Bapatla Engineering College :: Bapatla

(An Autonomous Institution & Affiliated to Acharya Nagarjuna University)

Sponsored by Bapatla Education Society

Bapatla – 522102, Bapatla District,

Andhra Pradesh, India.

R 20-Scheme & Syllabus

(w.e.f. A.Y. 2020-2021)

4 Year B.Tech Program
of
Electronics and Communication Engineering

www.becbapatla.ac.in

BAPATLA ENGINEERING COLLEGE :: BAPATLA

(Autonomous)

Vision

- To build centers of excellence, impart high quality education and instill high standards of ethics and professionalism through strategic efforts of our dedicated staff, which allows the college to effectively adapt to the ever changing aspects of education.

- To empower the faculty and students with the knowledge, skills and innovative thinking to facilitate discovery in numerous existing and yet to be discovered fields of engineering, technology and interdisciplinary endeavors.

Mission

- Our Mission is to impart the quality education at par with global standards to the students from all over India and in particular those from the local and rural areas.

- We continuously try to maintain high standards so as to make them technologically competent and ethically strong individuals who shall be able to improve the quality of life and economy of our country.

BAPATLA ENGINEERING COLLEGE :: BAPATLA

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Vision

- To produce globally competitive and socially responsible Electronics and Communication Engineering graduates to cater the ever changing needs of the society.

Mission

- To provide quality education in the domain of Electronics and Communication Engineering with advanced pedagogical methods.
- To provide self-learning capabilities to enhance employability and entrepreneurial skills and to inculcate human values and ethics to make learners sensitive towards societal issues.
- To excel in the research and development activities related to Electronics and Communication Engineering.

BAPATLA ENGINEERING COLLEGE :: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Program Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Program Specific Outcomes (PSO)

A graduate of the Electronics and Communication Engineering Program will be able to:

PSO-1: Develop and implement modern Electronic Technologies using analytical methods to meet current as well as future industrial and societal needs.

PSO-2: Analyze and develop VLSI, IoT and Embedded Systems for desired specifications to solve real world complex problems.

PSO-3: Apply machine learning and deep learning techniques in communication and signal processing

Program Educational Objectives (PEO)

PEO-I: Equip Graduates with a robust foundation in mathematics, science and Engineering Principles, enabling them to excel in research and higher education in Electronics and Communication Engineering and related fields.

PEO-II: Impart analytic and thinking skills in students to develop initiatives and innovative ideas for Start-ups, Industry and societal requirements.

PEO-III: Instill interpersonal skills, teamwork ability, communication skills, leadership, and a sense of social, ethical, and legal duties in order to promote lifelong learning and Professional growth of the students.

Academic Rules & Regulations (R20 Regulations)
Regulations for Four Year Bachelor of Technology (B.Tech) Degree Program for the Batches admitted from the academic year 2020-21 (Academic Regulations as amended in November 2021)

1. Award of B.Tech. Degree

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

i. Pursues a course of study for not less than four academic years and in not more than eight academic years. However, for the students availing Gap year facility, this period shall be extended by two years at the most and these two years would not be counted in the maximum time permitted for graduation. A lateral entry student pursues a course of study for not less than three academic years and in not more than six academic years.

ii. Registers for 160 credits and secures all 160 credits. However, a lateral entry student registers for 121 credits and secures all the 121 credits from III semester to VIII semester of Regular B. Tech. program.

iii. The student will be eligible to get Under graduate degree with Honors or additional minor engineering if he/she completes an additional 20 credits.

iv. A student will be permitted to register either for Honors degree or additional minor engineering but not both.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. A lateral entry student should complete the course within six academic years from the year of their admission, failing which his/her admission in B.Tech course stands cancelled.

3. Courses of study

The following courses of study are offered at present as specializations for the B. Tech. course.

S.No.	Title of the UG Programmed	Abbreviation
1.	Civil Engineering	CE
2.	Computer Science & Engineering	CS
3.	Electrical & Electronics Engineering	EE
4.	Electronics & Communication Engineering	EC
5.	Electronics & Instrumentation Engineering	EI
6.	Information Technology	IT

7.	Mechanical Engineering	ME
8.	Cyber Security	CS
9.	Data Science	DS
10.	CSE (Artificial Intelligence & Machine Learning	CM

4. Credits:

i. *Credit:* A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture) or two hours of practical work/field work per week.

ii. *Academic Year:* Two consecutive (one odd + one even) semesters constitute one academic year.

iii. *Choice Based Credit System (CBCS):* The CBCS provides choice for students to select from the prescribed courses.

iv. Each course in a semester is assigned certain number of credits based on following:

Description	**Hours/Week**	**Credits**
Theory	03	03
Tutorial	01	01
Practical	03	1.5
Internship (At the end of IV & VI evaluated in V & VII resp.)	-	1.5/3.0
Project Work	24	12

5. Course Structure

Every course of the B.Tech program will be placed in one of the 8 categories with suggested credits as listed below.

