peripherals
3. Hardware kits- Various FPGA families.

Note: Six Experiments from each section.

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	0	2	-	50	50	2
Code: R20EC31SC3	EMBEDDED SYSTEMS AND ROBOTICS LAB						

COURSE OBJECTIVES:

1. To understand Embedded-System programming.
2. To simulate and test ARM processor based circuits and their interfaces.
3. To provide a platform to conduct advanced fundamental and applied research in the design development and programming the robots for various applications.
4. To provide solutions to solve real life problems by the use of robots.

COURSE OUTCOMES:

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

CO1: Develop basic program on serial communication implementation and Delay generation using timers using microcontroller **[K3].**

CO2: Develop Interrupt handling, Share resource using MUTEX and Allocate resource using semaphores with ARM. **[K3].**

CO3: Construct robotic concept like sensor guided robotics, spy robotics etc **[K3].**

CO4: Examine the different behaviour of robotics **[K4].**

LIST OF EXPERIEMENTS:

1. Serial communication between two microcontrollers.
2. Interrupt generation using microcontrollers.
3. Delay generation using internal timers of microcontrollers.
4. Interrupt handling with ARM.
5. Share Resource using MUTEX with ARM.
6. Allocate resource using semaphores with ARM.
7. Simple Motion Control Robot.
8. Line Following Robot.
9. Obstacle avoidance robot.
10. Zigbee controlled Robot.
11. Pick and Place Robot.
12. Range Detection Robot.

BEYOND SYLLABUS:

1. Steeper Motor Control using Arduino.
2. Surveillance robot.

VIRTUAL LABS:

1. ADC triggering through timer (ON-CHIP Timer).
2. MCU DAC interfacing and generation of Ramp wave.

III B.TECH- I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0				
Code: R20CC31MC01	PROFESSIONAL ETHICS AND HUMAN VALUES						

COURSE OUTCOMES:

Student is able to

CO1: Interpret the fundamentals of Human values. [K2]
CO2: Analyse the ethical issues and role of engineers in industry. [K4]
CO3: Develop the principles of harmony in value education. [K3]
CO4: List out the duties and rights of engineers. [K4]
CO5: Summarise the engineer's responsibilities towards safety and risk. [K2]

UNIT-I; HUMAN VALUES

Ethics, Morals, Values, Integrity, Work Ethics- Service Learning – Civic Virtue- Respect for Others- Living Peacefully- Caring- Sharing- Honesty- Courage- Value Time- Cooperation- Commitment – Empathy- Self-Confidence- Spirituality- Character.

UNIT-II: ENGINEERING ETHICS

Professional Roles to Be Played By Engineer- Engineers Role as Managers, Consultants and Leaders- Ethical Theories And Its Uses.

UNIT- III: PRINCIPLES FOR HARMONY

Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT-IV: ENGINEERS' DUTIES AND RIGHTS

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes-
Industrial Espionage- Price Fixing-Whistle Blowing.

UNIT-V: ENGINEERS' RESPONSIBILITIES TOWARDS SAFETY AND RISK

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects – Threshold Levels of Risk - Delayed v/s Immediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

TEXT BOOKS:

1. "Professional Ethics and Morals by Prof. A.R.Arasri, DharanikotaSuyodhana- Maruthi Publications.
2. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
3. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill –2003.

REFERENCE BOOKS:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill –2003.
3. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
4. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd.,Noida.
5. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
6. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
7. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013
8. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications.

III B.Tech., II Semester, ECE

R20 Course Structure

&

Syllabus

III B.TECH., – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Micro wave and Optical communications	R20EC3201	PC	3	1	0	30	70	100	3
2	VLSI Design	R20EC3202	PC	3	0	0	30	70	100	3
3	Microprocessors and Microcontrollers	R20EC3203	PC	3	0	0	30	70	100	3
4	Professional Elective - II:		PE	3	0	0	30	70	100	3
	i. Data Acquisition and Transmission	R20EC3204								
	ii. Satellite Communications	R20EC3205								
	iii. Introduction to Machine Learning	R20EC3206								
	iv. Digital Image Processing	R20EC3207								
5	Open Elective – II		OE	3	0	0	30	70	100	3
	i. Fundamentals of Image Processing (Other than ECE)	R20CC2OE07								
	ii. Global Positioning System(GPS)	R20CC2OE08								
6	MP&MC Lab	R20EC32L1	PC	0	0	3	15	35	50	1.5
7	VLSI Lab	R20EC32L2	PC	0	0	3	15	35	50	1.5
8	MW&OC Lab	R20EC32L3	PC	0	0	3	15	35	50	1.5
9	English Employability Skills	R20CC32SC1	SC	1	0	2	0	50	50	2
10	Essence of Indian Traditional Knowledge	R20CC32MC1	MC	2	0	0	-	-	-	0
	Total			**17**	**1**	**13**	**195**	**505**	**700**	**21.5**
Honors/Minor course				**4**	**0**	**0**	**30**	**70**	**100**	**4**

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	3
Code: R20EC3201	MICROWAVE AND OPTICAL COMMUNICATIONS						

COURSE OBJECTIVES:

1. To know about different waveguides and mode analysis.
2. To introduce the microwave components and microwave devices.
3. To familiarize in microwave measurements using microwave bench.
4. To introduce different types of optical fibres.
5. To know about different optical sources and optical detectors.

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

CO1: **Summarize** the field components and analyse different modes in waveguide **(K2)**
CO2: **Interpret** different microwave components and devices **(K2)**
CO3: **Experiment** with microwave measurements through bench setup **(K3)**
CO4: **Classify** different types of optical fibers **(K4)**
CO5: **Categorize** the optical sources, optical detectors and explain digital receiver **(K4)**

SYLLABUS:

UNIT I: MICROWAVE TRANSMISSION LINES: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Dominant and Degenerate Modes, Introduction to Circular wave guides, related problems

UNIT-II: MICROWAVE COMPONENTS & MICROWAVE TUBES: Waveguide Attenuators – Resistive Card and Rotary Vane types; Calculation of scattering matrix for E plane, H plane, Magic Tee and Directional Coupler; Ferrite Components – Gyrator, Isolator and Circulator. Classification of Microwave Tubes, Two Cavity Klystron – Structure, Velocity Modulation Equation, Applegate Diagram; Reflex Klystron – Structure, Applegate Diagram; Travelling Wave Tube – operation, Magnetron operation.

UNIT- III: MICROWAVE SOLID STATE DEVICES & MEASUREMENTS: Gunn Diode – Principle, RWH Theory; IMPATT Diode, Description of Microwave Bench, Measurement of Attenuation, Frequency, VSWR using Microwave Bench and Power measurement using Bolometer Method.

UNIT- IV: OVERVIEW OF OPTICAL FIBER COMMUNICATION - Historical development, the general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Types of rays, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Related problems.

UNIT- V: OPTICAL SOURCES AND OPTICAL DETECTORS: LEDs- structures, quantum efficiency, modulation; Laser diodes principle ,modes, threshold conditions, external quantum efficiency, reliability of LED&ILD , Photodiodes – Principle, PIN and avalanche photo diodes; comparison of photo detectors, Temperature effect on avalanche gain, noise in photo detectors ,Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Digital receiver, Probability of Error, Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples.

TEXT BOOKS:

1. Samuel Y. Liao, "Microwave Devices and Circuits", PHI, 3rd Edition, 1994.
2. Gerd Keiser, "Optical fiber communications", 3rd ed.,MGH. (Units -IV to VI).
3. *M.Kulkarni,* "Microwave *and Radar Engineering*", Umesh Publications, New Delhi. 3rd Edition.

REFERENCE BOOKS:

1. R.E. Collin, "Foundations for Microwave Engineering", IEEE Press, John Wiley, 2 nd Edition, 2002.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, "Microwave Principles", CBS Publishers and Distributors, New Delhi, 2004.
3. Djafar K. Mynbaev and Lowell L. Scheiner, "Fiber Optic Communication Technology", Pearson Education Asia.

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3202	VLSI DESIGN						

COURSE OBJECTIVES:

1. To learn the MOS Process Technology
2. To understand the operation of MOS devices
3. Understand and learn the characteristics of CMOS circuit construction.
4. Describe the general steps required for processing of CMOS integrated circuits.
5. To impart in-depth knowledge about analog and digital CMOS circuits.

COURSE OUTCOMES: On successful completion of this course, student will be able to

CO1: Apply the concept of fabrication steps involved in IC design for various MOS transistors and come across basic electrical properties of MOSFET **(K3)**

CO2: Develop the expressions for inverter and propagation delays **(K3)**

CO3: Analyse the behaviour of amplifier circuits with various loads **(K4)**

CO4: Build combinational and sequential logic circuits using CMOS Logic design **(K4)**

CO5: Apply the knowledge of FPGA design to introduce advanced technologies **(K3)**

SYLLABUS:

UNIT-I: INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS: VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Regions of operation of MOSFET. Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology.

UNIT-II: BASIC CIRCUIT CONCEPTS: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers. Switch logic, Gate logic.

UNIT-III: VLSI CIRCUIT DESIGN PROCESS: MOS Layers, Stick Diagrams, Design Rules and Layout, Layout Diagrams for MOS circuits.

SCALING OF MOS CIRCUITS: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density.

BASIC BUILDING BLOCKS OF ANALOG IC DESIGN: Modelling of transistor, body bias effect, biasing styles, single stage amplifier with resistive load, single stage amplifier with diode connected load.

UNIT-IV: CMOS COMBINATIONAL AND SEQUENTIALLOGIC CIRCUIT DESIGN: STATIC CMOS DESIGN: Introduction to Complementary CMOS, Rationed Logic, Pass Transistor Logic.

DYNAMIC CMOS DESIGN: Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates. Latch versus Register, Latch based design, timing decimation, positive feedback, instability, Metastability, multiplexer based latches.

UNIT-V: FPGA DESIGN: FPGA design flow, Basic FPGA architecture, FPGA Technologies.
INTRODUCTION TO ADVANCED TECHNOLOGIES: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, FinFET, TFET.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Design of Analog CMOS Integrated Circuits by Behzad Razavi , McGraw Hill, 2003
3. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd Edition, 2016.

REFERENCE BOOKS:

1. Introduction to VLSI Circuits and Systems, John P. Uyemura, John Wiley & Sons, reprint 2009.
2. Integrated Nano electronics: Nano scale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.
3. FinFETs and other multi-gate transistors, Colinge JP, Editor New York, Springer, 2008.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=b75At6VGQzQ&list=PL0c0N7xv8s06jXRL5qzmEpyJjHcPKl17S
2. https://www.youtube.com/watch?v=OAxIm8up7QY

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3203	MICROPROCESSORS & MICROCONTROLLERS						

COURSE OBJECTIVES:

1. To understand the 8086 architecture and its programming.
2. To understand the hardware features of 8086 and Pentium processor.
3. Explore how to interface the memory and I/O devices to 8086 microprocessor.
4. Learn the features of basic Microcontroller, its instruction set and also other advanced controllers.
5. Know the building blocks of typical embedded system, memory devices and supporting devices.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Make use of Instruction set in developing the assembly language programming. **(K3)**
CO2: Demonstrate the hardware features of 8086 and Pentium processors. **(K2)**
CO3: Model an 8086 based microcomputer system by interfacing memory and I/O devices. **(K3)**
CO4: Explain 8051 architecture and the function of on-chip hardware units in 8051. **(K2)**
CO5: Develop 8051 embedded C programs for interfacing Matrix Keyboard, LCD, DAC, ADC and 7segment LED Display. **(K3)**

SYLLABUS:

UNIT–I: 8086 MICROPROCESSOR ARCHITECTURE & PROGRAMMING

Introduction to 8085, Architecture of 8086, Register organization of 8086, physical memory organization, I/O addressing capability, addressing modes of 8086, instruction set off 8086, assembler directives and operators. Assembly Language Programming of 8086, introduction to stack, stack structure of 8086/8088,

UNIT–II: 8086 INTERRUPTS

Signal description of 8086, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming, minimum mode, maximum mode of 8086 system and timings diagrams for different bus operations. Introduction to Pentium processor architecture.

UNIT–III: 8086 INTERFACING

Semiconductor memory interfacing, Interfacing I/O ports, PIO 8255, modes of operation of 8255, interfacing of D/A and A/D converters and stepper motor. Programmable interrupt controller 8259A, programmable communication interface 8251 USART, 8257 DMA.

UNIT-IV: INTRODUCTION TO 8051 MICROCONTROLLER

Overview of 8051 microcontroller, Architecture, I/O Ports, Memory organization, addressing modes and instruction set of 8051, Interrupts, timer/ Counter and serial communication

UNIT–V: INTERFACING AND APPLICATIONS OF 8051

Interfacing 8051 to LED's, LCD and Keyboard Interfacing, Interfacing Seven segment display, ADC and DAC Interfacing.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. Ayala, K.J., "The 8051 Microcontroller Architecture, Programming and Applications", 3rd Edition, Penram International, 2007.
3. Ajay V Deshmukh, "Microcontrollers", McGraw-Hill Education, 2017.

REFERENCE BOOKS:

1. Douglas V Hall, "Microprocessors and interfacing, Programming and Hardware", 2nd Edition, TMH, 2006
2. N.Sentil Kumar,M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

WEB REFERENCES:

1. http:// http://nptel.ac.in/courses/106108100/
2. https://onlinecourses.nptel.ac.in/noc18_ec03/
3. https://www.electronicshub.org/8051-microcontroller-introduction/
4. https://www.edgefx.in/8051-microcontroller-architecture/

*****

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3204	DATA ACQUISITION AND TRANSMISSION (PROFESSIONAL ELECTIVE – II)						

COURSE OBJECTIVES:

1. To understand different types of data acquisition systems
2. To understand different types of data transmission systems
3. To understand different types of digital instruments
4. To understand the different types of display systems
5. To understand the types of recorders

COURSE OUTCOMES: After completion of the course, the student will be able to

CO1: Construct analog and digital data acquisition system **(K3)**
CO2: Identify different data transmission systems **(K3)**
CO3: List the different display system **(K4)**
CO4: Classify different types of digital instruments.**(K4)**
CO5: Analyze the working principle of recorders **(K4)**

SYLLABUS:

UNIT-I: DATA ACQUISITION SYSTEM

Definition and generalized block diagram of data acquisition system (DAS), Classification of Data Acquisition System. Analog data acquisition system using time division multiplexing, Analog data acquisition system using frequency division multiplexing, Digital data acquisition system with different configurations and Data logger.

UNIT-II: DATA TRANSMISSION SYSTEMS

Definition, Generalized block diagram of Telemetry system, Classification of Telemetry system and working principle, Block diagram, Construction, Landline Telemetry system, Radio frequency amplitude modulated and frequency modulated telemetry system, Pulse telemetry system, Modem based telemetry system, Satellite Telemetry system and Fiber optic Telemetry system.

UNIT-III: DISPLAY SYSTEMS

Construction, principle of operation and salient features of LED, Nixie tube, LCD, segmental gas discharge type, single and multi-digit LED 7-segmental display system , Nixie tube based display system for numeric display (study of BCD to decimal decoder), to design LED Dot Matrix (3 x 5) numeric display system and LCD 7- segmental numeric display system.

UNIT-IV: DIGITAL INSTRUMENTS

Digital Frequency Meter: working principle, construction, range selection and operation of time period meter, frequency ratio meter, Digital Clock: block diagram construction and working, Analog Storage Oscilloscope and Digital storage oscilloscope: working principle, construction, operation and salient features.

UNIT-V: RECORDERS

The working principle, construction, operation and salient features of X-t strip chart recorder, X- Y strip chart recorder and Magnetic tape recorder.

TEXT BOOKS:

1. Sawhney A K, ―Electric and Electronic Measurement and Instrumentation‖, Dhanpat Rai and Sons, New Delhi, 2007.
2. Electronic Instrumentation and Measurements‖, 3rd Edition, Oxford University Press David A. Bell, ―India, 2013.

REFERENCE BOOKS:

1. Doebelin E O ―Measurement systems – Applications and Deign‖, McGraw Hill, New Delhi, 2003.
2. Mani and Rangan ―Instrumentation Devices and Systems‖, Tata McGraw Hill, New Delhi, 1997.

WEB LINKS:

1. www.academia.edu
2. http://easyengineering.net

III B.TECH	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
II SEMESTER	3	0	0	30	70	100	3
Code: R20EC3205	SATELLITE COMMUNICATIONS (PROFESSIONAL ELECTIVE – II)						

COURSE OBJECTIVES:

1. To learn the concepts of communication satellites, earth stations
2. To understand communication link for satellite communications.
3. To compare various multiple access techniques.
4. To familiarize with various multiple access techniques and Satellite Navigation.
5. To understand Non-Geostationary orbit satellite systems

COURSE OUTCOMES: After completion of the course, the student will be able to
CO1: Apply the concepts of communication satellites and earth stations (**K3)**
CO2: Analyze communication link for satellite communications **(K4)**
CO3: Compare various multiple access techniques **(K4)**
CO4: Illustrate various multiple access techniques and Satellite Navigation **(K2)**
CO5: Apply Non-Geostationary orbit satellite systems and Satellite navigation **(K3)**

SYLLABUS:

UNIT–I: FUNDAMENTALS AND ORBITAL MECHANICS: Origin of Satellite Communications, Historical Background, Basic concepts and Frequency allocations, Applications and Future Trends, Orbital Mechanics, Look Angle Determination, Orbital Perturbations, Orbit Determination, Orbital Effects.

UNIT–II: LAUNCHERS AND SATELLITE SUB-SYSTEMS: Launchers and Launch Vehicles, Attitude and Orbit Control System, TTCM, Power System, Communication Sub System, Satellite Antennas, Equipment Reliability and Space Qualification.