S.No	**Category**	**Category Description**	**Abbreviation**	**Credits**
1	Humanities and social science	Humanities and social science including Management courses	HS	10.5
2	Basic Sciences	Basic Science courses	BS	21
3	Engineering	Engineering Science Courses	EC	24

	Science courses	including workshop, drawing, basics of electrical / mechanical/ Computer etc.		
4	Professional core	Professional core Courses	PC	51
5	Job Oriented /Open Electives	Emerging and job oriented/ Open Elective Courses- from other technical	JO/OE	12
6	Professional Courses	Professional Elective Courses relevant to chosen specialization/ branch	PE	18
7	Project Work & Internship	Project Work, Seminar, Internship in industry elsewhere	PW/INT	16.5
8	Mandatory courses	Environmental Studies, Induction training, Universal human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge (Non- Credit)	MC	0
9	Skill Oriented Courses	Skill Oriented Courses relevant to domain, interdisciplinary, communication skill, industry	SO	10
Total Credits				160

6. Weightage for Course Evaluation

6.1 Course Pattern

1. The entire course of study is for four academic years. Semester pattern shall be followed in all years.
2. A student eligible to appear for the end examination in a subject, but absent or has

   failed in the end examination may appear for that subject at the next supplementary examination when offered.
3. When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

6.2 Evaluation Process

The performance of the students in each semester shall be assessed course wise. All assessments will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate, letter grades and grade points will be awarded.

The performance of a student in each course is assessed with alternate assessment

methods, term examinations on a continuous basis during the semester called Continuous Internal Evaluation (CIE) and a Semester End Examination (SEE) conducted at the end of the semester. For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester, except where stated otherwise in the detailed Scheme of Instruction.

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition, Internships carried out after IV Semester & VI Semester shall be evaluated for 100 marks each and the Internship along with Project Work carried out in VIII Semester shall be evaluated for 100 marks. For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. For practical subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination. For project work, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination / Viva-Voce. The distribution of marks between Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) to be conducted at the end of the semester will be as follows:

Nature of the Course	CIE	SEE
Theory subjects	30	70
Practical	30	70
Summer / Industrial / Research Internship	-	100
Project Work	30	70

6.3 Continuous Internal Evaluation (CIE) in Theory subjects:

6.3.1 In each Semester there shall be two Term examinations and some ***Alternate Assessment Tools (AAT)*** like Home Assignment, Class Test, Problem Solving, Group Discussion, Quiz, Seminar and Field Study in every theory course. The Alternate Assessment Tools with detailed modality of evaluation for each course shall be finalized by the teacher concerned before beginning of the course. It will be reviewed and approved by the Department Committee.

Particulars	Term Exams (Max. 20 marks)	AAT (Max. 10 marks)
Better Performed exam	75% of obtained marks	Continuous assessment by teacher as per the predetermined course delivery & assessment plan. (Minimum two & maximum four assessments). AAT marks shall be considered based on average of all tests conducted.
Other exam	25% of obtained marks	

The Term Examination is conducted in the regular mode according to a schedule

which will be common for a particular year of study. The maximum weightage for Term Examinations, AATs and the calculation of marks for CIE in a theory course is given in the following Table.

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that course and eligible to write the Semester End Examination (SEE) of that course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

6.3.2 Make up Test:

a) A student can appear for a Make-up Test for **maximum two theory subjects** of a semester to improve marks in the Continuous Internal Evaluation (CIE).
b) A student is eligible for **Make-up test** which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.
   i) Unable to secure 50% internal marks (CIE) and has more than or equal to 50% attendance in a particular theory subject (After finalizing the internal marks).
   ii) Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or greater than 50% marks in the I Mid Term Examination and AAT 1 together.
   iii) Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).
c) The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 15 only.

6.3.3 Semester End Examination (SEE) in Theory and Design Course:

a) For each theory, design and/or drawing course, there shall be a comprehensive Semester End Examination (SEE) of three hours duration at the end of each Semester for 70 marks, except where stated otherwise in the detailed Scheme of Instruction. Question paper setting shall be set by the teacher or teachers together in a multi section courses and to be verified as described in policy document.

b) A minimum of 25 marks are to be secured exclusively in the Semester End Examination (SEE) of theory, design and/or drawing course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.4 Continuous Internal Evaluation (CIE) in laboratory courses:

The evaluation for Laboratory course is based on CIE and SEE. The CIE for 30 marks comprises of 15 marks for day to day laboratory work, 5 marks for record

submission and 10 marks for a laboratory examination at the end of the semester. In any semester, a minimum of 90% of prescribed number of experiments / exercises specified in the Syllabi for laboratory course shall be taken up by the students. They shall complete these experiments / exercises in all respects and get the record certified by the internal lab teacher concerned and the Head of the Department concerned to be eligible to appear for the Final Examination in that laboratory course.

A minimum of 15 (50%) marks are to be secured exclusively in the Continuous Internal Evaluation (CIE) in order to be declared as qualified in that lab course and eligible to write the SEE of that lab course. If a student fails to obtain 15 marks in CIE, he can register for the course repetition as per the guidelines mentioned in 6.5.

6.3.5 Semester End Examination (SEE) in laboratory courses:

a) For each laboratory course, the Semester End Examination (SEE) shall be conducted by one internal and one external examiner appointed by the Principal and the duration of the exam shall be for three hours. The SEE is for 70 marks which include 15 marks for write up, 35 marks for lab experiment/exercise, 15 marks for Viva-voce and 5 marks for general impression.

b) A minimum of 25 marks are to be secured exclusively in the Semester End Examination (SEE) of laboratory course. However a minimum 40 marks are to be secured in CIE & SEE together for the award of the grade and securing the credits in that course.

6.3.6 Evaluation of Summer Internship and Industrial/Research Internship:

a) Summer Internship at the end of IV semester and Industrial/Research Internship at the end of VI carried out in industry are to be evaluated in V & VII semesters respectively based report and certificate provided by the industry. The report and certificate will be evaluated by the department committee for 100 marks. 50 marks shall be for the report and certificate and 50 marks based on seminars/presentation to the department committee by the student.

b) A minimum of 40 (40%) marks are to be secured exclusively to be declared as passed and securing the credits in the internships.

6.3.7 Evaluation of the Project

a) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.

b) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.

c) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.

6.4 There shall be mandatory courses with zero credits. There shall be no external examination. However, attendance in the mandatory course shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates every six months/semester at a mutually convenient date of college/student satisfying the conditions mentioned in item 1 & 2 of the regulations.

6.5 Course Repetition (Repeater course)

The students not qualified to write SEE in a course may register for the repeater courses through course repetition and summer semester. The students have to apply to the Principal through the respective HOD by paying prescribed fees.

Course repetition: A student can take up a maximum of two theory courses in a semester immediately after the semester end examinations of that particular semester in accordance with the guidelines recommended by the Academic Council. The students who are not taking regular semester courses may additionally register for one more theory course.

The documents for monitoring the candidates registered for course repetition are available with the Heads of the Departments and Exam Section.

6.6 There shall be five Professional Elective Courses from V Semester to VII and for each elective there shall be choices such that the student shall choose a course from the list of choice courses offered by the department for that particular elective.

6.7 There shall be three Job Oriented elective Courses in all programs from V to VII semester. One Open Elective course in VII semester will be offered by various departments. The student shall register for open elective in the VII semester offered by other departments in such a manner that he/she has not studied the same course in any form during the Program. The students shall be permitted to pursue up to a maximum of two elective courses (either Professional Elective Courses in clause 6.6 or Open Electives/ Job Oriented Courses in clause 6.7) under MOOCs (Massive Open Online Courses) offered by NPTEL and other reputed organizations as notified by the Department during the semester. Each of the Courses must be of minimum 8/12 weeks in duration. The student has to acquire a certificate for the concerned course from the agency during the semester only in order to earn the

credits for that course. For further details and guidelines, the students can visit the college website.

6.8 There shall be a mandatory **induction program** for three weeks before the commencement of first semester.

6.9 **Minor in a discipline** (Minor degree/program) concept is introduced in the curriculum for all conventional B. Tech programs in which it offers a major. The main objective of Minor in a discipline is to provide additional learning opportunities for academically motivated students and it is an optional feature of the B. Tech. program.

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

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

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

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

d. There shall be no limit on the number of programs offered under Minor. The University/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.

e. 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.

f. A student shall be permitted to register for Minor program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of **8.0 SGPA** in each semester up to 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 Minor Program stands cancelled and he/she shall continue with the regular Program. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minor registration

active

g. 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).

h. 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 Program.

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

j. Student can opt for the industry relevant minor specialization as approved by the concerned departmental BOS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

k. A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BOS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

l. 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.

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

n. 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.

o. Minimum enrollment for a Minor course to be offered is 12.

6.10 Honors degree in a discipline:

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

a. 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** in each semester up to 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 Program stands cancelled and he/she shall continue with the regular Program. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Honors registration active.

b. 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.

c. In addition to fulfilling all the requisites of a Regular B.Tech Program, 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).

d. 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 Board of studies.

e. 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.

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

g. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BOS shall explore the possibility of introducing virtual labs for such courses with lab component. (Model pool list is enclosed in the Annexure-2).

h. 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 BOS with grading or marks or pass/fail in order to earn

credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the BOS/academic council.

i. 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 Program.

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

k. In case a student fails to meet the CGPA requirement for 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.

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

6.11 National Service Scheme (NSS)/Yoga is compulsory for all the Undergraduate students. The student participation shall be for a minimum period of 45 hours during the first year. Grades will be awarded as Very Good, Good, Satisfactory in the mark sheet on the basis of participation, attendance, performance and behaviour. If a student gets Un-satisfactory grade, he/she has to repeat the above activity in the subsequent years along with the next year students.

6.12 Students shall undergo two summer internships each for a minimum of six weeks duration at the end of second and third years of the program for 1.5 credits & 3 credits respectively. The organization in which the student wishes to carry out Internship need to be approved by Internal Department Committee comprising Head of Department and two senior faculty members. The student shall submit a detailed technical report along with internship certificate from the Internship organization in order to obtain the prescribed credits. The student shall submit the Internship Report along with Certificate of Internship. The evaluation of the first and second summer internships shall be conducted at the end of the V Semester & VII semester respectively.

6.13 There shall be internal evaluation for 100 marks and there shall not be external evaluation. The Internal Evaluation shall be made by the departmental committee (Head of the Department and two senior faculty of the department) on the basis of the internship report submitted by the student.

Completion of the internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship in the subsequent summer provided that the student doesn't pursue two summer internships in the same summer.

Community Service Project focussing on specific local issues shall be an alternative to the six weeks of summer Internship, whenever there is any emergency and when students cannot pursue their summer internships. The Community Service Project shall be for 6 weeks in duration which includes preliminary survey for 1 week, community awareness programs for one week, community immersion program in consonance with Government agencies for 3 weeks and a community exit report (a detailed report) for one week. The community service project shall be evaluated for 100 marks by the internal departmental committee comprising Head of the Department and two senior faculty of the department. **However, the first priority shall be given to the internship.**

6.14 There shall also be a mandatory full internship in the final semester (VIII Semester) of the Program along with the project work. The organization in which the student wishes to carry out the Internship need to be approved by Internal Department Committee comprising Head of the Department and two senior faculty. The faculty of the respective department monitors the student internship program along with project work. At the end of the semester, the candidate shall submit a certificate of internship and a project report. The project report and presentation shall be internally evaluated for 30 marks by the departmental project work committee. The Viva-Voce shall be conducted for 70 marks by a Project work committee and an External Examiner.