UNIT–III: LEO, GEO SATELLITE SYSTEMS AND LINK DESIGN :Considerations-Orbit, Power and Frequency, Delay and Throughput, System, Operational NGSO Constellation Design; Basic transmission Theory, System Noise Temperature and G/T Ratio, Design of Uplink and Downlinks, Design of satellite Links for specified C/N, System Design Examples.

UNIT–IV: MULTIPLE ACCESS: FDMA, Inter modulation, Calculation of C/N, TDMA, Frame Structure, Satellite Switched TDMA On-Board Processing, DAMA, CDMA, Spread Spectrum Transmission and Reception.

UNIT–V: EARTH STATION TECHNOLOGY: Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power, Test Methods.
SATELLITE NAVIGATION AND GPS: Radio and Satellite navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A code Accuracy, Differential GPS

TEXT BOOKS:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", WSE, WileyPublications,2nd Edition, 2003.(Units-I,II,III,IV,V).
2. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, "Satellite CommunicationsEngineering", 2nd Edition, Pearson Publications, 2003.(Unit-V)

REFERENCE BOOKS:

1. M. Richharia, "Satellite Communications: Design Principles", BS Publications, 2 nd Edition,2003.
2. D.C Agarwal, "Satellite Communication"- Khanna Publications, 5th Ed.
3. K. N. Raja Rao, "Fundamentals of Satellite Communications" – PHI, 2004 4.Dennis.Roddy,"Satellite Communications", McGraw Hill, 2nd Edition, 1996.

WEB SOURCES:

1. https://www.britannica.com/technology/satellite-communication
2. https://onlinecourses-archive.nptel.ac.in/noc17_ec14/preview
3. http://nptel.ac.in/noc

III B.TECH II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC3206	INTRODUCTION OF MACHINE LEARNING (PROFESSIONAL ELECTIVE – II)						

COURSE OBJECTIVES:

To impart knowledge about the following topics:

1. To be Familiar with a set of well-known supervised unsupervised and semi-supervised learning algorithms.
2. To be able to implement some basic machine learning algorithms.
3. To understand how machine learning algorithms are evaluated.

COURSE OUTCOMES: After successful completion of this course, students will be able to:

CO 1: **Identify** the characteristics of machine learning that make it useful to real-world Problems **(K3)**
CO 2: **Compare** and contrast supervised, semi-supervised, and unsupervised machine learning algorithms **(K4)**
CO 3: Apply regularized regression algorithms **(K3)**
CO 4: Summarize the concept of Neural Networks for learning non-linear functions **(K2)**
CO 5: **Analyse** support vector machines, Instance based learning and genetic algorithms **(K4)**

SYLLABUS:

UNIT–I: INTRODUCTION: Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning. Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

UNIT – II: LINEAR REGRESSION & LOGISTIC REGRESSION: Predicting numeric values: regression - Finding the best fit lines with linear regression, Locally weighted linear regression, Shrinking Coefficients, The bias / Variance trade off. Logistic Regression: Classification with logistic regression and the sigmoid function, Using optimization to find the best regression coefficients**.**

UNIT–III: ARTIFICIAL NEURAL NETWORKS: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition, Advanced topics in artificial neural networks

UNIT–IV: EVALUATION HYPOTHESES: Motivation, Estimation hypothesis accuracy, Basics of sampling theory,A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms.

UNIT–V: SUPPORT VECTOR MACHINE: Support vector machines & Dimensionality Reduction techniques: Separating data with the Maximum margin, finding the maximum margin, efficient optimization with SMO algorithm, speeding up optimization with full platt SMO, Using Kernels for more Complex data.

TEXT BOOKS:

1) Stephen Marsland, Machine Learning -An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2) Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das Machine Learning, Pearson,2019

REFERENCE BOOK:

1. Ethem Alpaydin,- Introduction to Machine Learning, , PHI, 2004

WEB REFERENCES:

1. https://www.coursera.org/learn/machine-learning
2. https://www.simplilearn.com/big-data-and-analytics/machine-learning
3. https://www.appliedaicourse.com/course/applied-ai-course-online
4. http://nptel.ac.in/courses/106105152

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	3
Code: R20EC3207	DIGITAL IMAGE PROCESSING (PROFESSIONAL ELECTIVE – II)						

COURSE OBJECTIVES:

1. To study the image fundamentals and mathematical transforms necessary for image processing
2. To study the image enhancement techniques
3. To study image restoration procedures
4. To study the image compression procedures
5. To study morphological processing techniques

COURSE OUTCOMES:

CO1: Develop any image processing application and List different techniques employed for the enhancement of images **(K3)**

CO2: Compare different causes for image degradation and overview of image restoration Techniques **(K4)**

CO3: Relate the need for image compression and to learn the spatial and frequency domain techniques of image compression **(K1)**

CO4: Interpret Image compression standards and representation techniques **(K5)**

CO5: Construct different feature extraction techniques for image analysis and recognition **(K3)**

SYLLABUS:

UNIT-I: INTRODUCTION AND IMAGE TRANSFORMS: Elements of Visual perception. Image sensing and Acquisition. Imaging in different bands. Digital Image Representation. Relationship between pixels. Image transformations: 2D-DFT, DCT, DST, Hadamard, Walsh, Hotelling transformation, 2D-Wavelet transformation, Wavelet packets.

UNIT-II: TRANSFORMATIONS AND FILTERING: Some basic intensity transformation functions, histogram processing, Image Enhancements in spatial domain and Frequency domain, Image Restoration techniques, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions

UNIT-III: COLOR IMAGE PROCESSING: 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.

UNIT-IV: WAVELETS AND MULTI-RESOLUTION PROCESSING: Image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimensions. 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: Preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, grey – scale morphology Image segmentation: Fundamentals, point, line, edge detection thresholding, region –based segmentation, segmentation using Morphological watersheds, the use of motion in segmentation.

TEXT BOOKS:

1. R. C.Gonzalez, R.E.Woods," Digital Image processing", Pearson edition, Inc3/e, 2008.
2. A.K.Jain," Fundamentals of Digital Image Processing", PHI,1995
3. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw-Hill Education, 2011.

REFERENCE BOOKS:

1. J.C. Russ," The Image Processing Handbook", (5/e), CRC, 2006
2. R.C.Gonzalez & R.E. Woods; "Digital Image Processing with MATLAB", Prentice Hall, 2003

WEB LINKS:

1. https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8
2. https://www.tutorialspoint.com/dip/index.htm

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	3
Code: R20CC2OE07	FUNDAMENTALS OF IMAGE PROCESSING (OTHER THAN ECE) (OPEN ELECTIVE-II)						

COURSE OBJECTIVES:

1. To introduce the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images
2. To comprehend the relation between human visual system and machine perception and processing of digital images
3. To introduce the concepts of image processing and basic analytical methods to be used in image processing
4. To familiarize students with image enhancement and restoration techniques
5. To provide a detailed approach towards image processing applications like enhancement, segmentation, and compression

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

CO1: Interpret the limitations of the computational methods on digital images **(K2)**
CO2: Develop Fourier transform for image processing in frequency domain **(K3)**
CO3: Illustrate the spatial and frequency domain image transforms on enhancement and restoration of images **(K4)**
CO4: Utilize the image enhancement techniques **(K3)**
CO5: Define the need for compression and evaluate the basic compression algorithms **(K1)**

SYLLABUS:

UNIT–I: DIGITAL IMAGE FUNDAMENTALS & IMAGE TRANSFORMS: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT–II: IMAGE ENHANCEMENT: Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Spatial Filters: Median Filter, Low Pass and High Pass Filtering.
Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT–III: IMAGE RESTORATION: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT–IV: IMAGE SEGMENTATION: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Oriented Segmentation.
Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

UNIT–V: IMAGE COMPRESSION: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression.

TEXT BOOKS:

1. Digital Image Processing – Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- Mc Graw Hill Education, 2010.
3. A.K.Jain, Fundamentals of Digital Image Processing, Prentice Hall.

REFERENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, 2nd Edition, Mc Graw Hill Education, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2008, 2nd Edition.

WEB LINKS:

1. https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8
2. https://www.tutorialspoint.com/dip/index.htm

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC2OE08	GLOBAL POSITIONING SYSTEM (OPEN ELECTIVE-II)						

COURSE OBJECTIVES:

1. To understand the fundamental concepts of GPS.
2. To analyze the GPS observables.
3. To Demonstrate the Surveying Procedure.
4. To list the different methods of processing GPS data.
5. To conclude various application areas of GPS.

COURSE OUTCOMES: After completion of the course, the student will be able to

CO1: Identify the importance of Space segment, Control segment and User segment in GPS **(K3)**
CO2: Analyse the GPS observables like code, phase pseudo ranges, Doppler data and Biases **(K4)**
CO3: Estimate surveying with GPS **(K5)**
CO4: Categorize the different application areas of GPS **(K4)**
CO5: Recommend the Hardware and Software improvements for future GPS **(K5)**

SYLLABUS:

UNIT–I: OVERVIEW OF GPS

Basic concepts- History of GPS, Basic definitions, GPS system operation, Trilateration method. Space segment- constellation, satellites, operational capabilities, denial of accuracy and access. Control segment- master control station, monitor stations, ground control stations. User segment- user categories, receiver types, information services.

UNIT–II: GPS OBSERVABLES

Data acquisition- code pseudo ranges, phase psecudo ranges, Doppler data, biases and noise. Data combinations- linear phase combinations, code, psecud orange smoothing. Atmospheric effects- phase and group velocity, ionospheric refraction, tropospheric refraction, atmospheric monitoring. Reletivitistic effects- special relativity, general relativity, relevant relativistic effects of GPS. Antenna Phase centre offset and variation Multipath- general remarks, mathematical model, multipath reduction.

UNIT–III: SURVEYING WITH GPS

Introduction-terminology definitions-code range vs. carrier phase, real time processing vs. post processing, point positioning vs. relative positioning, static vs. kinematic, static point processing vs. kinematic point processing, and static relative positioning vs. kinematic relative positioning. Observation techniques- point positioning, differential GPS, relative positioning. Field equipment Planning a GPS survey- General remarks, Pre survey planning, field reconnaissance, monumentation, organizational design. Surveying Procedure-pre observation, observation, post observation, ties to control monuments. In Situ data Processing- data transfer, data processing, trouble shooting and quality control, datum transformations, computation of plane coordinates, Survey report.

UNIT–IV: APPLICATIONS OF GPS

General Uses of GPS- global uses, regional uses, local uses. Attitude determination- theoretical and practical considerations. Air borne GPS for photo control. Interoperability of GPS- GPS and inertial navigation systems, GPS and GLONASS, GPS and other sensors.

UNIT–V: FUTURE OF GPS

New application aspects. GPS modernization- future GPS satellites, augmented signal structure. GPS augmentation- ground based and satellite based augmentation. GNSS - GNSS development, GNSS/Loran-C integration. Hardware and software improvements- Hardware, Software.

TEXT BOOKS:

1. B. Hofmann- Wellnhoff , H. Lichtenegger and J. Collins, “GPS theory and practice” , Fifth Edition, Springer-Verlag Wien, Newyork, 2001.
2. Bradford W. Parkinson, James Spilker, “Global Positioning System: Theory and Applications”, Vol. I, 1996.

REFERENCE BOOKS:

1. Gunter Seeber, “Satellite Geodesy Foundations, Methods and Applications”, Walter de Gruyter Publications, 2003.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=sOP6VibhtgU
2. https://www.youtube.com/watch?v=I1KCZCyNWbA
3. https://www.youtube.com/watch?v=Wg3GRhuWBR4
4. https://www.youtube.com/watch?v=usmv_DxnpJE

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC32L1	MICROPROCESSORS & MICROCONTROLLERS LAB						

COURSE OBJECTIVES:

1. To study the basics architecture model of 8086 microprocessor and 8051 microcontroller.
2. To learn 8086 microprocessor based ALP using arithmetic, logical and shift operations.
3. To understand modular and DOS/BIOS programming using 8086 microprocessor.
4. Familiarize to interface 8086 with I/O and other devices.
5. To develop 8051 system by interfacing different peripherals.

COURSE OUTCOMES:

After completion of the course students will be able to

CO1: Build Up the assembly language programs on arithmetic, logical and string operations **(K3)**

CO2: Construct an 8086 system by interfacing I/O and other devices **(K3)**

CO3: Make Use of Instruction set of 8086 for modular programming and Dos/Bios Programming **(K3)**

CO4: Distinguish processor based systems and controller system **(K4)**

CO5: Model the 8051 based embedded systems for various applications **(K3)**

I. Microprocessor 8086:

1. Introduction to MASM/TASM.
2. Arithmetic operation – Multi byte addition and subtraction, multiplication and division - Signed and unsigned arithmetic operation, ASCII – Arithmetic operation.
3. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD toASCII conversion.
4. String Operations**:** Move block, Reverse string, Sorting, Inserting, Deleting, Length of thestring, String comparison.
5. Modular Program: Procedure, Near and Far implementation, Recursion.
6. Dos/BIOS programming: Reading keyboard (Buffered with and without echo) – Displaycharacters, Strings.
7. Interfacing 8255–PPI.
8. Interfacing 8259 – Interrupt Controller.
9. Interfacing 8279 – Keyboard Display Controller.
10. Stepper motor control using 8253/8255.

II.Microcontroller 8051

11. Reading and Writing on a parallel port.
12. Timer in different modes.
13. Serial communication implementation.
14. Understanding three memory areas of 00 – FF (Programs using above areas) using external interrupts
15. Interfacing LED's & LCD

EQUIPMENT REQUIRED FOR LABORATORY

1. MASM/TASM software.
2. 8086

Microprocessor.

Kits

1. 8051 Micro Controller kits.
2. Interfaces/peripheral subsystems.
   i) 8259 PIC
   ii) 8279-KB/Display
   iii) 8255 PPI
   iv) 8251 USART
3. A/D and D/AC Interface.

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC32L2	VLSI LAB						

COURSE OBJECTIVES:

1. Students will be able to draw the schematic diagram & layout for the gates, Combinational logic circuits, Differential Amplifier Circuits using EDA Tool.
2. Students will be able to draw the schematic diagram & layout for Flip Flops, Counters, Static RAM cell and Common Source amplifier circuits using EDA Tool.

COURSE OUTCOMES:

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

CO1: Construct and test Logic gates using CMOS using EDA Tool. **(K3)**

CO2: Construct and test Combinational logic circuits like Adder, Subtractor, and Decoder using EDA Tools. **(K3)**

CO3: Construct and test Sequential logic circuits like Flip Flops, Counters using EDA Tools **(K3)**

CO4: Construct and test static RAM cell and Differential Amplifier using CMOS using EDA Tool. **(K3)**

LIST OF EXPERIMENTS

1. Introduction to Mentor graphics EDA tool
2. Design and Implementation of CMOS Inverter.
3. Design and Implementation of CMOS NOR and NAND gates.
4. Design and Implementation of CMOS XOR and XNOR gates.
5. Design and Implementation of CMOS 1-Bit Full Adder.
6. Design and Implementation of Full Subtractor.
7. Design and Implementation of RS-Latch.
8. Design and Implementation of D-Flip flop.
9. Design and Implementation of Decade Counter.
10. Design and Implementation of static RAM cell.
11. Design and Implementation of Differential Amplifier.
12. Design and Implementation of Common Source amplifier.

EXPERIMENTS BEYOND SYLLABUS

1. Design and Implementation of Decoder.
2. Design and Implementation of 8 bit DAC using R-2R latter network.

VIRTUAL LAB EXPERIMENTS

1. To design and plot the characteristics of a 4x1 digital multiplexer using pass transistor logic.
2. To design and plot the characteristics of a master-slave positive and negative edge triggered registers based on multiplexers.
3. To design and plot the output characteristics of a 3-inverter ring oscillator.

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
Code: R20EC32L3	MICROWAVE AND OPTICAL COMMUNICATIONS LAB						

COURSE OBJECTIVES:

1. To know about practical application of microwave components
2. To obtain knowledge in microwave parameters
3. To get ability to build analog/digital link setup
4. To identify better optical source for the required applications

COURSE OUTCOMES:

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

CO1: Illustrate the different microwave sources **(K2)**
CO2: Identify the characteristics of microwave components **(K3)**
CO3: Inspect the signal parameters at microwave frequencies **(K4)**
CO4: Find numerical aperture of an optical fiber **(K1)**
CO5: Analyze the characteristics of optical sources and analog link setup **(K4)**

LIST OF EXPERIMENTS:

1. Reflex Klystron characteristics.
2. Gunn-diode characteristics.
3. VSWR measurement.
4. Directional coupler characteristics.
5. Attenuation measurement.
6. Waveguide parameters
7. S-Matrix of Magic Tee.
8. Directional coupler characteristics.
9. Characterization of LED.
10. Characterization of Laser Diode.
11. Analog link set up using optical fiber.
12. Measurement of Numerical aperture.

*****

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	**0**	**2**	**15**	**35**	**50**	**2**
Code: R20CC32SC1	**ENGLISH EMPLOYABILITY SKILLS (Common to All Branches)**						

COURSE OBJECTIVES:

1. To train the students to use language effectively in professional situations like group discussions, public speaking, presentations and interviews.
2. To make the students understand the importance of body language.
3. To expose the students to Analysis. SWOT

COURSE OUTCOMES:

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

CO 1: Write effective Resume for employment..

CO 2: Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose.

CO 3: Participate in Group Discussions using analytical and problem solving skills.

CO 4: Face job interviews confidently and enhance employability.