Completion of internship is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such a case, the student shall repeat the internship along with project work for next six months.

6.15 There shall be five skill-oriented courses offered during III semester to VII semester. Out of the five skill courses, two shall be skill-oriented programs related to the domain and these two shall be completed in second year. Of the remaining three skill courses, one shall 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 student can choose between a skill advanced course being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies which are duly approved by the Internal Department Committee. The credits assigned to the skill advanced course shall be awarded to the student upon producing the Course Completion Certificate from the agencies / professional bodies.

The Internal Department Committee comprising Head of Department and two senior faculty shall evaluate the grades / marks awarded for a course by external agencies and convert to the equivalent marks / grades.

7. Attendance Requirements:

- A student shall be eligible to appear for semester end examinations (SEE), if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

- Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical ground

duly approved by the principal.

- Shortage of Attendance below 65% in aggregate shall in NO case be condoned.
- Further the student must obtain a minimum of 50% attendance in each subject failing which; the student shall not be permitted to write the SEE of that subject. Student has to register this subject through course repetition and satisfy the CIE qualification criteria of attendance and marks in the subsequent semesters.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.
- A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester when offered next.
- A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

8. Minimum Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.7.

8.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project, if he/she secures not less than 15 marks in CIE and 25 marks in SEE. In case of, internships, project work viva – voce, he/she should secure 40% of the total marks. For mandatory courses minimum 15 marks in CIE are to be secured.

8.2 B.Tech students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

- One regular and two supplementary examinations of I Semester.
- One regular and one supplementary examination of II Semester.
- One regular examination of III semester.

Lateral Entry students: A student shall be promoted from II to III year only if he/she fulfils the academic requirement of securing 40% of the credits in the subjects that have been studied up to III Semester from the following examinations.

- One regular examination of III semester.

8.3 B.Tech students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

- ✓ One regular and four supplementary examinations of I Semester.

- ✓ One regular and three supplementary examinations of II Semester.
- ✓ One regular and two supplementary examinations of III Semester.
- ✓ One regular and one supplementary examinations of IV Semester.
- ✓ One regular examination of V Semester.

Lateral entry students: A student shall be promoted from III year to IV year only if he/she fulfils the academic requirements of securing 40% of the credits in the subjects that have been studied up to V semester from the following examinations, irrespective of whether the candidate takes the end examination or not as per the normal course of study.

- ✓ One regular and two supplementary examinations of III Semester.
- ✓ One regular and one supplementary examinations of IV Semester.
- ✓ One regular examination of V Semester.

If a student is detained for want of credits for particular academic year by sections 8.2 and 8.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V Semester or VII Semester as the case may be.

8.4 A student shall register and put up minimum attendance in all 160 credits and earn all the 160 credits. Marks obtained in all 160 credits shall be considered for the calculation of aggregate percentage of marks obtained. In case of lateral entry students, the number of credits is 121.

8.4.1 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.
Lateral entry students who fail to earn 121 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

9. Course Pattern:

(i) A student eligible to appear for the end examination in a subject, but absent or has failed in the end examination may appear for that subject at the next supplementary examination when offered.
When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

(ii) **With–holding of Results**
If any case of indiscipline or malpractice is pending against candidate, the result of the candidate shall be with held and he/she will not be allowed/promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

(iii) **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.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade Points Assigned
≥ 90	S (Superior)	10
80-89	A (Excellent)	9
70-79	B (Very Good)	8
60-69	C (Good)	7
50-59	D (Average)	6
40-49	E (Below Average)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered. Same is the case with a student who obtains 'Ab' in end examination.

For **mandatory** courses "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

10. 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.,

$$SGPA = \frac{\sum_{i=1}^{n} C_i \times GP_i}{\sum_{i=1}^{n} C_i}$$

where, C_i is the number of credits of the i^{th} subject and GP_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.,

$$SGPA = \frac{\sum_{j=1}^{m} SGPA_j \times TC_j}{\sum_{j=1}^{m} TC_j}$$

where "SGPAj" is the SGPA of the j^{th} semester and TCj 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) While computing the SGPA, the subjects in which the student is awarded Zero grade points will also be included.

(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 S, A, B, C, D, E and F.

11. 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 four classes.

Class Awarded	**CGPA Secured**
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

12. 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 II year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted by the College to evaluate the proposal submitted by the student and the committee shall decide whether or not to permit the student(s) to avail the Gap Year.

13. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, and they will be in the academic regulations into which they get readmitted.

Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B.Tech from the date of commencement of class work, and they will be in the academic regulations into which the candidate is presently re-joining.

14. Minimum Instruction Days

The minimum instruction days including exams for each semester shall be 90 days.

15. Medium of Instruction

The Medium of Instruction is **English** for all courses, laboratories, internal and external examinations and project reports.

16. Rules of Discipline

(i) Use of mobile phones with camera, in the campus is strictly prohibited.

(ii) Students shall behave and conduct themselves in a dignified and courteous manner in the campus/Hostels.

(iii) Students shall not bring outsiders to the institution or hostels.

(iv) Students shall not steal, deface, damage or cause any loss to the institution property.

(v) Students shall not collect money either by request or coercion from others within the campus or hostels.

(vi) Students shall not resort to plagiarism of any nature/extent. Use of material, ideas, figures, code or data without appropriate acknowledgement or permission of the original source shall be treated as cases of plagiarism. Submission of material, verbatim or paraphrased, that is authored by another person or published earlier by oneself shall also be considered as cases of plagiarism.

(vii) Use of vehicles by the students inside the campus is prohibited.

(viii) Any conduct which leads to lowering of the esteem of the organization is prohibited.

(ix) Any material to be uploaded to social media sites need to be approved by Head of the Department concerned/Dean/Principal.

(x) Any student exhibiting prohibited behaviour shall be suspended from the institute. The period of suspension and punishment shall be clearly communicated to the student. The student shall lose the attendance for the suspended period.

(xi) Dress Code

Boys: All the boy students should wear formal dresses. Wearing T-shirts and

other informal dresses in the campus is strictly prohibited.

Girls: All the girls students shall wear saree / chudidhar with dupatta.

17. Punishments for Malpractice cases – Guidelines

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc; during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

S.No.	Nature of Malpractice/Improper conduct	Punishment
1.	possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cellphones, pager, palm computers or any other form of material concerned with or related to the course 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 student which can be used as an aid in the course of the examination).	Expulsion from the examination hall and cancellation of the performance in that course only.
2.	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 course
3.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
4.	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the students involved. In case of an outsider, he will be handed over to the police and a case shall be registered against him.
5.	Has copied in the examination hall from	Expulsion from the examination hall

	any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the student is appearing.	and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
6.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year.
7.	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeit of seat.
8.	Refuses to obey the orders of the Chief 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 other act which in the opinion of the officer on duty amounts to use of unfair	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case shall be registered against them.

	means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
9.	Leaves the exam hall taking away answer script or intentionally tears up the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.
11.	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 S.No7 to S.No 9.	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that course and all other courses including practical examinations and project work 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 shall be registered against them.
12.	Impersonates any other student in connection with the examination	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college for one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case shall be registered against him. The performance of the original student

		who has been impersonated, shall be cancelled in all the courses of the examination including practical's and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
13.	If any malpractice is detected which is not covered in the above S.No 1 to S.No 12 items, it shall be reported to the college academic council for further action and award suitable punishment.	
14.	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.	

18. ADDITIONAL ACADEMIC REGULATIONS:

(i) Any attempt to impress upon the teachers, examiners, faculty and staff of Examinations, bribing for either marks or attendance will be treated as malpractice.

(ii) When a component of Continuous Internal Evaluation (CIE) or Semester End Examination (SEE) is cancelled as a penalty, he/she is awarded zero marks in that component.

19. AMENDMENTS TO REGULATIONS:

The Academic Council of Bapatla Engineering College (Autonomous) reserves the right to revise, amend, change or nullify the Regulations, Schemes of Examinations and / or Syllabi, Academic schedules, Examination schedules, Examination pattern, Moderation to students, Special opportunity to complete degree beyond stipulated time and any other matter pertained that meets to the needs of the students, society and industry without any notice and the decision is final.

Discipline and Code of Conduct for Students

The following are some of the important rules of discipline. All students are required to be aware of and act consistently with these values.

1. Students must punctually attend all lectures, practicals, tutorials, assignments, tests, examinations, etc. A student whose attendance and/or progress in the various tests and examinations are not satisfactory and who does not perform the required number of assignments, tutorials and/or practicals are likely to lose their terms. Prolonged absence even on ground of ill health may also lead to loss of terms. Defaulters will not be sent up for Final /University Examinations.
2. The identity card is meant for identifying bonafide students and is used for permitting the students to participate in various activities and programs of the college. Every student must wear Identity card as long as he/she is in the college campus. It must be produced by the student whenever demanded by the member of the teaching or non-teaching staff of the college. Every student must wear his/her Identity card in the college every day. He/She must take proper care of it to avoid its misuse by other students and outsiders. In case the Identity card is lost, the matter should be immediately reported to the Principal and an application should be made for a duplicate Identity card, which will be issued on payment of charges.
3. The conduct of the students in the classes and in the premises of the college shall be such as will cause no disturbance to teachers, fellow students or other classes.
4. Every student shall wear a clean formal dress while coming to the college also when representing the college for various activities out station.
5. No Society or Association shall be formed in the College and no person should be invited in the college campus without the specific permission of the Principal.
6. No student is allowed to display any Notice/Circular/Poster/Banner in the College premises without the prior permission of the Principal.
7. Using foul languagein the college campus is prohibited. If any student is caught using foul language, disciplinary action shall be initiated against the student.
8. Use of **BEC name tag or logo** by the students for their caste, political, religious, personal reasons is prohibited. Further placing banners on caste, political, religious, personal reasons, promoting cinema heroes & political leaders, taking possessions and burning fire crackersin front of the collegeis strictly prohibited. If any student is involved in such activities in and around the campus, severe disciplinary action will be taken including rusticating from the college and filing a criminal case.