UNIT– I

Personal Introduction & JAM
SWOT Analysis

UNIT–II

Resume and Video Portfolio
Non Verbal Communication
Professional Etiquette

UNIT–III

Presentation Skills
Emotional Intelligence (How to face ambiguity, uncertainty and contingencies)

UNIT-IV

Group Discussion

UNIT-V

Interview skills- Mock Interviews

REFERENCE BOOKS:

1. Rajendra Pal, J S KorlahaHi, Essentials of Business Communication, Sultan Chand & Sons
2. Andrea J. Rutherford, Basic Communication Skills for Technology, Pearson Education Asia
3. V. Prasad, Advanced Communication Skills, Atma Ram Publications
4. Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press
5. Meenakshi Raman, Sangeeta Sharma, Fundamentals of Technical Communication, Oxford University Press

*****

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	-	-	-	-
Code: R20CC32MC1	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE						

COURSE OBJECTIVES:

1. To get necessary knowledge on Indian culture
2. To know the Indian languages and Literature in India
3. To explore the Indian arts and architecture in India
4. To know the education system, science and scientists in India

COURSE OUTCOMES: After successful completion of the course students will be able to

CO 1: Understand the philosophy of Indian Culture
CO 2: Know the Indian languages, Epics Ramayana and Mahabharata
CO 3: Acquire the information about Indian arts and architecture
CO 4: Know the spread of cultural exchange in abroad
CO 5: Know the contributions of scientists in different eras

SYLLABUS:

UNIT-I: INDIAN CULTURE: AN INTRODUCTION

Characteristics of Indian culture, Significance of Indian culture, Geography of Indian Culture. Society in India through ages- Ancient period- varna and jati, family and marriage in India, position of women in ancient India, Contemporary period; caste system and communalism

UNIT-II: INDIAN LANGUAGES AND LITERATURE

Evolution of script and languages in India: Harappan Script and Brahmi Script. Short History of the Sanskrit literature: The Vedas, The Brahmanas and Upanishads & Sutras, Epics: Ramayana and Mahabharata.

UNIT-III: INDIAN ARTS AND ARCHITECTURE

Indian Art & Architecture: Hindu Temple Architecture, Buddhist Architecture, Medieval Architecture. Rise of modern theatre and Indian cinema.

UNIT-IV: SPREAD OF INDIAN CULTURE ABROAD

Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies. Indian Culture in South East Asia. India, Central Asia and Western World through ages

UNIT-V: EDUCATION SYSTEM IN INDIA

Education in ancient, medieval and modern India, aims of education, Science and scientists of ancient India, Science and Scientists of Modern India.

SUGGESTED READINGS:

1) Kapil Kapoor, “Text and Interpretation: The indian tradition” ISBN: 81246033375, 2005
2) “ Science in Samskrit”, Samskrita Bharti Publisher , ISBN 13 : 978- 8187276333,2007
3) NCERT , “Position Paper On Arts ,Music, Dance Theatre”, ISBN 81-7450 494-X,200

*****

IV B.Tech., I Semester, ECE

R20 Course Structure

&

Syllabus

IV B.TECH., – I SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Professional Elective - III:		PE	3	0	0	30	70	100	3
	i. PC based Instrumentation	R20EC4101								
	ii. Cellular and Mobile Communication	R20EC4102								
	iii. Introduction to Deep Learning	R20EC4103								
	iv. Speech Processing	R20EC4104								
2	Professional Elective - IV:		PE	3	0	0	30	70	100	3
	i. Bio Medical Instrumentation	R20EC4105								
	ii. Radar Systems	R20EC4106								
	iii. Soft Computing Techniques	R20EC4107								
	iv. DSP Architectures	R20EC4108								
3	Professional Elective - V:		PE	3	0	0	30	70	100	3
	i. Analytical Instrumentation	R20EC4109								
	ii. Advanced communication Technologies	R20EC4110								
	iii. Edge Computing	R20EC4111								
	iv. Multimedia Signal Processing	R20EC4112								
4	Open Elective – III		OE	3	0	0	30	70	100	3
	i. Introduction to Micro Processors & Micro Controllers (Other than ECE)	R20CC3OE07								
	ii. Nano Electronics	R20CC3OE08								
5	Open Elective - IV:		OE	3	0	0	30	70	100	3
	i. Introduction to Embedded Systems (Other than ECE)	R20CC4OE07								
	ii. Embedded and Real time Operating System	R20CC4OE08								

6	Humanities and Social Science Elective: i. Business Management Concepts for Engineers	R20CC4101	HS	3	0	0	30	70	100	3
	ii. Entrepreneurship and Innovation	R20CC4117								
7	Python Programming for Deep Learning/Mobile App Development	R20EC41SC1	SC	1	0	2	0	50	50	2
8	Internship/ Community Service Project	R20CC41IN	PR	0	0	0	-	50	50	1.5
9	MOOCS	R20CC41MC	PE	-	-	-	-	-	-	1.5
	Total			**17**	**0**	**6**	**195**	**505**	**700**	**23**
Honors/Minor course				**4**	**0**	**0**	**30**	**70**	**100**	**4**

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4101	PC BASED INSTRUMENTATION *(Professional Elective – III)*						

COURSE OBJECTIVES:

1. Provide and ensure a comprehensive understanding of using personal computers in measurement and control instrumentation.
2. Learn the process of collecting information/ data through PC from real world sources.
3. Learn remote and networked data acquisition and operating system.
4. Learn programmable logic controllers, and its application.

COURSE OUTCOMES:

After completion of the course, the student is able to

CO1: Demonstrate the main functional units in a PC and be able to explain how they interact. **[K2]**

CO2: Interpret the standard serial and parallel interfacing buses and able to distinguish account for different generations of PCs. **[K2]**

CO3: Analyze the basics of PLC and its programming. **[K4]**

CO4: Identify different PLC functions to applications. **[K3]**

CO5: Analyze the basics of SCADA and Develop DAQ using I/O systems. **[K4]**

SYLLABUS:

UNIT-I: REVIEW OF COMPUTER INSTRUMENT COMMUNICATION

Personal Computer, Overview of operating System, I/O Ports, Plug-in-slots, PCI bus, Operators Interface. Computer Interfacing for Data Acquisition and Control – Interfacing Input Signals, Output system with continuous actuators. Data Acquisition and Control using Standard Cards: PC expansion systems, Plug-in Data Acquisition Boards; Transducer to Control room, Backplane bus – VXI.

UNIT-II: PROGRAMMABLE LOGIC CONTROLLER (PLC) BASICS

Definition, Overview of PLC systems, input/output modules, Power supplies and Isolators.

BASIC PLC PROGRAMMING: Programming On-Off inputs/ outputs. Creating Ladder diagrams, Basic PLC functions, register basics, timer functions, counter functions.

UNIT-III: PLC INTERMEDIATE AND ADVANCED FUNCTIONS

Arithmetic functions, Number comparison functions, Skip and MCR functions, data move systems. Utilizing digital bits, sequencer functions, Matrix functions. PLC Advanced functions: Analog PLC operation, Networking of PLC.

UNIT-IV: APPLICATION OF PLC

Controlling of Robot using PLC, PID control of continuous processes, Continuous Bottle-filling system, Batch mixing system, 3-stage air conditioning system, Automatic frequency control of Induction heating.

RELATED TOPICS: Alternate programming languages. Auxiliary commands and functions. PLC installation, troubleshooting and maintenance. Field bus: Introduction, concept. HART protocol: Method of operation, structure, and applications. Smart transmitters, smart valves and smart actuators.

UNIT-V: SCADA BASICS

Computer Process interface for Data Acquisition and control – Computer control loops – Supervisory Digital Control (SCADA) - introduction and brief history of SCADA – SCADA Hardware and software – Landlines for SCADA – use of modems in SCADA – SCADA with LAN.

DATA ACQUISITION ON THE PC

The PC as a platform for data acquisition: types of pc, the processor, memory, input and outputs ports, buses and adapter card slots. Software considerations: an overview of DA&C software, DA and control in real time, implementing real time systems on the PC and robustness reliability and safety.

TEXT BOOKS:

1. John. W .Webb Ronald A Reis , ‐Programmable Logic Controllers – Principles and Applications‖, Fourth edition, Prentice Hall Inc., New Jersey, 2003.
2. M. Chidambaram, Computer Control of Processes‖, Narosa 2003.

REFERENCE BOOKS:

1. Gary Dunning, Introduction to Programmable Logic Controllers‖, Thomson Delmar Learning,2nd Edition Second reprint 2003.
2. S.A. Boyer ,Supervisory control and data acquisition‖, 4th edition,2010
3. Mike Tooley, PC Based Instrumentation and Control, 3rd Edition, Elsevier.
4. Kevin James, PC Interfacing and Data Acquisition Techniques for Measurement, Instrumentation and Control, Elsevier.
5. John Park and Steve Mackay, Practical Data Acquisition for Instrumentation and Control Systems, Elsevier, 2003.
6. Frank D. Petruzella, Programmable Logic Controllers, 2nd Edition, Mc Graw Hill, Newyork, 1997.

WEB RESOURCES:

https://www.youtube.com/watch?v=MS3qJq2jvu0
https://www.youtube.com/watch?v=t5w9rdsCiVA
https://www.youtube.com/watch?v=LUPioicPtws

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4102	CELLULAR AND MOBILE COMMUNICATIONS *(Professional Elective – III)*						

COURSE OBJECTIVES:

1. To know the evolution of Mobile communication and cell concept to improve capacity of the system.
2. To know the fading mechanism and types of fading and effect of fading on Mobile communication.
3. To know the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques.
4. To know the types of channel coding techniques, data transmission modes and services of GSM.
5. To know the types of channel coding techniques, data transmission modes and services of CDMA.

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

CO1: Illustrate fundamental concept of Cellular Radio System Operation and Design. [**K2]**

CO2: Analyze Measurement of C/I value in Omni directional & Directional Antenna System, Co-channel, Non Co-channel interference, and Adjacent Channel Interference. **[K4]**

CO3: Interpret cell coverage for signal and traffic, diversity techniques and mobile antennas and demonstrate Frequency management and Channel assignment. [**K2]**

CO4: Classify different types of handoffs. [**K2]**

CO5: Summarize GSM architecture and channels, TDMA architecture and channels, and CDMA architecture and channels. **[K2]**

SYLLABUS:

UNIT I: INTRODUCTION TO CELLULAR MOBILE RADIO SYSTEMS

Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, Uniqueness of Mobile Radio Environment - Fading - Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time. Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring.

UNIT-II: CO-CHANNEL INTERFERENCE AND CELL COVERAGE

Co-Channel Interference: Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Time Diversity. Non-Co-Channel Interference: Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease.

Cell Coverage for Signal and Traffic: Signal Reflections in Flat And Hilly Terrain, Effect of Human Made Structures, Phase Difference Between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope.

UNIT- III: ANTENNAS AND CHANNEL ASSIGNMENT

Cell Site and Mobile Antennas: Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

Frequency Management and Channel Assignment: Numbering And Grouping, Setup Access And Paging Channels, Channel Assignments to Cell Sites and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, Non Fixed Channel Assignment.

UNIT- IV: HANDOFFS AND DROPPED CALLS

Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, inter system Handoff, Introduction to Dropped Call Rates and their Evaluation.

UNIT- V: DIGITAL CELLULAR MOBILE SYSTEM

GSM architecture, GSM-channels, TDMA architecture, TDMA channels, CDMA architecture, CDMA channels.

TEXT BOOKS:

4. William C.Y. Lee, Mobile Cellular Telecommunications: Analog and Digital Systems, Mc. Graw Hill, 2nd Edition, 2006.
5. Theodore. S. Rapport, Wireless Communications, Pearson Education, 2010.
6. Gottapu Sashibhushana Rao, Mobile Cellular Communication, Pearson, 2012.

REFERENCE BOOKS:

3. Gordon L. Stuber, Principles of Mobile Communications‖, Springer International, 2nd Edn., 2001.
2. Simon Haykin, Michael Moher, Modern Wireless Communications‖, Pearson Education, 2005.

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4103	INTRODUCTION TO DEEP LEARNING *(Professional Elective – III)*						

COURSE OBJECTIVES:

1. To present the mathematical, statistical and computational challenges of building neural Networks
2. To study the concepts of deep learning
3. To introduce dimensionality reduction techniques
4. To enable the students to know deep learning techniques to support real-time applications
5. To examine the case studies of deep learning techniques

COURSE OUTCOMES:

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

CO1: Summarize the characteristics of Machine Learning and Deep Learning that make it useful to real-world Problems. **[K2]**
CO2: Organize high dimensional data using reduction techniques. **[K3]**
CO3: Analyze optimization and generalization in deep learning. **[K4]**
CO4: Outline various deep learning models. **[K2]**
CO5: Analyze case studies of deep learning techniques. **[K4]**

SYLLABUS:

UNIT-I: MACHINE LEARNING BASICS

Learning Algorithms, Capacity, Over fitting and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Estimation Bayesian Statistics. Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

UNIT-II: DEEP FEEDFORWARD NETWORKS

Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

UNIT-III: REGULARIZATION FOR DEEP LEARNING

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning.

UNIT-IV: OPTIMIZATION

Optimization for Training Deep Models How Learning Differs from Pure Optimization?, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT-V: CONVOLUTIONAL NETWORKS AND RECURRENT NETWORKS

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuro-scientific Basis for Convolutional Networks.

Recurrent Networks: Types, Feed-Forward Neural Networks vs Recurrent Neural Networks, Applications.

TEXT BOOKS:

1. Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y, Deep Learning, Vol.1. Cambridge, MIT press.
2. François Duval, Deep Learning: Deep Learning for Beginners. Practical Guide with Python and Tensorflow, Data Sciences Publishing.

REFERENCE BOOKS:

1. Sebastian Raschka, Vahid Mirjalili, Python Machine Learning: Machine. Learning and Deep Learning with Python, scikit-learn and TensorFlow, 2nd Edition, Packt Publishing.

WEB RESOURCES:

1. https://buomsoo-kim.github.io/learning/2020/03/25/Data-science-study-materials.md/
2. https://www.kaggle.com/getting-started/37999
3. https://drive.google.com/file/d/1DXdl4iPzYy7GEFRUROUv8cZRSxgUmu1E/view?usp=drivesdk
4. https://mega.nz/folder/NmQRlaBa#0FKTDkkHYBmkSmcEu0kGoQ

IV B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4104	SPEECH PROCESSING *(Professional Elective – III)*						

COURSE OBJECTIVES:

1. To introduce the models for speech production and develop time and frequency domain techniques for estimating speech parameters.
2. To introduce a predictive technique for speech compression
3. To understand speech recognition, synthesis and speaker identification.
4. To discuss research, both orally and in writing, to other students and scientists.
5. To locate, interpret, and synthesize scientific literature.

COURSE OUTCOMES: After going through this course the student will be able to
CO1: Identify the fundamentals of speech and speech production system. [**K3]**
CO2: Analyze time domain models for speech signals. [**K4]**
CO3: Compare various speech coding techniques in time domain. **[K4]**
CO4: Analyze the speech enhancement techniques. **[K4]**
CO5: Elaborate the purpose of the various blocks in applications of Speech Synthesis. **[K5]**

SYLLABUS:

UNIT-I: SPEECH PRODUCTION AND ACOUSTIC PHONETICS

Articulatory Phonetics, **Acoustic Phonetics**, Acoustic theory of speech production, Digital models of speech signals, Uniform lossless tube model, Articulator phonetics, Co- articulation, Prosody.

UNIT-II: SPEECH ANALYSIS

Time and frequency domain analysis of speech, linear predictive coding (LPC) analysis, Cepstral analysis, Speech parameter (pitch) estimation.

UNIT-III: CODING OF SPEECH SIGNALS

Introduction, Quantization, Speech redundancies, Time domain waveform coding, and linear predictive coding: linear delta modulation, Adaptive delta modulation, and Adaptive differential pulse code modulation, Filter bank analysis: Phase Vocoders and Channel Vocoders, Adoptive Multirate Coders.

UNIT-IV: SPEECH ENHANCEMENT & RECOGNITION

Introduction, Nature of interfering sounds, speech enhancement techniques: spectral subtraction and filtering, harmonic filtering, Adaptive noise cancellation.
Introduction, Bayes 'rule, Segmental feature extraction, MFCC, DTW, HMM and DNN approaches for speech recognition

UNIT-V: SPEECH SYNTHESIS

Principles of speech synthesis, Methods: Articulatory synthesis, Formant synthesis and LPC synthesis, Applications of speech synthesis.

TEXT BOOKS:

1. Speech Communications: Human & Machine, Douglas O'Shaughnessy, 2nd Ed., Wiley India, 2000.
2. L R Rabiner, B.H Juang and B. Yegnanarayana, Fundamentals of Speech Recognition, Pearson, 2009 (Indian subcontinent adaptation).
3. Lawrence R. Rabiner and Ronald W. Schafer, Digital Processing of Speech Signals, PearsonEducation, Fourth Impression 2009.

REFERENCE BOOKS:

1. JR Deller, Jr, JG Proakis & JHL Hansen, Discrete-Time Processing of Speech Signals,Macmillan 1993.
2. Ben Gold &Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons,2006.
3. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, Prentice Hall, 2002.
4. J. L. Flanagan, Speech Analysis Synthesis and Perception, 2nd Edition, Springer-Verlag,1983.

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee117/preview
2. https://www.udemy.com/course/digital-speech-processing/
3. https://ocw.mit.edu/courses/6-345-automatic-speech-recognition-spring-2003/pages/syllabus/

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4105	BIOMEDICAL INSTRUMENTATION *(Professional Elective – IV)*						

COURSE OBJECTIVES:

1. Identify and describe operation of biomedical instrumentation.
2. Analyze and evaluate the effect of different diagnostic and therapeutic methods, their risk potential, physical principles, opportunities and possibilities for different medical procedures.
3. Explain and contrast measurement principles for blood flow, pressure and volume as well as respiratory variables.
4. Find the best suitable method for different pathological diagnoses
5. Outline the design of cardiac pacemakers and defibrillators

.