9. Outsiders are not permitted in the college premises without the prior permission of the Principal. College students are not allowed to bring their relatives/friends to the college premises without the permission of the principal.
10. All meetings, cultural programs, debates, elocutions etc. organized on the college premises must be held in presence of teaching staff members and with the prior permission of the Principal. The subjects of debates/elocutions must have the prior approval of the principal.
11. Conducting fresher's meet, farewell meets etc. by the students outside the campus are prohibited. If any student is involved in such activities (organizing as well as participating), severe disciplinary action will be taken including rusticating from the college.
12. Students must take proper care of the college property. Strict action will be taken against students damaging College property and will be required to compensate the damage.
13. Students should not be involved in academic offences including cheating or plagiarism in academic course work malpractices at the College/Board/University Examinations
14. Smoking is strictly prohibited in the college premises.
15. If, for any reason, the continuance of a student in the College is found detrimental to the best interest of the college, the Management may ask the student to leave the college without assigning any reasons and the decision will be final and binding on the student.
16. Playing music on Transistors, Tape-Recorders, Car Stereos, Mobile phones or any other similar gadgets with or without earphones is strictly prohibited in the college premises. Defaulters will be punished and their instrument shall be confiscated.
17. Use of Mobile phones is strictly prohibited in the academic area of the college, Defaulters will be penalized and their instrument confiscated.
18. Students who are travelling to college on personal vehicles (2/4 wheelers) need to have valid driving license issued by RTO and follow all the rules listed by RTO. Students have to park the vehicle in the parking area of the college.
19. Students must not hang around in the college premises while the classes are at work.
20. Students must not attend classes other than their own without the permission of the authority concerned.
21. Students shall do nothing inside or outside the college that will interface with the discipline of the college or tarnish the image of the college.
22. Students are not allowed to communicate any information about college matters to

Press.

23. Matters not covered above will be decided at the discretion of the Principal.

Acts of misbehavior, misconduct, indiscipline or violation of the Rules of Discipline mentioned above liable for one more punishments as stated below:

A. Warning to the students.
B. Warning to the student as well as inform the parents.
C. Imposition of a fine.
D. Denial of gymkhana, library, laboratory, N.C.C., N.S.S. student aid or any other facility for a specified period or for the whole Term/Year.
E. Expulsion from College for a specified period
F. Cancellation of Terms.
G. Refusal of admission in the term or academic year.
H. Cancellation of admission.
I. Rustication.

Anti Ragging Rules and Regulations (As per AICTE Norms)

What constitutes Ragging: - Ragging constitutes one or more of any of the following acts:

a. Any conduct by any student or students whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness a fresher or any other student.
b. Indulging in rowdy or undisciplined activities by any student or students which causes or is likely to cause annoyance, hardship, physical or psychological harm or to raise fear or apprehension thereof in any fresher or any other student.
c. Asking any student to do any act which such student will not in the ordinary course do and which has the effect of causing or generating a sense of shame, or torment or embarrassment so as to adversely affect the physique or psyche of such fresher or any other student.
d. Any act by a senior student that prevents, disrupts or disturbs the regular academic activity of any other student or a fresher.
e. Exploiting the services of a fresher or any other student for completing the academic tasks assigned to an individual or a group of students.
f. Any act of financial extortion or forceful expenditure burden put on a fresher or any other student by students.
g. Any act of physical abuse including all variants of it: sexual abuse, homosexual assaults, stripping, forcing obscene and lewd acts, gestures, causing bodily harm or any other danger to health or person.
h. Any act or abuse by spoken words, emails, posts, public insults which would also include deriving perverted pleasure, vicarious or sadistic thrill from actively or passively participating in the discomfiture to fresher or any other student.
i. Any act that affects the mental health and self-confidence of a fresher or any other student with or without an intent to derive a sadistic pleasure or showing off power, authority or superiority by a student over any fresher or any other student.

1. Actions to be taken against students for indulging and abetting ragging in technical institutions Universities including Deemed to be University imparting technical education:

a) The punishment to be meted out to the persons indulged in ragging has to be exemplary and justifiably harsh to act as a deterrent against recurrence of such incidents.
b) Every single incident of ragging a First Information Report (FIR) must be filed without exception by the institutional authorities with the local police authorities.
c) The Anti-Ragging Committee of the institution shall take an appropriate decision, with regard to punishment or otherwise, depending on the facts of each incident of ragging and nature and gravity of the incident of ragging.
d) Depending upon the nature and gravity of the offence as established the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:-
    (i) Cancellation of admission

(ii) Suspension from attending classes
(iii) Withholding/withdrawing scholarship/fellowship and other benefits
(iv) Debarring from appearing in any test/examination or other evaluation process
(v) Withholding results
(vi) Debarring from representing the institution in any regional, national or international meet, tournament, youth festival, etc.
(vii) Suspension/expulsion from the hostel
(viii) Rustication from the institution for period ranging from 1 to 4 semesters
(ix) Expulsion from the institution and consequent debarring from admission to any other institution.
(x) Collective punishment: when the persons committing or abetting the crime of ragging are not identified, the institution shall resort to collective punishment as a deterrent to ensure community pressure on the potential raggers.

Guidelines for Remedial Classes and Make-up Test (R20 Regulations) The guidelines for conducting the remedial classes:

a) Faculty need to identify the underperforming students in their respective subject. An underperforming student is one, whose marks less than 50% in the I Mid Term Examination and AAT 1 together. A list of such students should be prepared by the faculty soon after the I Mid Term examination is over and get it signed by the concerned HOD.
b) Faculty should conduct remedial classes for the underperforming students with an objective of improving their marks in the CIE. Minimum number of remedial classes to be taken should be 20% of the classes taken prior the I Mid Term Examination which is 6 classes. Teaching methodology is left to the faculty member, but he/she should keep the objective in mind.
c) Regular students who could not appear for the I Mid Term Examination and AAT (with genuine reason) should appear to the remedial classes with the prior permission of the HOD.
d) The entire process of conduct of remedial classes should be well documented and is subjected to academic audit.