COURSE OUTCOMES:

After going through this course the student will be able to

CO1: Compare the different bio potential characteristics and recording methods so as to enable to record various bio signals. **[K4]**

CO2: Apply nonelectrical parameters measurements so as to enable to record various non-electrical parameters. **[K3]**

CO3: Identify the patient safety issues related to biomedical instrumentation. **[K3]**

CO4: Build and operate bio potential amplifiers. **[K6]**

CO5: Classify Patient care monitoring systems and operation of displays. **[K4]**

UNIT-I: FUNDAMENTALS OF BIOMEDICAL INSTRUMENTATION

Age - Development of Biomedical Instrumentation - Man Instrumentation System - Components of the Man - Instrument System - Physiological System of the Body – Sources of biomedical signals - Problems Encountered in Measuring a Living System.

UNIT-II: ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS

Electrodes – Types of electrodes – silver-silver Chloride Electrodes – Electrodes for ECG - Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG –EEG – EMG – Lead systems and recording methods – Typical waveforms. Biopotential Amplifiers -Shock Hazards and Prevention – Physiological Effects and Electrical Current - leakage current - Shock Hazards from Electrical Equipment - Instruments for checking safety parameters of biomedical equipment‘s - Methods of Accident Prevention - Isolated Power Distribution System.

UNIT-III: NON-ELECTRICAL PARAMETER MEASUREMENTS

The Heart and Cardiovascular System - Electro Cardiography - Measurement of blood pressure –Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Plethysmography - Photo Plethysmography - Body Plethysmography – Blood Gas analyzers: pH of blood –measurement of blood pCO2, pO2.

UNIT-IV: PATIENT CARE MONITORING AND THERAPEUTIC EQUIPMENTS

Elements of Intensive - Care Monitoring - Cardiac Monitor - Patient Monitoring Displays – Diagnosis - Calibration and Repair ability of Patient - Monitoring Equipment - Other Instrumentation for Monitoring Patients - Organization of the Hospital for Patient – Care Monitoring - Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy- Heart – Lung machine – Audio meters – Dializers.

UNIT-V: BIOTELEMETRY SYSTEM

Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems - Introduction to Biotelemetry - Physiological Parameters Adaptable to Biotelemetry - The Components of Biotelemetry System - Implantable Units - Telemetry for ECG Measurements during Exercise - Telemetry for Emergency Patient Monitoring.

TEXT BOOKS:

1. Cromwell, Wiebell, Pfeiffer, Bio-Medical Instrumentation & Measurements, 2nd Edition, Prentice Hall of India, 2001.
2. Onkar N. Pandey, Rakesh Kumar, Bio-Medical Electronics and Instrumentation, Katson Books, 2011.

REFERENCE BOOKS:

1. Joseph J. Carr, John Brown, Introduction to Bio-Medical Equipment Technology, 4th Edition, Pearson Publications, 2018.
2. Khandapur, Hand Book of Bio-Medical Instrumentation‖, McGraw Hill, 2014.
3. M. Arumugam, Bio-Medical Instrumentation‖, Anuradha Agencies, 2003.
4. L.A. Geddes and L.E. Baker, Principles of Applied Bio-Medical Instrumentation, 1969.

WEB REFERENCES:

1 https://nptel.ac.in/courses/108/105/108105101/#
2 https://onlinecourses.nptel.ac.in/noc21_bt50/preview
3 https://lecturenotes.in/subject/27/biomedical-instrumentation-bi/note
4 https://www.slideshare.net/abhi1802verma/biomedical-instrumentation
5 https://www.coursera.org/learn/bioengineering
6 https://www.edx.org/course/fundamentals-of-biomedical-imaging-ultrasounds-x-r
7 https://academicearth.org/biomedical-engineering/
8 https://www.classcentral.com/tag/biomedical-engineering
9 https://www.classcentral.com/course/edx-so-you-want-to-be-a-biomedical-engineer-13131
10 https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-bt50/

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4106	RADAR SYSTEMS *(Professional Elective – IV)*						

COURSE OBJECTIVES:

1. Different Antennas systems and communication equipment required for the operation of RADAR.
2. Different parameters of Transmitter and Receiver of RADAR
3. The concept of Doppler Effect to measure parameters of RADAR.

COURSE OUTCOMES:

After completion of this course, the students are able to

CO1: Demonstrate the basic principles of RADAR System. **[K2]**
CO2: Solve the RADAR Equation and to calculate Transmitter power. **[K3]**
CO3: Know working principles of different types of RADARs. [K3]
CO4: Demonstrate the knowledge of solving issues related to different RADAR problems. [K2]
CO5: Contrast the different methods used for tracking targets. [K4]

SYLLABUS:

UNIT–I: INTRODUCTION

Nature of Radar: Basic 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, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere), Transmitter power, PRF and Range Ambiguities, System Losses (Qualitative treatment), Related Problems.

UNIT–II: CW AND FM-CW RADAR

CW Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Bandwidth Requirement, Sign of the radial velocity, Doppler frequency shift, Applications of CW radar.

Frequency Modulated - CW Radar: Range and Doppler Measurement, Block Diagram FM-CW Radar, FM_CW altimeter, Measurement errors, Multiple Frequency CW Radar.

UNIT–III: MTI AND PULSE DOPPLER RADAR

Introduction, Description of operation , MTI Radar with-Power Amplifier Transmitter, Power Oscillator Transmitter, Delay Line Cancellers, Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs, Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, Equipment instability, Internal fluctuation, Limiting in MTI Radar, Non-coherent MTI, MTI versus Pulse Doppler radar.

UNIT–IV: TRACKING RADAR

Tracking with Radar, Types of Tracking Radar , Angle Tracking, Sequential Lobing, Conical Scan, Boxcar generator, Automatic gain control, Squint angle, Other considerations, Mono-pulse Tracking, Amplitude comparison mono pulse, Hybrid tracking system, Phase comparison mono pulse, Target Reflection Characteristics and Angular Accuracy, Amplitude fluctuations, Angle fluctuations, Receiver and servo noise, Summary of errors, Frequency agility and glint reduction, Low angle tracking, Tracking in Range, Acquisition, Comparison of Trackers.

UNIT–V: RADAR ANTENNAS

Antenna Parameters: Directive gain, power gain, effective aperture, polarization, side lobe radiation, aperture efficiency, Parabolic Reflector Antennas, Lens Antennas, Cosecant-Squared Antenna Pattern, Radomes.

Detection of Radar Signals in Noise: Introduction, Matched Filter Receiver, Response Characteristics of Matched Filter Receiver, Derivation of Matched Filter Receiver, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False AlarmRate Receiver.

TEXT BOOK:

1. Merrill I. Skolnik, –Introduction to Radar Systems‖, 3rd Edition, Tata McGraw –Hill, 2001.

REFERENCE BOOKS:

1. G.S.N. Raju, –Radar Engineering and fundamentals of Navigational Aids‖, I.K International, 2008.
2. Byron Edde, Radar: Principles, Technologies, Applications‖, Pearson Education, 2008.

WEB SOURCE REFERENCES:

1. https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems-spring-2007/
2. http://www.radartutorial.eu/
3. Principles and Techniques of Modern Radar Systems https://nptel.ac.in/courses/108105154/

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4107	SOFT COMPUTING TECHNIQUES *(Professional Elective – IV)*						

COURSE OBJECTIVES:

The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing.

1. Artificial Intelligence, Various types of production systems, Characteristics of production systems.
2. Neural Networks, architecture, functions and various algorithms involved.
3. Fuzzy Logic, various fuzzy systems and their functions.
4. Genetic algorithms, its applications and advances.

COURSE OUTCOMES:

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

CO1: Classify the concepts of Artificial Neural Network, different features of fuzzy logic and their modelling, control aspects and different hybrid control schemes. (K2)
CO2: Explain modelling of Artificial Neural Network and Control Technique. (K2)
CO3: Apply knowledge on modelling and control of fuzzy control schemes. (K3)
CO4: Analyze knowledge on hybrid control schemes. (K4)
CO5: Evaluate the concepts of Adaptive Resonance Theory and Hybrid Control Schemes. (K5)

SYLLABUS:

UNIT I: ARTIFICIAL NEURAL NETWORK

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – Reinforcement learning.

UNIT II: NEURAL NETWORKS FOR MODELING AND CONTROL

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III: FUZZY SET THEORY

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV: FUZZY LOGIC FOR MODELING AND CONTROL

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox.

UNIT V: GENETIC ALGORITHMS

Genetic Algorithms (GA) – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques: Particle Swarm Optimization (PSO), and Differential Evolution (DE), Support Vector Machine (SVM).

TEXT BOOKS:

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.

REFERENCES

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989.
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992.
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, Second Edition, 2010.
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

WEB REFERENCES:

1. www.myreaders.info/html/soft_computing.html

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4108	DSP ARCHITECTURES *(Professional Elective – IV)*						

COURSE OBJECTIVES:

1. Recall Digital Signal Processing and classify various computational errors in DSP.
2. Interpret basic Architecture for programmable DSP devices.
3. Learn the Architecture and programming of TMS320C6x Processors.
4. Implement DSP algorithm for digital filters.
5. Analyze various DSP interfacing techniques.

COURSE OUTCOMES:

After undergoing the course, students will be able to

CO1: Identify the functions of building blocks in DSP Architecture. **[K3]**

CO2: Perceive the knowledge on Instructions and Interrupts of TMS320C6x Processors. **[K5]**

CO3: Model programming of TMS320C6x Processors. **[K3]**

CO4: Recommend suitable FFT algorithms for computation on TMS320C54XX DSP device. **[K5]**

CO5: Choose the DSP programmable devices that will interface with memories and I/O peripherals. **[K3]**

SYLLABUS:

UNIT–I: ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

UNIT–II: PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Introduction, Commercial digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.

UNIT–III: IMPLEMENTATION OF BASIC DSP ALGORITHMS

Introduction, Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). PID Controller, Adaptive Filters, An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT–IV: IMPLEMENTATION OF FFT ALGORITHMS

Introduction, FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx.

UNIT – V: INTERFACING MEMORY AND PARALLEL I/O PERIPHERALS TO DSP DEVICES

Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).

TEXT BOOKS:

1. Avatar Singh and S. Srinivasan, Digital Signal Processing, Thomson Learning, 2004.
2. B Venkataramani and M Bhaskar, Digital Signal Processors, TMH, 2002.

REFERENCE BOOKS:

1. Ifeachor E. C., Jervis B. W, Digital Signal Processing: A practical approach, Pearson-Education, PHI, 2002.
2. Sen M. Kuo & Woon-Seng S. Gan, Digital Signal Processors, Architectures, Implementations, and Applications, Prentice Hall, 2004

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_ee70/preview
2. https://www.udemy.com/course/digital-signal-processing-dsp-from-ground-uptm-in-c/
3. https://www.coursera.org/specializations/digital-signal-processing#courses
4. https://www.youtube.com/watch?v=qguxy0Te3pc

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4109	ANALYTICAL INSTRUMENTATION *(Professional Elective – V)*						

COURSE OBJECTIVES:

1. Identify the whole array of modern analytical instrumentation with tools, which are useful in further applied Research.
2. List out different meters and analyzers.
3. Indicates the purpose of chromatography in various matters.
4. Select spectrophotometers in source and detection levels.
5. Predict detectors used in analytical instrumentation.
6. Memorize basic concept, principles and terms of chromatography.
7. Summarize the need of Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR).

COURSE OUTCOMES:

After going through this course, the student will be able to

CO1: Interpret different Analyzers in Analytical Instrumentation. **[K2]**

CO2: Apply the Knowledge of Gas Analyzers. **[K3]**

CO3: Analyze the basic Principles of Chromatography Techniques. **[K4]**

CO4: Choose Instrumentation Associated with Spectrophotometer and Sources for Flame Photometer. **[K3]**

CO5: Explain the basic instrumentation associated with NMR Spectrophotometer, principle and discussion on ESR. **[K2]**

UNIT-I: PH AND CONDUCTIVITY METERS & DISSOLVED COMPONENT ANALYZER

Conductivity meters, pH meters, dissolved oxygen analyzer, hydrogen analyzers, Sodium analyzer, Silica analyzer and sampling systems.

UNIT-II: GAS ANALYZERS

Thermal conductivity types, CO monitor, NOX analyzer, Industrial analyzer circuits, Theory and problems on Beer – Lambert's Law.

UNIT-III: CHROMATOGRAPHY

Gas Chromatography, Liquid chromatography, their principles and applications, Oxygen analyzer, paramagnetic type detectors and sampling systems.

UNIT-IV: SPECTROPHOTOMETERS

UV, VIS Spectrophotometers – Single beam and double beam instruments, Instrumentation associated with the above Spectrophotometers Sources, and detectors, Sources and detectors for IR Spectrophotometers. FT IR Spectrometer, Flame Emission and Atomic Absorption Spectrophotometer, Atomic Emission Spectrophotometer, Sources for Flame Photometer.

UNIT-V: PRINCIPLE OF NUCLEAR MAGNETIC RESONANCE

Instrumentation Associated with NMR Spectrophotometer, Introduction to mass spectrophotometers, Principle and brief discussion on Electron Spin Resonance (ESR), Nuclear Radiation Detectors - Ionization chamber, GM Counter, Proportional Counter, Solid state Detectors.

TEXT BOOK:

1. R.S. Khandpur, ―Handbook of Analytical Instruments‖, 2nd Edition, TMH, 2006.

REFERENCE BOOKS:

1. Skoog D. A, ―Principles of Instrumental Analysis‖, Weste D.M., Holt Sounder Publication, Philadelphia, 1985.
2. R.K. Jain, ―Mechanical & Industrial Measurements‖, 2nd Edition, Khanna Publishers, New Delhi, 1992.
3. D. Sirisha, D. Srinivas, ―Analytical Instrumentation‖, Sure Publications, 2004.

WEB RESOURCES

https://www. gasanalyzerbasics - YouTube
https://www.Hydrogen Purity Analyzer - Vasthi - YouTube
https://www.youtube.com/watch?v=JrkHsly2unE
https://youtube/kmSezAaTzQ4

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
Code: R20EC4110	ADVANCED COMMUNICATION TECHNOLOGIES *(Professional Elective – V)*						

COURSE OBJECTIVES:

1. To understand the working principle of Smart Antennas.
2. To know the various diversity schemes.
3. To understand features of UWB modulation methods in wireless communication.
4. To understand antenna radiation for UWB signals.
5. To learning UWB Communication sstandards in UWB Communication systems.

COURSE OUTCOMES:

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

CO1: Analyze the working principle of Smart Antennas. **[K4]**
CO2: Identify the various Diversity Schemes. **[K3]**
CO3: Utilize the UWB modulation methods in wireless communication. **[K3]**
CO4: Analyze the Antenna radiation for UWB signals. **[K4]**
CO5: Examine the UWB Communication Standards in UWB Communication Systems **[K4]**

.

SYLLABUS:

UNIT–I: SMART ANTENNAS:

Introduction, Cellular Radio Systems Evolution, Signal propagation, Diversity and Combining Techniques, Smart Antenna System, Benefits and drawbacks of Smart Antennas, Antenna beam forming.

UNIT–II: DIVERSITY SCHEMES:

Macroscopic diversity scheme, Microscopic diversity scheme – Space diversity, Field diversity, Polarization diversity, Angle diversity, Frequency diversity and time diversity scheme. Combining techniques for Macroscopic diversity, Combining techniques for Microscopic diversity.

UNIT–III: UWB COMMUNICATIONS AND ADVANCED UWB PULSE GENERATION:

UWB modulation methods – Pulse trains – UWB transmitter/receiver – Multiple access techniques in UWB – Capacity of UWB systems – Comparison of UWB with other wideband communication systems – Interference and coexistence of UWB with other systems – Hermite pulses – Orthogonal prolate spheroidal wave functions – Wavelet packets in UWB PSM – Applications of UWB communication systems.

UNIT–IV: - UWB ANTENNAS AND ARRAYS, POSITION AND LOCATION WITH UWB SIGNALS:

Antenna fundamentals – Antenna radiation for UWB signals – Conventional antennas and Impulse antennas for UWB systems – Beam forming for UWB signals – Radar UWB array systems – Wireless positioning and location – GPS techniques – Positioning techniques – Time resolution issues – UWB positioning and communications.

UNIT–V: UWB COMMUNICATION STANDARDS AND ADVANCED TOPICS IN UWB COMMUNICATION SYSTEMS:

UWB standardization in wireless personal area networks – DS-UWB proposal – MB-OFDM UWB proposal – IEEE proposals for UWB channel models – UWB ad-hoc and sensor networks – MIMO and Space-time coding for UWB systems – Self interference in high data-rate UWB communications – Coexistence of DS-UWB with WIMAX.

TEXT BOOKS:

1. Constantine A. Balanis & Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers' series-2007.
2. Rappaport T. S., "Wireless Communication: Principles and Practice", Second Edition, Pearson Education, 2009.
3. M. Ghavami, L. B. Michael and R. Kohno, "Ultra Wideband signals and systems in Communication Engineering", 2nd Edition, John Wiley and Sons, NY, USA, 2007.

REFERENCE BOOKS:

1. T.S Rappaport, "Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location", IEEE press 1998, PTR – PH publishers 1999.
2. Jeffrey H. Reed, "An Introduction to Ultra Wideband Communication systems", Prentice Hall Inc., NJ, USA, 2012.