The guidelines for conducting the Make-up test:

e) A student can appear for a Make-up Test for **maximum two theory subjects** of a semester to improve marks in the Continuous Internal Evaluation (CIE).
f) A student is eligible for **Make-up test** which is conducted after the second Mid Term examination and before SEE examination if he/she satisfies the following conditions.

iv)Unable to secure 50% internal marks (CIE) and has more than or equal to

i) 50% attendance in a particular theory subject (After finalizing the internal marks).

Attendance in Remedial classes is more than or equal to 65% (if Remedial classes are conducted) or greater than 50% marks in the I Mid Term Examination and AAT 1 together.

ii) Attended 50% of CIE tests (at least one AAT & one Mid Term Examinations).

g) The make-up test will be conducted for 30 marks (6 X 1M, 2X 12M) in Mid Examination format covering the entire syllabus and the marks obtained in this test are final. However, the maximum marks awarded will be 15 only.

h) The eligible students have to apply by paying a fee prescribed by the institution and submit the application along with a letter of request indicating the genuineness of his/her candidature to be eligible for the make-up test. Applications should be approved by the concerned HOD. After approval from the HOD the concerned department will conduct the make-up test and send the updated CIE marks to COE immediately.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

APPLICATION FOR MAKE-UP TEST

Date:

1. Name of the Candidate :
2. Register Number :
3. Academic Year :
3. Branch :
4. Year & Semester of Study :
5. Student Mobile No. :

Make-up test Applied For:

S.No.	Sub Code	Subject Title	% of Subject Attendance in Regular	CIE Marks				(To be filled by the concerned subjec	
				AAT - 1	Mid-1	AAT - 2	Mid-2	% Attendance in Remedial Classes*	Signature
01									
02									

***** Write 'NA' if the student name is not in the remedial class list.

Signature of the Student Signature of the HOD

Fee Particulars:

The make-up test fee has to be paid through HDFC payment gateway and a printout of the receipt has to be taken. The student has to submit the office copy of the receipt in the COE office, get the signature and has to submit the signed application form along with student copy of the receipt in the department.

Amount paid in Rs	Date of payment	Signature of Exam Section Clerk

Note:

1. As per the "Make-up test guidelines", the eligible students have to fill this form, with the signature of the concerned subject faculty and the HOD.

2. After making the payment, the filled form along with a photocopy of the payment receipt has to be submitted in the department.
3. The make-up test will be scheduled and conducted by the department.

Guidelines for Internships

As per R20 guidelines, every student has to undergo internship twice, once between IV and V semester, the other between VI and VII Semester. The first internship is for a duration of 4 weeks and the second internship is for a duration of 6 weeks.

There shall be a departmental internship committee consisting of the Head of the Department and two faculty members nominated by the HOD. The committee shall identify the potential organizations which can provide internship opportunity to the students. The department shall enter into an MOU with the concerned organization and the details will be shared with the students.

The students shall be informed to apply for undergoing internship in the specified proforma. The details and consent of the organization in which he/she is seeking for internship are to be furnished. Further, the student along with the parent must submit an undertaking form. The committee shall scrutinize the applications and approve the same. If a student fails to acquire internship, he/she may be permitted to undergo equivalent work (mini project, research project, fabrication work, field work, research paper, etc.,) in the department under the guidance of a faculty member.

After the completion of the internship, the student must submit the report and attend a departmental internal assessment for award of grade and credits.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Internship Approval Proforma

Name of the Department
Name of the Student
Registered No
Email id
Mobile No
Academic Year
Internship Semester After VI Semester / After IV Semester

Internship Details

Internship Organization
Duration in weeks
Start Date of Internship
End Date of Internship
Probable Date of Certificate Submission

Note:
1. The consent letter from the organization is to be enclosed
2. Undertaking form from the student and parent

Signature of the Student

Recommendations of the Internship Committee:

Signature of the Head of the Department

Guidelines for Massive Open Online Courses (MOOCs)

1. Head of the department should constitute a three member MOOC committee under his chairmanship along with two more members.

2. The committee should take the responsibility of

(i) Notifying the MOOC courses twice in a semester (May and November) along with the details of portals offering the MOOC such as NPTEL/SWAYAM.

(ii) Checking the relevance of courses to the concerned branch.

(iii) Verifying the syllabus of chosen MOOC course and to ensure that it is not studied in the regular curriculum (either full or partial)

3. A student willing to take MOOCS course should apply in the prescribed format to the concerned Head of the Department at least one week prior to the commencement of the MOOC course.

4. The MOOC committee should ensure the following

(i) The course duration must be minimum of 12 weeks

(ii) The course should contain a proctored examination for evaluation

(iii) The agency offering MOOCs should be a recognized and reputed one and approved by
the BOS of the concerned program.

5. Students should submit the Course completion certificate with marks memos to the department MOOCs committee.

6. If the certifying authority/agency is not able to conduct the exam, then the student can show certified course progress, applied hall ticket and mail communication from the authority as proofs and can avail the extension time by one semester for submitting the course completion certificate.

7. After the student submits the MOOCs certificates, the committee should recommend 3 credits and the appropriate grade to be allocated to the student and send to the Controller of Examination.