IV B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4111	EDGE COMPUTING *(Professional Elective – V)*						

COURSE OBJECTIVES:

1. To introduce the concepts of Edge Computing.
2. To understand the IoT Architecture, Implementation of Edge Computing with help of IoT Architecture with Core Modules.
3. To understand the RasberryPi Hardware Layouts and Operating systems and Configuration of Rasberry Pi.
4. To understand the Implementation of Interface of RasberryPi with Micro Computer and Edge to Cloud Protocols and MQTT State transitions.
5. To familiarize with the concepts of Edge Computing with RasberryPi and Industrial and Commercial IoT.

COURSE OUTCOMES:

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

CO1: To illustrate the .Edge Computing use cases and outline Edge computing hardware architecture. **[K2]**

CO2: Make use of IoT architecture and implementation use cases. **[K3]**

CO3: Analyzing the layout and interface, configure of Rasberry Pi. **[K4]**

CO4: List out the relationships of edge computing with Rasberry Pi, with cloud protocols, industrial and commercial IoT and Edge Computing. **[K4]**

SYLLABUS:

UNIT- I: IoT AND EDGE COMPUTING DEFINITION AND USE CASES

Introduction to Edge Computing Scenario's and Use cases- Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge *vs* Fog Computing, Communication Modles-Edge, Fog and M2M.

UNIT- II: IoT ARCHITECTURE AND CORE IoT MODULES

A Connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of Network and Metcalfe's and Beckstroms's laws, IoT and Edge Architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study-Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

UNIT- III: RASBERRYPi

RasberryPi: Introduction to RasberryPi, About RasberryPi Board, Hardware Layout and Pin outs, Operating systems on RasberryPi, Configuring RasberryPi, Programming RasberryPi, Connecting RasberryPi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

UNIT- IV: INTERFACING RASBERRYPi & MQTT

Implementation of Microcomputer RasberryPi and device Interfacing, Edge to Cloud Protocols-Protocols, MQTT, MQTT publish-subscribe, MQTT Architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

UNIT- V: EDGE COMPUTING WITH RASBERRYPi

Edge Computing with RasberryPi, Industrial and Commercial IoT and Edge, Edge Computing and solutions.

TEXT BOOKS:

1. IoT Edge Computing for Architects –Second Edition, by Perry Lea, Publisher: Packet Publishing, 2020, ISBN: 9781839214806.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc 2019,ISBN: 978149204322.

REFERENCE BOOKS:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley Publication, 2019, ISBN: 9781119524984.
2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent. Edge, Microsoft Azure

IV B. TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20EC4112	MULTIMEDIA SIGNAL PROCESSING *(Professional Elective – V)*						

COURSE OBJECTIVES:

1. To understand the fundamentals behind multimedia signal processing.
2. To familiarize students with the various international standards on speech and audio coding algorithms.
3. To understand the basic principles behind existing multimedia compression and communication standards.
4. To understand the Future multimedia technologies.
5. To apply the acquired knowledge to specific media related problems and projects at work.

COURSE OUTCOMES:

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

CO1: Apply & illustrate the Principles and techniques of signal processing in Multimedia systems.**[K3]**

CO2: Analyze the speech and audio using multichannel filtering techniques and Cepstral Analysis: Compress audio signals using LPC, CELP and MELP techniques. **[K4]**

CO3: Analyze basic image compression techniques; compress images with linear prediction DCT and sub band coding Techniques. **[K4]**

CO4: Analyze video signals with motion estimation techniques; describe video compression Standards (MPEG and H263/264). **[K4]**

SYLLABUS:

UNIT- I: BASIC DIGITAL SIGNAL PROCESSING

Signals and Information - Signal Processing Methods - Applications of Digital Signal Processing- Fourier Analysis and Synthesis –Introduction to Fourier Series- Representation of Periodic Signals- Fourier Transform-Representation of Nonperiodic Signals- Discrete Fourier Transform -Short-Time Fourier Transform- Fast Fourier Transform (FFT)- 2-D Discrete Fourier Transform (2-D DFT) - Discrete Cosine Transform (DCT) -Some Applications of the Fourier Transform.

UNIT- II: DIGITAL AUDIO & AUDIO COMPRESSION

Digital Audio - The Nature of Sound - Development of Systems for Storing and Playback of Digital Audio - Effects of Sampling and Quantization on the Quality of Audio Signal- Nonlinear Quantization - Block Floating-Point Conversion- Differential Pulse Code Modulation (DPCM) - Super Bit Mapping .Speech Signals-Linear Model of Speech Production System -Voice Activity Analysis and Detectors - Audio Compression -Lossless Compressions - Lossy Compressions- MPEG Compression- ATRAC Compression.

STORING AND TRANSMISSION OF DIGITAL AUDIO SIGNALS

Compact Disc: CD-Encoding CD- Mini Disc-Super Audio CD (SACD)-DVD-Audio- Principles of Digital Audio Broadcasting: DAB- Orthogonal Frequency-Division Multiplexing (OFDM).

UNIT- III: DIGITAL VIDEO - DIGITAL VIDEO STANDARDS

Motion Parameters Estimation in Video Sequences-Digital Video Compression-MPEG-1 Video Compression Algorithm - MPEG-2 Compression Algorithm MPEG-4 Compression Algorithm - VCEG Algorithms -H.261 and H.263- H.264/MPEG4-AVC - Data Rate and Distortion-Communications Protocols for Multimedia Data-H.323 Multimedia Conference SIP Protocol-Audio Within a TV Signal -Video Signal Processor.

UNIT- IV: MUSIC SIGNAL PROCESSING & SPEECH PROCESSING

Music Signal Processing and Auditory Perception- Introduction- Musical Notes, Intervals and Scales - Musical Instruments - Review of Basic Physics of Sounds - Music Signal Features and Models- Anatomy of the Ear and the Hearing Process - Psychoacoustics of Hearing - Music Coding (Compression) - High Quality Audio Coding: MPEG Audio Layer-3 (MP3) - Stereo Music Coding

SPEECH PROCESSING:

Speech Communication-Acoustic Theory of Speech: The Source–filter Model-Speech Models and Features - Linear Prediction Models of Speech -Harmonic plus Noise Model of Speech - Fundamental Frequency (Pitch) Information -Speech Coding - Speech Recognition

UNIT- V: MULTIMEDIA SIGNALS AND SYSTEMS IN TELEMEDICINE

General Health Care –Telenursing – Telepharmacy - Telerehabilitation - Specialist Health Care Telecardiology – Teleradiology - Telesurgery

TEXT BOOKS:

1. Multimedia Signals and Systems, Srdjan Stankovic, Irena Orovic, Ervin Sejdic, 2nd Edition, Springer Publication, ISBN 978-3-319-23948-4
2. Multimedia Signal Processing, Saeed V. Vaseghi, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester- ISBN: 978-0-470-06201-2

REFERENCE BOOK:

1. Digital Signal Processing for Multimedia Systems, K.J. Ray Liu, Marcedl Ekker, Inc. New York Basel, ISBN: 0-8247-1924-7.

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC3OE07	**INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS** (Other than ECE) *(Open Elective-III)*						

COURSE OBJECTIVES:

1. To familiarize the students with architecture of 8086 microprocessor and 8051 microcontroller.
2. To introduce the assembly language programming concepts of 8086 processor.
3. To expose the students to various interfacing devices with 8086.
4. To introduce the concepts of interrupt mechanism.
5. To understand various interfacing and applications of 8051

COURSE OUTCOMES:

After completion of the course, the students are able to

CO1: Explain the architecture of 8086 microprocessor. **[K2]**
CO2: Demonstrate programming proficiency using Instruction set. **[K2]**
CO3: Analyze concept of interfacing different peripheral devices with 8086. **[K4]**
CO4: Interpret the memory organization and I/O management of 8051. **[K2]**
CO5: Summarize various interfacing and applications of 8051. **[K2]**

UNIT–I: 8086 MICROPROCESSOR

Evolution of Microprocessors, Introduction to 8085, Introduction to 8086 Processor, Architecture-Functional diagram, Register Organization, Physical memory organization, signal descriptions of 8086- common function signals, Minimum and Maximum mode signals, Timing diagrams.

UNIT–II: INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086

Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations. Interrupt structure of 8086, Vector interrupt table, Interrupt service routine.

UNIT–III: BASIC PERIPHERALS AND THEIR INTERFACING

8255 PPI various modes of operation and interfacing to 8086. Interfacing Keyboard, Display, Stepper Motor Interfacing.

UNIT–IV: 8051 MICROCONTROLLER

Microprocessors vs. Microcontrollers. Overview of 8051 microcontroller, Architecture, I/O Ports, Memory organization, addressing modes and instruction set of 8051, Interrupts, timer/ Counter and serial communication.

UNIT–V: INTERFACING OF 8051

Interfacing 8051 to LEDs, LCD and Keyboard Interfacing, Interfacing Seven segment display.

TEXT BOOKS:

1. A. K. Ray, K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH, 2000.
2. D. V. Hall' "Microprocessors and Interfacing", 3rd Edition, Mc Graw Higher Ed, 2012.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D.Mc Kinlay, "The 8051 Microcontrollers and Embedded Systems", 2nd Edition, Pearson, 2007.

REFERENCE BOOKS:

1. Barry B. Brey, Intel Microprocessors, 7th Edition, PHI, 2006.
2. Liu and GA Gibson, Micro Computer System 8086/8088 Family Architecture. Programming and Design, 2nd Edition, PHI, 1985.
3. Kenneth. J. Ayala, 8051 Microcontroller, 3rd Edition, Cengage Learning, 2010.

WEB REFERENCES:

1. http:// http://nptel.ac.in/courses/106108100/
2. https://onlinecourses.nptel.ac.in/noc18_ec03/
3. https://www.electronicshub.org/8051-microcontroller-introduction/
4. https://www.edgefx.in/8051-microcontroller-architecture/

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC3OE08	NANOELECTRONICS *(Open Elective - III)*						

COURSE OBJECTIVES:

1. To gain knowledge and fundamental concepts of Nano Electronics.
2. To learn characteristics and microscopic structures.
3. To understand the fabrication techniques.
4. To learn the concept of carbon nano structures and its applications.
5. To understand the classification of nano sensors and its applications.

COURSE OUTCOMES:

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

CO1:.Describe the classification of nano structures with energy bands. [K2]

CO2:.Differentiate the scanning probe techniques and diffraction techniques. [K4]

CO3: Compare and contrast Quantum well width fluctuations and thermally annealed quantum well. [K4]

CO4: Summarize the features of carbon clusters and nano tubes. [K2]

CO5:.Differentiate the key features of NEMS and MEMS. [K4]

SYLLABUS:

UNIT–I: INTRODUCTION

Overview of nanoscience and engineering. Development milestones in microfabrication and electronic industry. Moore's law and continued miniaturization, Classification of Nanostructures, Electronic properties of atoms and solids: Isolated atom, Bonding between atoms, Giant molecular solids, Free electron models and energy bands, crystalline solids, Periodicity of crystal lattices, Electronic conduction, effects of nanometer length scale.

UNIT–II: CHARACTERIZATION

Characterization:

Classification, Microscopic techniques, Field ion microscopy, scanning probe techniques, diffraction techniques: bulk and surface diffraction techniques.

Inorganic semiconductor nanostructures:

Overview of semiconductor physics. Quantum confinement in semiconductor nanostructures: quantum wells, quantum wires, quantum dots, super-lattices, band offsets, electronic density of states.

UNIT–III: FABRICATION TECHNIQUES

Requirements of ideal semiconductor, epitaxial growth of quantum wells, lithography and etching, cleaved-edge over growth, growth of vicinal substrates, strain induced dots and wires, electrostatically induced dots and wires, Quantum well width fluctuations, thermally annealed quantum wells, semiconductor nanocrystals, colloidal quantum dots, self-assembly techniques.

UNIT–IV: CARBON NANOSTRUCTURES

Carbon molecules, Carbon Clusters, Carbon Nanotubes, application of Carbon Nanotubes.

UNIT–V: NANOSENSORS

Nanosensors:

Introduction, Order from Chaos, Characterization, Perception, Nanosensors Based On Quantum Size Effects, Electrochemical Sensors, Sensors Based On Physical Properties, Nanobiosensors, Smart dust Sensor for the future.

Applications:

Injection lasers, quantum cascade lasers, single-photon sources, biological tagging, optical memories, coulomb blockade devices, photonic structures, QWIP's, NEMS, MEMS.

TEXT BOOKS:

1. Robert Kelsall, Ian Hamley and Mark Geoghegan, Nanoscale Science and Technology, John Wiley, 2007.
2. Charles P Poole, Jr, Frank J Owens, Introduction to Nanotechnology, John Wiley, Copyright 2006, Reprint 2011.
3. T Pradeep, Nano: The essentials-Understanding Nanoscience and Nanotechnology, TMH.

REFERENCE BOOKS:

1. William A Goddard III, Donald W Brenner, Sergey E. Lyshevski and Gerald J Iafrate, Hand Book of Nanoscience Engineering and Technology, CRC Press, 2003.

WEB RESOURCES:

1. http://www.ewh.ieee.org/tc/nanotech/
2. http://www.nano.org.uk
3. http://www.library.ualberta.ca/subject/nanoscience/guide/index.cfm
4. http://www.avs.org
5. http://www.cientifica.eu
6. http://www.euspen.org
7. http://www.foresight.org
8. http://www.nanotec.org.uk
9. http://nanotechweb.org
10. http://www.ostp.gov/nstc/index.html

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC4OE07	**INTRODUCTION TO EMBEDDED SYSTEMS** (Other than ECE) *(Open Elective - IV)*						

COURSE OBJECTIVES:

1. To gain knowledge and fundamental concepts and basic building blocks of an embedded system
2. To learn characteristics, quality attributes and applications of embedded systems
3. To understand the concept of real time operating systems
4. To learn the RTOS basics and various Communication & Synchronization techniques
5. To understand the classification and applications of embedded systems

COURSE OUTCOMES: After completion of the course, the student will be able to

CO1: Illustrate the classification and applications of embedded systems. **[K3]**
CO2: Classify the memory devices and passive components of embedded systems**. [K4]**
CO3: Summarize various Communication interface in Embedded Systems. **[K2]**
CO4: Summarize the steps involved in developing application specific embedded systems with suitable example. **[K6]**
CO5: Describe the RTOS basics and various Communication & Synchronization techniques. **[K2]**

SYLLABUS:

UNIT–I: INTRODUCTION

Embedded Systems vs. general computing systems, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems.

UNIT–II: CORE AND MEMORY

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 shading, memory selection for embedded system.

UNIT–III: COMMUNICATION INTERFACE AND EMBEDDED SYSTEM COMPONENTS

Communication Interface: Onboard and external Communication Interfaces embedded firmware. Embedded system Components: reset circuit, brown-out protection circuit, oscillator unit, Real Time Clock (RTC), watchdog timer, PCB and passive components.

UNIT–IV: CHARACTERISTICS, QUALITY ATTRIBUTES AND EXAMPLES OF EMBEDDED SYSTEMS.

Characteristics of embedded systems and quality attributes of embedded systems. Embedded systems application and domain-specific: washing machine-application-specific embedded system, automotive- domain-specific embedded system.

UNIT–V: RTOS BASED EMBEDDED SYSTEM DESIGN

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling. Task communication, task synchronization, task communication/synchronization issues, task synchronization techniques, device drivers, How to choose an RTOS?

TEXT BOOKS:

1. Shibu K.V, Introduction to Embedded Systems, Mc Graw Hill Education, 2013.
2. Raj Kamal, Embedded Systems, TMH, 2007.
3. Tammy Noergaard, Embedded systems Architecture, Elsevier publications, 2005.

REFERENCE BOOKS:

1. Frank Vahid, Tony Givargis, Embedded System Design, John Wiley, 1999.
2. David E. Simon, An Embedded Software Primer, Pearson Education, 1999.

WEB RESOURCES:

1. http://www.embeddedtechnology.com/
2. http://www.omg.org/realtime/
3. http://www.eembc.org
4. http://www.instantweb.com/~foldoc/
5. http://www.realtime-info.be/magazine/98q4/1998q4_p014.pdf
6. http://www.eet.com/
7. http://www.zdnet.com/intweek/

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC4OE08	EMBEDDED AND REAL TIME OPERATING SYSTEMS *(Open Elective - IV)*						

COURSE OBJECTIVES:

1. To survey the basics of an embedded system.
2. To survey the general structure of a real-time system.
3. To develop task scheduling and task communication algorithms.
4. To develop task synchronization algorithms.
5. To identify the design methods of embedded systems.

COURSE OUTCOMES:

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

CO1: Survey the basics of an embedded system. **[K4]**
CO2: Survey the general structure of a real-time system. **[K4]**
CO3: Develop task scheduling and task communication algorithms. **[K3]**
CO4: Develop task synchronization algorithms. **[K3]**
CO5: Identify the design methods of embedded systems. **[K3]**

SYLLABUS:

UNIT-I: INTRODUCTION TO EMBEDDED SYSTEMS

Embedded system vs. General computing system, classification, major application areas, purpose of embedded systems, core of embedded system, memory, sensors and actuators, communication interface.

UNIT-II: INTRODUCTION TO RTOS

Operating System basics, types, RTOS, Architecture of the Kernel, Kernel objects, tasks/process and threads, Context Switching, Interrupt service routines- Interrupt latency, interrupt response time, interrupt recovery time, How to choose an RTOS?

UNIT-III: TASK SCHEDULING AND TASK COMMUNICATION

Task Scheduling - Types of multitasking, non-preemptive and preemptive scheduling algorithms, Task Communication - shared memory, pipes, memory mapped objects, message passing, message queue, mailbox, signalling, RPC and sockets.

UNIT-IV: TASK SYNCHRONIZATION

Task Communication/Synchronization issues, racing, deadlock, Conditions favoring deadlock situation, deadlock handling, the dining philosopher's problem, Task Synchronization techniques-Semaphore, Mutex,

UNIT-V: DESIGN TECHNOLOGY

Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioural Synthesis, Systems Synthesis and Hardware/Software Co-Design.

TEXT BOOKS:

1. Introduction to embedded systems, Shibu. K.V, TMH, 2009.
2. Embedded / Real Time Systems, KVKK Prasad, Dreamtech Press, 2005.
3. Embedded System Design, A Unified Hardware/Software Introduction, Frank Vahid, Tony D. Givargis, John Wiley, 2002.

REFERENCE BOOKS:

1. 8051 Microcontroller & Embedded Systems using Assembly and C, Ayala & Gadre: Cengage
2. Embedded Systems, Rajkamal, TMH, 2009.
3. Embedded Software Primer, David Simon, Pearson.
4. The 8051 Microcontroller and Embedded Systems, Mazidi, Pearson.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=F321087yYy4
2. https://www.youtube.com/watch?v=JIr7Xm_riRs&list=PLEBQazB0HUyQ4hAPU1cJED6t3DU0h34bz&index=2
3. https://www.youtube.com/watch?v=95yUbClyf3E&list=PLEBQazB0HUyQ4hAPU1cJED6t3DU0h34bz&index=3
4. https://www.youtube.com/watch?v=pHJ3lxOoWeI&list=PLEBQazB0HUyQ4hAPU1cJED6t3DU0h34bz&index=5
5. https://www.youtube.com/watch?v=5JcMtbA9QEE&list=PLEBQazB0HUyQ4hAPU1cJED6t3DU0h34bz&index=7

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC4101	BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS *(Humanities and Social Science Elective)*						

COURSE OBJECTIVES:

1. To provide an insight into the various economic concepts which are necessary for taking decisions related to economic aspects of the organization.
2. To provide familiarity with the accounting concepts which will help in preparation of various accounting records
3. To equip the student with the basic management concepts and functions and to provide knowledge relating to recruitment, selection, training, and motivation of employees in the organization

COURSE OUTCOMES:

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

CO1: Summarize fundamentals of Managerial economics for decision making. **[K2]**
CO2: Apply concepts of Financial Accounting and BEP for business decisions. **[K3]**
CO3: Evaluate fundamental concepts and principles of management. **[K5]**
CO4: Discuss functional areas of management like HR, marketing and finance. **[K6]**
CO5: Apply project management techniques for project planning and evaluation **[K3]**

UNIT-I: INTRODUCTION TO MANAGERIAL ECONOMICS

Definitions, - Nature And Scope- Relation With Other Subjects- Demand Definition- Determinants- Law of Demand and Its Exceptions- Concept of Elasticity of Demand- Cost Concepts- CVP Analysis (With Simple Problems), Significance- Limitations.

UNIT-II: MARKET STRUCTURES AND FINANCIAL ACCOUNTING

Introduction to Markets – Features of various markets-Perfect competition, Monopoly and Oligopoly. Definition – Importance, limitations and basic books of financial accounting, Preparation of basic books of accounting: journal, ledger and trail balance.

UNIT-III: INTRODUCTION TO MANAGEMENT

Concept, Nature, Importance- Functions of Management- Henry Fayols Principles of Management- F.W.Taylors Scientific Management- Douglas Mc Gregors Theory X and Y.

UNIT-IV: FUNCTIONAL AREAS OF MANAGEMENT

Concept of HRM, Functions of HR Manager- Marketing Management- Functions of Marketing Manager- Production Management-Functions of Production Management – Financial Management and functions of Financial Management.

UNIT-V: PROJECT MANAGEMENT: (PERT/CPM)

Development of Network – Difference between PERT and CPM- Problems on Critical Path- Problems on PERT Analysis.

TEXT BOOKS:

1. Dr. N. Appa Rao, Dr. P. Vijay Kumar, Managerial economics and financial analysis, Cengage publication's, New Delhi-2011.
2. Dr. A. R. Aryasri, Managerial Economics and Financial Analysis, TMH2011.
3. V. Maheswari, Managerial Economies, Sultan Chand.
4. Suma Damodaran, Managerial Economics, Oxford 2011.
5. Koontz & Weihrich, Essentials of Management. TMH 2011.

REFERENCE BOOKS:

1. DM Mithani, Managerial Economics Theory & Applications, Himalaya Publishing House, 2013 - **Unit-1, 2**
2. G. Prasad, Accounting For Managers, Jaibharath Publishers, 2016 - **Unit-3**
3. Management Science, Dr. P. Vijaya Kumar & Dr. N. Appa Rao, Cengage, Delhi, 2012. - **Unit-4, 5**
4. Project Planning & Control with PERT & CPM, BC Punmia & KK Khandelwal, Lakshmi Publications, New Delhi, 4th Edition – 2016. - **Unit-6**

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC4117	ENTREPRENEURSHIP & INNOVATION *(Humanities and Social Science Elective)*						

COURSE OBJECTIVES:

1. Creating awareness among the students about the significance of entrepreneurship and its social relevance.
2. Imparting knowledge to the students on institutional support available to start a business venture
3. To understand the significance of entrepreneurial training in the development of new and existing entrepreneurs

COURSE OUTCOMES:

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

CO1 : Outline the concepts of Entrepreneurship. **[K2]**
CO2 : Create the awareness on creativity and innovation. **[K6]**
CO3 : Adopt the Entrepreneurship Development programs.**[K6]**
CO4 : Evaluate the project planning and feasibility studies. **[K5]**
CO5 : Analyze the concept of small and micro enterprises. **[K4]**

SYLLABUS:

UNIT –I: ENTREPRENEUR AND ENTREPRENEURSHIP

Entrepreneur – Definitions, concept of entrepreneur, characteristics of entrepreneur, types of entrepreneurs, concept of entrepreneurship, characteristics of entrepreneurship, role of entrepreneurship in economic development, ethics and social responsibilities of an entrepreneur, Financial institutional support to entrepreneurs (IDBI, SISI, DIC, NIESBUD, Commercial banks etc.)

UNIT-II: CREATIVITY AND INNOVATION IN ENTREPRENEURSHIP

Meaning and concept of creativity - Nature and characteristics of creativity -Creativity Process- Factors affecting creativity - Meaning and Importance Innovation - Process -Distinguish the Creativity and Innovation.

UNIT –III: ENTREPRENEURSHIP DEVELOPMENT PROGRAMMES

Designing Appropriate Training Programme to inculcate Entrepreneurial Spirit -Training for Entrepreneurs, Entrepreneurship Development Programme (EDP) – Need and objectives of EDP's - Phases and evolution on EDP's existing and new Entrepreneurs.

UNIT –IV: PROJECT PLANNING AND FEASIBILITY STUDIES

Meaning of a project, Project identification – Sources of new Ideas, Methods of generating ideas, Project selection, - Project Feasibility Study -Project evaluation and Techniques (PBP, ARR, NPV, IRR & PI).

UNIT –V: SMALL AND MICRO ENTERPRISES

Importance, definitions, MSME's Development Act 2006 – policies and their support to MSMEs - Growth of Firm and growth strategies, Factors inducing growth – sickness in small business and remedies.

TEXT BOOKS:

1. Entrepreneurship, Arya Kumar, Pearson, Publishing House, New Delhi, 2012.
2. Entrepreneurship, VSP Rao, Kuratko, Cengage Learning, New Delhi,2012.
3. Innovation Management, Shoimo Maital, DVR Seshadri, Response Books 2007.

REFERENCE BOOKS:

1. Entrepreneurship Development, B. Janakiram, M. Rizwana: Excel Books, ND, 2011.
2. Entrepreneurship Development, P.C. Shejwalkar Everest Publishing House, ND, 2011.
3. Innovation Management, Vinnie Jauhari & Sudhanshu Bhushan, Oxford University Press, 2014.

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	0	2	0	50	50	2
CODE: R20EC41SC1	PYTHON PROGRAMMING FOR DEEP LEARNING / MOBILE APP DEVELOPMENT						

COURSE OBJECTIVES:

1. To discover the basics of machine learning
2. To apply different classifier algorithms
3. To model detection systems using different Neural Networks
4. To develop mobile apps

COURSE OUTCOMES:

After completion of this course, student will be able to

CO1: Make use of Tensor Flow / Keras to get familiar with Deep learning applications. **[K3]**
CO2: Apply various concepts related with Deep Learning to solve Problems. **[K3]**
CO3: Analyze different deep learning models in solving Image related problems. **[K4]**
CO4: Make use of CNN in modeling classifiers. **[K3]**
CO5: Develop simple mobile apps. **[K3]**

PART-1: Deep Learning

1. To demonstrate a decision tree based ID3 algorithm and classify a new sample.
2. To implement the naïve Bayesian classifier and Compute the accuracy of the classifier.
3. To implement the k-Nearest Neighbor algorithm.
4. To Implement regression model.
5. To Implement a perceptron.
6. To implement back propagation algorithm.
7. To implement an image classifier using CNN.
8. To implement genetic algorithm.

PART-2: Mobile App Development

9. Create Hello World Android App using Android Studio and explain each step in detail.
10. Create an Android Application that shows the usage of Async Task Loaders by fetching data from movies db.
11. Create an Activity that demonstrates the Life Cycle of an Activity.
12. Create an Android App which receives name form the user and displays welcome name in Second Activity.

Beyond Syllabus

13. Write an Android application program that demonstrates Notifications.
14. Create an Android Application that show the usage of Recycler View.

IV B.Tech., II Semester, ECE

R20 Course Structure

&

Syllabus

IV B.TECH. – II SEMESTER

S.No.	SUBJECT	SUBJECT CODE	Cat. Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Internship and Project Work	R20CC42PW	PR	**0**	**0**	**0**	**60**	**140**	**200**	**12**

LIST OF HONORS

POOL-1: DIGITAL SIGNAL PROCESSING

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S.No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Adaptive Signal Processing	R20ECHN01	3	1	0	30	70	100	4
2	Bio- Medical Signal Processing	R20ECHN02	3	1	0	30	70	100	4
3	Wavelet Theory	R20ECHN03	3	1	0	30	70	100	4
4	Multirate Systems And Filter Banks	R20ECHN04	3	1	0	30	70	100	4
5	Mathematical methods for signal processing	R20ECHN05	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-2: INTEGRATED CIRCUITS AND SYSTEMS

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	CMOS Analog IC Design	R20ECHN06	3	1	0	30	70	100	4
2	CMOS Digital IC design	R20ECHN07	3	1	0	30	70	100	4
3	Design for Testability	R20ECHN08	3	1	0	30	70	100	4
4	System on Chip	R20ECHN09	3	1	0	30	70	100	4
5	Low Power VLSI Design	R20ECHN10	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-3: COMMUNICATION ENGINEERING:

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Software Defined Radio	R20ECHN11	3	1	0	30	70	100	4
2	Global Navigational Satellite Systems	R20ECHN12	3	1	0	30	70	100	4
3	Cognitive Radio	R20ECHN13	3	1	0	30	70	100	4
4	5G Communications	R20ECHN14	3	1	0	30	70	100	4
5	Optical Networks	R20ECHN15	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-4: INSTRUMENTATION AND CONTROL SYSTEMS

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Adaptive Control Systems	R20ECHN16	3	1	0	30	70	100	4
2	Digital Control Systems	R20ECHN17	3	1	0	30	70	100	4
3	Process Control Instrumentation	R20ECHN18	3	1	0	30	70	100	4
4	Transducers & sensors	R20ECHN19	3	1	0	30	70	100	4
5	Intelligent & Smart Instrumentation	R20ECHN20	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-1: DIGITAL SIGNAL PROCESSING

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S.No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Adaptive Signal Processing	R20ECHN01	3	1	0	30	70	100	4
2	Bio- Medical Signal Processing	R20ECHN02	3	1	0	30	70	100	4
3	Wavelet Theory	R20ECHN03	3	1	0	30	70	100	4
4	Multirate Systems And Filter Banks	R20ECHN04	3	1	0	30	70	100	4
5	Mathematical methods for signal processing	R20ECHN05	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN01	ADAPTIVE SIGNAL PROCESSING						

COURSE OUTCOMES:

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

CO1: Review the Adaptive Systems and understand the various measures to be opted fordeveloping adaptive system

CO2: Study of different algorithms to develop the adaptive filter theory

CO3: Application of adaptive filter theory for different problems

CO4: Study of RLS & Kalman Filtering

SYLLABUS:

Unit –I:

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

Unit-II:

Development of Adaptive Filter Theory & Searching the Performance surface: Introduction to Filtering - Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance surface Searching the performance surface – Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability& Rate of convergence , Learning Curve.

Unit-III:

Steepest Descent Algorithms: Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

Unit-IV:

LMS Algorithm & Applications: Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm. Applications: Noise cancellation – Cancellation of Echoes in long distance telephone circuits, Adaptive Beam forming.

Unit-V:

RLS &Kalman Filtering: Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Examples using Kalman filtering.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Optimum signal processing: An introduction – Sophocles .J. Orfamadis, 2nd Ed., 1988,McGraw-Hill, New York
2. Adaptive signal processing-Theory and Applications - S.Thomas Alexander, 1986,Springer –Verlag.
3. Signal analysis – Candy, McGraw Hill Int. Student Edition
4. James V. Candy - Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988

POOL-I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN02	BIO- MEDICAL SIGNAL PROCESSING						

COURSE OUTCOMES: At the end of the course the student will be able to

CO1: Understand different types of biomedical signal.
CO2: Identify and analyze different biomedical signals.
CO3: Find applications related to biomedical signal processing

SYLLABUS:

Unit I:

Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, Study of diagnostically significant bio-signal parameters

Unit II:

Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artefact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's) Processing, Digital filtering

Unit III:

Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time-frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant)

Unit IV:

Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications

Unit V:

Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio–Signals analysis Multi resolution analysis (MRA) and wavelets, Principal component analysis(PCA), Independent component analysis(ICA). Pattern classification– supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples.

TEXT BOOKS:

1. W. J. Tompkins, "Biomedical Digital Signal Processing", Prentice Hall,1993.
2. Eugene N Bruce, "Biomedical Signal Processing and Signal Modeling", John Wiley & Son's publication,2001.

REFERENCES:

1. Myer Kutz, "Biomedical Engineering and Design Handbook, Volume I", McGraw Hill, 2009.
2. D C Reddy, "Biomedical Signal Processing", McGraw Hill,2005.
3. Katarzyn J. Blinowska, Jaroslaw Zygierewicz, "Practical Biomedical Signal Analysis Using MATLAB", 1st Edition, CRC Press,2011

POOL-I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN03	WAVELET THEORY						

COURSE OUTCOMES: At the end of the course the student will be able to

CO1: Understand windowed Fourier transform and difference between windowed Fourier Transform and wavelet transform.

CO2: Understand wavelet basis and characterize continuous and discrete wavelet transforms

CO3: Understand multire solution analysis and identify various wavelets and evaluate their Time-frequency resolution properties

CO4: discrete wavelet transforms with multirate digital filters and can under stand Wavelet packets

CO5: Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields

SYLLABUS:

Unit – I:

The Age of Wavelets –Introduction-The Origins of Wavelets-Are They Fundamentally New-Wavelets and Other Reality Transforms, Managing Heisenberg's Uncertainty Ghost. History of Wavelet from Morlet to Daubechies Via Mallat , Different Communities of Wavelets, Different Families of Wavelets within Wavelet Communities, Interesting Recent Developments, Wavelets in the Future

Unit – II:

Introduction-Vector spaces – bases, orthonormality, projection, functions and function spaces, orthogonal functions, orthonormal functions, function spaces, orthogonal basis functions, orthonormality and the method of finding the coefficients, complex fourier series, orthogonality of complex exponential bases

Unit – III:

Continuous Wavelet and Short time Fourier Transform-Wavelet Transform, mathematical preliminaries, continuous time frequency representation of signals, the windowed fourier transform(Short Time Fourier Transform), The uncertainty principle and time frequency tiling, properties of wavelets used in Continuous Wavelet Transform, Continuous Versus Discrete Wavelet Transform

Unit – IV:

Discrete Wavelet Transform-Haar scaling functions and function spaces, Nested Spaces, Haar Wavelet Function, Normalization of Haarbases at different scales, Standardizing the Notations, Refinement Relation with Respect to Normalized Bases, Support of a wavelet system, Daubechies Wavelets

Unit – V:

Biorthogonal Wavelets-Biorthogonality in vector space, Biorthogonal Wavelet Systems, Signal Representation using Biorthogonal Wavelet System, Biorthogonal Analysis, Biorthogonal Synthesis, Construction of Biorthogonal Wavelet Systems.

TEXT BOOKS:

1. Insight into Wavelets: From theory to practice by K.P.Soman, Ramachandran, Resmi, PHI Learning PVT Ltd,2010
2. L.Prasad & S.S.Iyengar, Wavelet Analysis with Applications to Image Processing,CRC Press, 1997.

REFERENCES:

1. Wavelet Transforms - Introduction to Theory and Applications, Raghuveer M.Rao, Ajit Bopardikar, Pearson Education, Asia
2. Fundaments of Wavelets - Theory, Algorithms and Applications, Jaideva C.Goswami, Andrew K. Chan, John Wiley & Sons.

POOL-I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN04	MULTIRATE SYSTEMS AND FILTER BANKS						

COURSE OUTCOMES: At the end of the course the student will be able to
CO1: Understand the concepts multi-rate systems
CO2: Describe the applications of multi-rate systems
CO3: Study of various filter banks
CO4: Analyze the efforts of quantization
CO5: Explain the overall multi-rate systems and filter banks

SYLABUS:
Unit – I:
Fundamentals of Multirate Systems: Basic Multirate Operations, Interconnection of Building Blocks, The Polyphase representation, Multistage Implementations, Some Applications of Multirate Systems, Special Filters and Filter Banks

Unit – II:
Maximally Decimated Filter Banks: Errors created in the QMF Bank, A Simple Alias Free QMF System, Power Symmetric QMF Banks, M-Channel Filter Banks, Polyphase representation, Perfect Reconstruction Systems, Alias Free Filter Banks, Tree Structured Filter Banks, Trans-Multiplexers

Unit – III:
Para unitary Perfect Reconstruction (PR) Filter Banks: Lossless Transfer Matrices, Filter Bank Properties Induced by Para unitariness, Two channel FIR Para unitary QMF Banks, TheTwo channel Para unitary QMF Lattice, Transform Coding and the LOT.

Unit – IV:
Cosine Modulated Filter Banks: The Pseudo QMF Bank, Design of Pseudo QMF Bank, Efficient Polyphase Structures, Deeper Properties of Cosine Matrices, Cosine Modulated Perfect Reconstruction Systems.

Unit – V:
Quantization effects, Types of Quantization effects, Review of standard techniques, Noise transmission in multirate systems, Noise in filter banks, Filter bank output noise, Limit Cycles, Coefficient Quantization

Text Book:
1. Multirate Systems and Filter Banks, P.P.Vaidyanathan, Pearson Education, LowPriced Edition, 2006.

Reference Books:
1. Multirate Signal Processing for Communication Systems by F.J.Harris, Pearson Education, Low Priced Edition.
2. Digital Signal Processing, A computer Based Approach by Sanjit K Mitra, Tata McGrawHill Publishing.

POOL-I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN05	MATHEMATICAL METHODS FOR SIGNAL PROCESSING						

COURSE OUTCOMES:

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

CO1: Understand and solve the problems associated with Vectors

CO2: Solve the problem associated with linear algebra

CO3: Understand probability theory and conditional probability

CO4: Summarize the concepts associated with multiple random variables and to solve the problems associated with power spectral density of the output of the system.

CO5: Recognize the usage of random process in signal processing and to solve the corresponding problems.

SYLABUS:

Unit – I:

Vectors: Representation and Dot products, Matrices: Matrix Multiplication, Transposes, Inverses, Gaussian Elimination, factorization, rank of a matrix, Vector spaces: Column and row spaces, Solving Ax=0 and Ax=b, Independence, basis, dimension, linear transformations, Orthogonality: Orthogonal vectors and subspaces, projection and least squares, Gram- Schmidt orthogonalization.

Unit – II:

Determinants: Determinant formula, cofactors, inverses and volume, Eigenvalues and Eigenvectors: characteristic polynomial, Diagonalization, Hermitian and Unitary matrices, Spectral theorem, Change of basis, Positive definite matrices and singular value decomposition, Linear transformations.

Unit – III:

Review of Probability: Basic set theory and set algebra, basic axioms of probability, Conditional Probability, Bayes theorem/Law of total probability.

Unit – IV:

Random variables PDF/PMF/CDF Properties, random vectors marginal/joint/conditional density functions, transformation of Random Variables, characteristic/moment generating functions, Random sums of Random variables, Law of Large numbers (strong and Weak), Limit theorems convergence types, Inequalities Chebyshev/Markov/Chernoff bounds.

Unit – V:

Random processes: classification of random processes, wide sense stationary processes, autocorrelation function and power spectral density and their properties. Examples of random process models - Gaussian/Markov Random process, Random processes through LTI systems

TEXTBOOKS:

1. Introduction to linear algebra - Gilbert Strang, SIAM, 2016.
2. Introduction to probability - Bertsekas and Tsitsiklis, Athena, 2008

REFERENCES BOOKS:

1. Probability and Random processes for Electrical Engineers, Leon Garcia Addison Wesley, 2nd edition, 1994
2. Probability and Random Processes, Geoffrey Grimmett, David Stirzaker, 3rd Edition, Oxford University Press, 2001.
3. Probability and Stochastic Process, Roy D Yates, David J Goodman, 2nd edition Wiley, 2010.

POOL-2: INTEGRATED CIRCUITS AND SYSTEMS

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	CMOS Analog IC Design	R20ECHN06	3	1	0	30	70	100	4
2	CMOS Digital IC design	R20ECHN07	3	1	0	30	70	100	4
3	Design for Testability	R20ECHN08	3	1	0	30	70	100	4
4	System on Chip	R20ECHN09	3	1	0	30	70	100	4
5	Low Power VLSI Design	R20ECHN10	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-1I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN06	CMOS ANALOG IC DESIGN						

COURSE OUTCOMES:

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

CO1: Design MOSFET based analog integrated circuits.
CO2: Analyze analog circuits at least to the first order.
CO3: Appreciate the trade-offs involved in analog integrated circuit design.
CO4: Understand and appreciate the importance of noise and distortion in analog circuits.

UNIT –I: BASIC MOS DEVICE PHYSICS

General Considerations, MOS I/V Characteristics, Second Order effects, MOS Device models. Short Channel Effects and Device Models. Single Stage Amplifiers –Basic Concepts, Common Source Stage, Source Follower, Common Gate Stage, Cascode Stage

UNIT -II: DIFFERENTIAL AMPLIFIERS

Single Ended and Differential Operation, Basic Differential Pair, Common Mode Response, Differential Pair with MOS loads, Gilbert Cell. Passive and Active Current Mirrors– Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors.

UNIT -III: FREQUENCY RESPONSE OF AMPLIFIERS

General Considerations, Common Source Stage, Source Followers, Common Gate Stage, Cascode Stage, Differential Pair. Noise – Types of Noise, Representation of Noise in circuits, Noise in single stage amplifiers, Noise in Differential Pairs.

UNIT -IV: FEEDBACK AMPLIFIERS

General Considerations, Feedback Topologies, Effect of Loading. Operational Amplifiers – General Considerations, One Stage Op Amps, Two Stage Op Amps, Gain Boosting, Common – Mode Feedback, Input Range limitations, Slew Rate, Power Supply Rejection, Noise in Op Amps. Stability and Frequency Compensation.

UNIT -V: CHARACTERIZATION OF COMPARATOR

Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

1. B.Razavi, “Design of Analog CMOS Integrated Circuits”, 2nd Edition, McGraw Hill Edition2016.
2. Paul. R.Gray & Robert G. Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley, 5th Edition, 2009.

REFERENCE BOOKS:

1. T. C. Carusone, D. A. Johns & K. Martin, “Analog Integrated Circuit Design”, 2nd Edition, Wiley, 2012.
2. P.E.Allen &D.R. Holberg, “CMOS Analog Circuit Design”, 3rd Edition, Oxford University Press, 2011.
3. R. Jacob Baker, “CMOS Circuit Design, Layout, and Simulation”, 3rd Edition, Wiley,2010.
4. Recent Literature in Analog IC Design.

POOL-1I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN07	CMOS DIGITAL IC DESIGN						

COURSE OUTCOMES:

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

CO1: Demonstrate advanced knowledge in Static and dynamic characteristics of CMOS, Alternative CMOS Logics, Estimation of Delay and Power, Adders Design.

CO2: Classify different semiconductor memories.

CO3: Analyze, design and implement combinational and sequential MOS logic circuits.

CO4: Analyze complex engineering problems critically in the domain of digital IC design for conducting research.

CO5: Solve engineering problems for feasible and optimal solutions in the core area of digital ICs.

SYLLABUS:

UNIT-I: MOS Design

Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II: Combinational MOS Logic Circuits

MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OAI gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT-III: Sequential MOS Logic Circuits

Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latchand edge triggered flip-flop.

UNIT-IV: Dynamic Logic Circuits

Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

UNIT-V: Semiconductor Memories

Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash.

TEXT BOOKS:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, YusufLeblebici, TMH, 3rd Ed., 2011.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan Borivoje Nikolic, 2nd Ed., PHI.

POOL-1I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN08	DESIGN OF TESTABILITY						

COURSE OUTCOMES:

Students are able to

CO1: Apply the concepts in testing which can help them design a better yield in IC design.

CO2: Tackle the problems associated with testing of semiconductor circuits at earlier design levels soas to significantly reduce the testing costs.

CO3: Analyse the various test generation methods for static & dynamic CMOS circuits.

CO4: Identify the design for testability methods for combinational & sequential CMOS circuits.

CO5: Recognize the BIST techniques for improving testability.

SYLLABUS:

UNIT-I: Introduction to Testing

Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

UNIT-II: Logic and Fault Simulation

Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation

UNIT -III: Testability Measures

SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT andScan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

UNIT-IV: Built-In Self-Test

The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test- Per- Scan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

UNIT-V: Boundary Scan Standard

Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description Language: BDSL Description Components, Pin Descriptions.

TEXT BOOKS:

1. Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits - M.L. Bushnell, V. D. Agrawal, Kluwer Academic Publishers.

REFERENCE BOOKS:

1. Digital Systems and Testable Design - M. Abramovici, M.A.Breuer and A.D Friedman, Jaico Publishing House.
2. Digital Circuits Testing and Testability - P.K. Lala, Academic Press.

POOL-1I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN09	SYSTEM ON CHIP						

COURSE OUTCOMES: At the end of the course, students will be able to:
CO1: Identify and formulate a given problem in the framework of SoC based design approaches Design SoC based system for engineering applications
CO2: Realize impact of SoC on electronic design philosophy and Macro-electronics therebyincline towards entrepreneurship & skill development.

SYLLABUS:

UNIT 1: ASIC
Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts.

UNIT 2: NISC
NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language forspecification, compilation and synthesis of embedded processors.

UNIT 3: Simulation
Different simulation modes, behavioral, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

UNIT 4: Low power SoC design / Digital system
Design synergy, Low power system perspective- power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS),building block optimization, building block memory, power down techniques, power consumption verification.

UNIT 5: Synthesis
Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs.

TEXT BOOKS:
1. Hubert Kaeslin, “Digital Integrated Circuit Design: From VLSI Architectures toCMOS
2. Fabrication”, Cambridge University Press, 2008.
3. B. Al Hashimi, “System on chip-Next generation electronics”, The IET, 2006

REFERENCE BOOKS:

1. Rochit Rajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center,2000
2. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008
3. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip".

POOL-1I (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN10	LOW POWER VLSI DESIGN						

COURSE OUTCOMES:

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

CO1: Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.

CO2: Characterize and model power consumption & understand the basic analysis methods.

CO3: Understand leakage sources and reduction techniques.

SYLLABUS

UNIT-I: Sources of Power Dissipation

Introduction, Short-Circuit Power Dissipation, Switching Power Dissipation, Dynamic Power for a Complex Gate, Reduced Voltage Swing, Switching Activity, Leakage Power Dissipation, p–n Junction Reverse-Biased Current, Band-to-Band Tunneling Current, Subthreshold Leakage Current, Short-Channel Effects

UNIT 2: Supply Voltage Scaling for Low Power

Device Feature Size Scaling, Constant-Field Scaling, Constant-Voltage Scaling, Architectural-Level Approaches: Parallelism for Low Power, Pipelining for Low Power, Combining Parallelism with Pipelining, Voltage Scaling Using High-Level Transformations: Multilevel Voltage Scaling Challenges in MVS Voltage Scaling Interfaces, Static Timing Analysis Dynamic Voltage and Frequency Scaling

UNIT-3: Switched Capacitance Minimization

Probabilistic Power Analysis: Random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy, Bus Encoding: Gray Coding, One-Hot Coding, Bus-Inversion, T0 Coding, Clock Gating, Gated-Clock FSMs FSM State Encoding, FSM Partitioning, Precomputation, Glitching Power Minimization

UNIT 4: Leakage Power Minimization

Fabrication of Multiple Threshold Voltages, Multiple Channel Doping, Multiple Oxide CMOS, Multiple Channel Length, Multiple Body Bias, VTCMOS Approach, MTCMOS Approach, Power Gating, Clock Gating Versus Power Gating, Power-Gating Issues, IsolationStrategy, State Retention Strategy, Power-Gating Controller, Power Management, CombiningDVFS and Power Management

UNIT 5: Low power clock distribution & Simulation Power Analysis

Low power clock distribution: Power dissipation in clock distribution, single driver versus distributed buffers, Zero skew versus tolerable skew, chip and package co design for clock network.

Simulation Power Analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, architecture level analysis, data correlation analysis of DSP systems, Monte Carlo Simulation

TEXT BOOKS:

1. Low-Power VLSI Circuits and Systems, Ajit Pal, SPRINGER PUBLISHERS
2. Practical Low Power Digital Vlsi Design , Gary Yeap Motorola, Springer Science Business Media, LLC.

REFERENCE BOOKS:

1. Low Power CMOS Design – Anantha Chandrakasan, IEEE Press/Wiley International, 1998. 2
2. Massoud Pedram, Jan M. Rabaey , "Low power design methodologies ", Kluwer Academic Publishers.
3. Low Power CMOS VLSI Circuit Design – A. Bellamour, M. I. Elamasri, Kluwer Academic Press, 1995.

POOL-3: COMMUNICATION ENGINEERING:

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Software Defined Radio	R20ECHN11	3	1	0	30	70	100	4
2	Global Navigational Satellite Systems	R20ECHN12	3	1	0	30	70	100	4
3	Cognitive Radio	R20ECHN13	3	1	0	30	70	100	4
4	5G Communications	R20ECHN14	3	1	0	30	70	100	4
5	Optical Networks	R20ECHN15	3	1	0	30	70	100	4
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-III (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN11	SOFTWARE DEFINED RADIO						

COURSE OUTCOMES:

On successful completion of this course the students will be able to

CO1: Demonstrate advanced knowledge in the evolving paradigm of Software defined radioand technologies for its implementation.

CO2: Analyze complex problems critically in the domains of Radio frequency implementation issues, Multirate signal processing in SDR, as well as a Smart antennatechniques for better spectrum exploitation for conducting research.

CO3: Apply appropriate techniques for the development of scientific and technological knowledge in designing software defined radios and their usage for cognitive radio.

SYLLABUS

UNIT -I: Introduction

The Need for Software Radios, What is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, RF Implementation issues- The Purpose of RF Front – End, Dynamic Range- The Principal Challenge of Receiver Design – RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios- Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DAC Distortion.

UNIT -II: Multi Rate Signal Processing

Introduction- Sample Rate Conversion Principles- Polyphase Filters Digital Filter Banks- Timing Recovery in Digital Receivers Using Multirate Digital Filters.

Digital Generation of Signals: Introduction- Comparison of Direct Digital Synthesis with Analog Signal Synthesis- Approaches to Direct Digital Synthesis- Analysis of Spurious Signals- Spurious Components due to Periodic jitter- Band Pass Signal Generation- Performance of Direct Digital Synthesis Systems- Hybrid DDS-PLL Systems- Applications of direct Digital Synthesis- Generation of Random Sequences- ROM Compression Techniques.

UNIT -III: Analog to Digital and Digital to Analog Conversion

Parameters of ideal data converters- Parameters of Practical data converters- Analog to Digital and Digital to Analog Conversion- Techniques to improve data converter performance- Common ADC and DAC architectures.

UNIT -IV: Digital Hardware Choices

Introduction- Key Hardware Elements- DSP Processors- Field Programmable Gate Arrays- Trade-Offs in Using DSPs, FPGAs, and ASICs- Power ManagementIssues Using a Combination of DSPs, FPGAs, and ASICs.

UNIT -V: Object – Oriented Representation of Radios and Network Resources

Networks- Object Oriented Programming- Object Brokers- Mobile Application Environments- Joint Tactical Radio System. Case Studies in Software Radio Design: Introduction and Historical Perspective, SPEAK easy- JTRS, Wireless Information Transfer System, SDR-3000 Digital Transceiver Subsystem, Spectrum Ware, CHARIOT

TEXT BOOKS:

1. Software Radio: A Modern Approach to Radio Engineering - Jeffrey H. Reed, 2002, PEAPublication.
2. Software Defined Radio: Enabling Technologies- Walter Tuttle Bee, 2002, Wiley Publications.

REFERENCE BOOKS:

1. Software Defined Radio for 3G - Paul Burns, 2002, Artech House.
2. Software Defined Radio: Architectures, Systems and Functions - Markus Dillinger, Kambiz Madani, Nancy Alonistioti, 2003, Wiley.
3. Software Radio Architecture: Object Oriented Approaches to wireless System Engineering –Joseph Mitola, III, 2000, John Wiley & Sons.
4. R.F Microelectronics – B. Razavi, 1998, PHI. 5. DSP – A Computer Based Approach – S. K.Mithra, 1998, McGraw-Hill

POOL-1II (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN12	GLOBAL NAVIGATIONAL SATELLITE SYSTEMS						

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1: Understand global navigational satellite systems
CO2: Understand Indian regional Navigational Satellite System
CO3: Develop GNSS Receiver

SYLLABUS

UNIT I
Introduction, GNSS overview, Global Positioning System, Russian GLONASS system, Galileo satellite system, Chinese BeiDou system, Regional system: Quasi-Zenith Satellite System (QZSS), Navigation with Indian Constellation (NavIC), Augmentations, Markets and Applications.
Fundamentals of satellite Navigation: Concept of Ranging using Time of arrival Measurements: Two-Dimensional Position Determination, Principle of Position Determination via Satellite-Generated Ranging Codes, Fundamentals of satellite orbits: Orbital Mechanics, Constellation Design, Positioning determination using Ranging codes: Determining Satellite-to-User Range,

UNIT II
Global positioning system: overview: Space Segment Overview, Control Segment Overview, User Segment Overview, Space segment description: GPS Satellite Constellation Description, Space Segment Phased Development, Control segment description: OCS Current Configuration, OCS Transition, OCS Planned Upgrades, User segment: GNSS Receiver Characteristics

UNIT III
Navigation with Indian Constellation (NavIC): overview, space segment, NavIC control segment, Geodesy and time system, Navigation services, signals, applications and NavIC user equipment.

UNIT – IV
GNSS Receiver: Acquisition: Single Trial Detector, Tong Search Detector, M of N Search Detector, Combined Tong and M of N Search Detectors, FFT-Based Techniques, Direct Acquisition of GPS Military Signals, Vernier Doppler and Peak Code Search, carrier tracking, code tracking: Carrier Loop Discriminator, sequence of initial receiver operation.

UNIT – V
GNSS errors: Introduction, Measurement errors: satellite clock error, ephemeris error, relative effects, atmospheric effects, receiver noise and resolution, multipath and shadowingeffects, hardware bias errors, Psedorange error budgets.

TEXT BOOKS:

1. Elliott D. Kaplan, Christopher J. Hegarty, Understanding GPS/GNSS Principles and Applications, Third Edition, Artech House Publishers, Boston, 2017

REFERENCE BOOKS:

1. G S Rao, Global Navigational satellite system, Tata McGraw-Hill education privateLtd, New Delhi, 2010
2. ISRO-IRNSS-ICD-SPS-1.1, Bangalore, 2017
3. Bhatta, B., 2010. Global Navigation Satellite Systems: Insights Into GPS, Glonass, Galileo, Compass, and Others, BS Publications, New Delhi.
4. Grewal, M. S., Weill, L. R., Andrews, A. P., 2006. Global Positioning Systems, Inertial Navigation, and Integration, John Wiley & Sons, New York
5. Hofmann-Wellenhof, B., Lichtenegger, H., Wasle, E., 2008. GNSS – GlobalNavigation Satellite Systems, Springer, Verlag Wien.

.

POOL-1II (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	3
Code: R20ECHN13	COGNITIVE RADIO						

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of cognitive radio networks.

CO2: Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.

CO3: Understand technologies to allow an efficient use of TVWS for radio communicationsbased on two spectrum sharing business models/policies.

CO4: Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques forbetter Spectrum exploitation

SYLLABUS

Unit I: Introduction to Cognitive Radios

Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit II: Sensing

Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons,real time secondary spectrum market).

Unit III: Optimization Techniques of Dynamic Spectrum Allocation

Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit IV: Dynamic Spectrum Access and Management

Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit V: Spectrum Trading

Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross- layer design for cognitive radio networks

TEXT BOOKS:

1. Ekram Hossain, DusitNiyato, Zhu Han, “Dynamic Spectrum Access and Managementin Cognitive Radio Networks”, Cambridge University Press,2009.
2. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & Sons Ltd.,2009.

REFERENCE BOOKS:

1. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition,2009.
2. HuseyinArslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer,2007.
3. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer,2009.
4. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press,2009

POOL-1II (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN14	5G COMMUNICATION						

COURSE OUTCOMES:

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

CO1: Learn 5G Technology advances and their benefits

CO2: Learn the key RF, PHY, MAC and air interface changes required to support 5G

CO3: Learn Device to device communication and millimeter wave communication

CO4: Implementation options for 5G

SYLLABUS:

UNIT I

Overview of 5G Broadband Wireless Communications: Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro) , An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.

UNIT II

The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mm Wave MIMO Systems.

UNIT III

Transmission and Design Techniques for 5G: Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-orthogonal multiple accesses (NOMA).

UNIT IV

Device-to-device (D2D) and machine-to-machine (M2M) type communications – Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multi-operator D2D communications

UNIT V

Millimeter-wave Communications – spectrum regulations, deployment scenarios, beam forming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM).

TEXT BOOKS:

1. Martin Sauter "From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell.
2. Afif Osseiran, Jose.F.Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks" , Cambridge University Press.
3. Athanasios G.Kanatos, Konstantina S.Nikita, Panagiotis Mathiopoulos,"New Directions in Wireless Communication Systems from Mobile to 5G", CRC Press.
4. Theodore S.Rappaport, Robert W.Heath, Robert C.Danials, James N.Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications.

REFERENCES:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.
2. Amitabha Ghosh and Rapeepat Ratasuk "Essentials of LTE and LTE-A", Cambridge University Press.

POOL-III (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN15	OPTICAL NETWORKS						

COURSE OUTCOMES:

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

CO1: Recognize and classify the structures of Optical fiber and types**.**

CO2: Discuss the channel impairments like losses and dispersion.

CO3: Analyze various coupling losses.

CO4: Classify the Optical sources and detectors and to discuss their principle.

SYLLABUS:

UNIT I: OPTICAL NETWORKING COMPONENTS

First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers, filters, amplifiers, switches, and wavelength converters.

UNIT II: SONET AND SDH NETWORKS

Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management.

UNIT III: BROADCAST – AND- SELECT NETWORKS

Topologies, Single-hop, Multihop, and Shufflenet multihop networks, Media-Access control protocols, Testbeds.

UNIT IV: WAVELENGTH-ROUTING NETWORKS

Node designs, Issues in Network design and operation, Optical layer cost Tradeoffs, Routing and Wavelength assignment, Wavelength routing test beds.

UNIT V: HIGH CAPACITY NETWORKS

SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test beds.

REFERENCES:

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann, 2nd edition, 2001.
2. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.
3. Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.
4 . Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997.

POOL-4: INSTRUMENTATION AND CONTROL SYSTEMS

Any four of the following subjects which are not chosen earlier are to be considered for Honors Degree

S. No.	Subject	Sub Code	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
1	Adaptive Control Systems	R20ECHN16	3	0	0	30	70	100	3
2	Digital Control Systems	R20ECHN17	3	0	0	30	70	100	3
3	Process Control Instrumentation	R20ECHN18	3	0	0	30	70	100	3
4	Transducers & sensors	R20ECHN19	3	0	0	30	70	100	3
5	Intelligent & Smart Instrumentation	R20ECHN20	3	0	0	30	70	100	3
In addition to any of the 4 subjects, MOOC/NPTEL Courses for 4 Credits (2 Course @ 2 Credits each) are compulsory in the domain of Electronics and Communication Engineering									

POOL-4 (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: 20ECHN16	ADAPTIVE CONTROL SYSTEMS						

COURSE OUTCOMES:

CO1: Design identifiers and adaptive controllers for linear systems
CO2: Design Adaptive feedback linearizing control systems for nonlinear systems
CO3: Apply the concept of different types of optimal control for solving problems
CO4: Apply the concept of calculus of variation and principal of optimality for solving problems
CO5: Apply the concept of Linear Quadratic method for solving problems
CO6: Apply the concept of adaptive control technique for solving problems

SYLLABUS:

UNIT-1: INTRODUCTION

Definitions, History of adaptive Control, Essential aspects of adaptive control, Classification of adaptive control system: Feedback adaptive controllers, Feed forward adaptive controllers, Why adaptive control?

UNIT-2: MODEL REFERENCE ADAPTIVE SYSTEM

Different configuration of model reference adaptive Systems, classification of MRAS, Mathematical description, and Equivalent representation asa nonlinear time-varying system, direct and indirect MRAS.

UNIT-3: ANALYSIS AND DESIGN OF MODEL REFERENCE ADAPTIVE SYSTEMS

Model reference control with local parametric optimization (Gradient method), MIT rule, MRAS for a first order system, MRAS based on Lyapunov stability theory, Design of a first order MRAS based on stability theory, Hyperstability approach, Monopoli's augmented error approach.

UNIT-4: SELF TUNING REGULATORS

Introduction: The basic idea; process models, disturbance models, General linear difference equation models, model simplification, Different approaches to self- tuning, Recursive Parameter Estimation Methods: The RLS method, extended Least squares, Recursive instrumental variable method; U-D factorization, Covariance resulting, variable data forgetting, Estimation accuracy, Direct and Indirect Self-tuning regulators, Clarke and Gawthrop's Self tuning Controller, Pole Placement approach to self-tuning control; Connection between MRAS and STR.

UNIT 5: GAIN SCHEDULING

Introduction, The Principal, Design of Gain Scheduling Regulators, Nonlinear transformations, Applications of gain scheduling Alternatives to Adaptive Control: Why not Adaptive Control? Robust High gain feedback control, Variable Structure schemes, Practical aspects, application and Perspectives on adaptive control.

REFERENCES BOOKS:

1. B Landau, Adaptive Control - The Model Reference Approach, New York; Marcel Dekker, 1979.
2. K. J. Astrom and B. Wittenmark, Adaptive Control, Addison Wesley Publication Company, 1989.
3. B. Roffel, P. J. Vermeer, P. A. Chin, Simulation and Implementation of Self Tuning Controllers, Prentice-Hall, Englewood cliffs, NJ, 1989.
4. R. Isermann, K. Lashmann and D. Marko, Adaptive Control Systems, Printice-Hall International (UK) Ltd. 1992.
5. K. S. Narendra and A. M. Annaswamy, Stable Adaptive Systems

POOL-4 (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN17	DIGITAL CONTROL SYSTEMS						

COURSE OUTCOMES:

CO1: Design a pure, two-pole system that satisfies specified performance specifications like percent overshoot, peak time, settling time, and DC gain.

CO2: Calculate the z-plane location of a pair of dominant poles given time-domain performance information like percent overshoot, settling time, and peak time.

CO3: Create discrete equivalents from given continuous-time systems,

CO4: Able to construct a discrete-time difference equation containing input variables and output variables at particular time instances from a system's discrete-time transfer function.

CO5: Compute the value of any system variable (e.g., state variable or output variable) at any discrete, time instant given initial conditions and input waveforms.

SYLLABUS:

UNIT –I: SAMPLING AND RECONSTRUCTION

Introduction, sample and hold operations, Sampling theorem, Reconstruction of original sampled signal to continuous-time signal.

The Z – Transforms: Introduction, Linear difference equations, pulse response,

Z – transforms, Theorems of Z –Transforms, the inverse Z – transforms, Modified Z- Transforms. Z-Plane Analysis of Discrete-Time Control System: Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane: Primary strips and Complementary Strips.

UNIT –II: STATE SPACE ANALYSIS

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuoustime state – space equations

UNIT –III: CONTROLLABILITY AND OBSERVABILITY

Concepts of Controllability and Observability, Tests for controllability and Observability, Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

Stability Analysis: Stability Analysis of closed loop systems in the Z-Plane, Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion, Stability analysis using Liapunov theorems.

UNIT –IV: DESIGN OF DISCRETE TIME CONTROL SYSTEM BY CONVENTIONAL METHODS

Design of digital control based on the frequency response method – Bilinear Transformation and Design procedure in the W-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.Design digital control through deadbeat response method.

UNIT –V: STATE FEEDBACK CONTROLLERS AND OBSERVERS

Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula, State Observers Full order and Reduced order observers. Introduction to Kalman filters, State estimationthrough Kalman filters, introduction to adaptive controls.

TEXT BOOKS:

1. K. Ogata - "Discrete-Time Control systems" - Pearson Education/PHI, 2nd Edition.
2. M.Gopal - "Digital Control and State Variable Methods"- TMH

REFERENCE BOOKS:

1. Kuo - "Digital Control Systems"- Oxford University Press, 2nd Edition, 2003.
2. M. Gopal - "Digital Control Engineering".

POOL-4 (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN18	PROCESS CONTROL INSTRUMENTATION						

COURSE OUTCOMES:

CO1: Understand the popular process automation technologies.

CO2: Design and development of different PLC programming for simple process applications.

CO3: Understand the different security design approaches, Engineering and operator interface issues for designing Distributed control system.

CO4: Know the latest communication technologies like HART and Field bus protocol.

SYLLABUS:

UNIT-1: P & ID SYMBOLS. PROCESS CHARACTERISTICS

Process load, Process lag, self-regulation. Control system parameters: control lag, dead time, cycling. Discontinuous controller modes: two position, multi position, floating control modes. Continuous controller modes: Mathematical representation and description of P, I, D controller modes. Composite control modes: Mathematical representation and description of PI, PD, PID control modes. Response of control modes to linear, step and square wave error signals.

UNIT-2: ELECTRONIC CONTROLLER MODE IMPLEMENTATION

Designing of P, PI, PD, PID using OP amplifiers.

UNIT-3: PNEUMATIC CONTROLLER MODE IMPLEMENTATION

Implementation of P, PI, PD, PID using flapper nozzle system.

UNIT-4: FINAL CONTROL

Actuators – Electrical & Pneumatic. Control Valves – Quick opening, linear and equal percentage control valves, valve sizing. I to P, P to I converters

UNIT-5: PROGRAMMABLE CONTROLLERS & DIGITAL CONTROLLERS

Programmable controllers: Ladder Diagram, Programmable controller program from the ladder diagram of simple applications. Digital Controllers: Data logging, supervisory control, computer based controller.

TEXT BOOK:

1. Process control Instrumentation Technology by Curtis Johnson, 4th Edition – PHI,Dec, 2000.

REFERENCE BOOKS:

1. Principles of Process control by D. Patranabis- TMH 2 nd Edition, 1996
2. P. Harriott, process control, Tata MoGraw – Hill publishing Co., Ltd., New Delhi,1984.

POOL-4 (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN19	TRANSDUCERS AND SENSORS						

COURSE OUTCOMES:

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

CO1: Use concepts in common methods for converting a physical parameter into an electrical quantity

CO2: Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light

CO3: Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc

CO4: Predict correctly the expected performance of various sensors

CO5: Locate different type of sensors used in real life applications and paraphrase their importance

SYLLABUS:

UNIT – 1: INTRODUCTION

Functional elements of an instrument, generalized performance characteristics of instruments – static characteristics, dynamic characteristics. Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input Experimental determination of measurement system parameters, loading effects under dynamic conditions

UNIT – 2: TRANSDUCERS FOR MOTION AND DIMENSIONAL MEASUREMENTS

Relative displacement, translation and rotational resistive potentiometers, resistance strain gauges, LVDT, synchros, capacitance ickups, Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers. Magnetic and photoelectric pulse counting methods, relative acceleration measurements, seismic acceleration pickups, calibration of vibration pickups. Gyroscopic sensors

UNIT – 3: TRANSDUCERS FOR FORCE MEASUREMENT

Bonded strain guage transducers, Photo-electric transducers, variable reluctance pickup, torque measurement dynamometers. TRANSDUCERS FOR FLOW MEASUREMENT: Hot wire and hot-film anemometers, Electro-magnetic flow meters, laser Doppler velocity meter.

TRANSDUCERS FOR PRESSURE MEASUREMENT: Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers. Thermal conductivity gauges, ionization gauges, microphone.

UNIT – 4: TRANSDUCERS FOR TEMPERATURE MEASUREMENT

Thermal expansion methods, Thermometers (liquid in glass), pressure thermometers, Thermocouples, Materials configuration and techniques. Resistance thermometers, Thermistors, junction semiconductors, Sensors, Radiation methods, Optical pyrometers, Dynamic response of temperature sensors heat flux Sensors, Transducers for liquid level measurement, humidity, silicon and quartz sensors, fiber optic sensors.

UNIT –5: SMART SENSORS

Introduction, primary sensors, converters, compensation. Recent trends in sensor technology – film sensors, semiconductor IC technology, MEMS, Nano-sensors.

TEXT BOOKS:

1. Doebelin, E.O., "Measurement systems – Application and Design", McGraw Hill.
2. D. Patranabis, "Sensors and Transducers", PHI, 2nd Edition.

REFERENCE BOOKS:

1. Instrumentation Measurement & Analysis, by B.C. Nakra, K.K. Choudry, (TMH)
2. Transducers and Instrumentation, by D.V.S. Murthy (PHI)

POOL-4 (HONOR)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	0	30	70	100	4
Code: R20ECHN20	INTELLIGENT AND SMART INSTRUMENTATION						

COURSE OUTCOMES:

CO1: To develop the design methodologies for measurement and instrumentation of real world problems.

CO2: To be study the concepts of intelligent sensor devices, their performance characteristics and signaland system dynamics.

CO3: To address the issues in dealing signal conditioning operations such as calibration, linearizationand compensation

CO4: To use artificial intelligence in sensor signal processing to solve real world problems

CO5: To deal with interfacing protocols in wireless networking platform.

SYLABUS:

UNIT I: INTRODUCTION

Definition of intelligent instrumentation, types of instruments, Static Characteristics: Accuracy and Precision, Error, Correction, and Uncertainty, Repeatability, Reproducibility, and Hysteresis, Sensitivity, Offset, and Dead Band, Resolution and Linearity, Statistical Characteristics, Error Modeling, Dynamic Characteristics, Dynamic Error and Dynamic Sensitivity, Input-Output Impedances, Historical Perspective, Current status, software based instruments.

UNIT II: INTELLIGENT SENSORS

Classification, Smart sensors , Cogent Sensors, Soft or Virtual sensors, Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating IntelligentSensors, Pressure Sensor, Indirect Sensing

UNIT III: LINEARIZATION, CALIBRATION, AND COMPENSATION

Analog Linearization of Positive and Negative Coefficient Resistive Sensors, Higher-Order Linearization, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Artificial Neural Network–Based Linearization, Nonlinear Adaptive Filter–Based Linearization, Sensor Calibration, Conventional Calibration Circuits,Offset Compensation, Error and Drift Compensation, Lead Wire Compensation.

UNIT IV: SENSORS WITH ARTIFICIAL INTELLIGENCE

Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors

UNIT V: INTELLIGENT SENSOR STANDARDS AND PROTOCOLS:

IEEE 1451 Standard, STIM, TEDS, NCAP, Network Technologies, LonTalk, CEBUS, J1850Bus, 1 Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol

TEXT BOOKS:

1. Manabendra Bhuyan, ―Intelligent Instrumentation: Principles and Applications‖ CRC Press, 2011.
2. G. C. Barney, ―Intelligent Instrumentation‖, Prentice Hall, 1995.
3. J.B Dixit, A. Yadav, Laxmi Publications, Ltd., 01-Sep-2011.


NEC
NARASARAOPETA
ENGINEERING COLLEGE
(AUTONOMOUS)