8. If a student fails to successfully complete and acquire the certificate as per the guidelines and timelines specified by the concerned MOOCs authority, he/she has to register for that course subsequently. Unsuccessful candidates in the first attempt shall be marked as supplementary.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MOOCS APPLICATION

Date:

Name of the department:
Name of the Student:
Registered No:
Email id:
Mobile No:
Academic Year & Semester

S.No	Course Title	MOOCS Agency	Duratin in Weeks	Course Start &End date	Probable Date of Certificate Submission	MOOCs Course in lieu of (Professional Elective/Job	Remarks

Note: Syllabus, Timelines and Guidelines of the MOOC course should be attached.

Signature of the Student

Recommendations of the MOOCs Committee:

Signature of the Head of the Department

Guidelines for Project work

1. In R20 regulations, there is no theory or practical courses in VIII semester. An exclusive 12 credit course is included as Project Work and Internship. The student should mandatorily undergo internship as well as project work parallelly. At the end of the semester the student should submit an internship completion certificate along with a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

2. The departmental internship committee is advised to strictly adhere to the established guidelines for internships. Furthermore, it is recommended that internships for students be limited to organization/ industry authorized by **APSCHE/AICTE INTERNSHIP PORTAL/PUBLIC SECTOR ORGANIZATIONS**. This restriction applies to both online and offline internship opportunities.

3. The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members as defined in the Process Document for project work (R20 regulation). The PWC shall adhere to the process explained in the said document.

4. Evaluation of the Project work:
   i) The evaluation shall be based on CIE and SEE. The CIE is for 30 marks which consists of reviews at the end of each month as per the Process Document in the form of seminars/presentations for 15 marks and the project report submitted at the end of the semester which is evaluated for 15 marks. A minimum of 15 (50%) marks and 50% attendance are to be secured by the student exclusively in CIE in order to be declared as qualified in the project work and eligible to write the SEE in the project work.
   ii) SEE shall be evaluated in the form of a Viva-Voce and demonstration of the thesis work for 70 marks. Viva-voce Examination in project work shall be conducted by one internal examiner (Member of PWC) and one external examiner to be appointed by the principal. A minimum of 25 marks shall be obtained exclusively in SEE in order to be declared as passed in the Project work.
   iii) Completion of internships along with Project work in VIII Semester is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student has to repeat and complete the internship.
5. The project work committee should ensure the following, if the students are doing project work at any organization/ industry.

i) The student gets placement before commencement of eighth semester and joined the organization/Industry as advance placement. The student who obtained project work opportunity in organization / Industry may also be allowed as per the recommendation of the PWC.

ii) The above students will be informed to apply in the specified proforma for approval to undergo for project work along with the details and consent of the organization in which he/she is seeking for doing project work. Further, the student and the parent/guardian have to submit an undertaking form to the concerned department. The PWC shall scrutinize the applications and approve.

iii) The list of such approved students undertaking project work in organization/ industry shall be maintained in the department by the PWC.

iv) The students who are undertaking the project work outside the campus have to necessarily submit the monthly attendance duly certified by the concerned authority in the organization/ industry.

v) The PWC will have to maintain interaction regularly with the out-side organization/ concerned who are offering the project works.

vi) During the course of project work, the student has to attend the departmental internal reviews/assessment periodically as notified by the department mandatory. After the completion of the project work, thes student has to submit the report and attend semester end assessment examination by paying prescribed exam fee for award of grade and credits.

vii) The students who are undertaking the project work outside the campus will have to complete their project work with in the stipulated period (as per Academic Calander) along with the inhouse project work students and also submit the internship completion certificate at the end of the semester.

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Project work Approval Proforma

Date:

Name of the Department	
Name of the Student	
Registered No.	
Email id	
Mobile Number	
Academic Year and Semester	

Project Work Details:

Organization/Industry Name	
Duration in weeks	
Start Date of Project work	
End Date of Project work	
Probable Date of Project work completion Certificat	

Note: 1. The Consent letter from the organization/Industry is to be enclosed.

2. Undertaking form from the student and parent.

Signature of the Student

Recommendations of the Project work Committee (PWC):

Signature of the Project Coordinator Signature of the Head of the Departmen

Process document for Project work

As per the R20 regulations, students are required to do a project work in the VIII semester and submit a report. The following is the process to be followed for the project work.

A. Projects Batches and Guide allocation

1. The Head of the department should constitute a three-member Project Work Committee (PWC) under his chairmanship with three faculty members. One of them shall be a senior faculty member and acts as a Project Coordinator.
2. List of faculty members and their specializations, research areas will be communicated to the students. The information is disseminated via email, notice boards and display on the website. List of projects and their titles/themes should be identified and same may be communicated to all the students. Project batches are formed based on the performance of the students up to VI semester.
3. Students are given an option of specifying their choices for the project titles/guides and the final allocation of guides to project batches is done based on the merit order and the choices opted by the project batches.
4. It is to be ensured that no project batch should have more than 4 students.
5. Not more than two batches should be allocated to each project guide.

B. Project classification and mapping with program outcomes and program specific outcomes.

Projects may be broadly classified into the following categories.

1. Application oriented: When the project is related to hardware, then all the components are procured and assembled to get the desired outcome. If it is related to software, then a complete working version of the application is to be created.
2. Research oriented: In this category extensive review of literature is done. This aims to learn and implement new methods or procedures and validate results.
3. Simulation projects: These projects may be hardware or software related. The students will create a working prototype for the same.

- The PWC should ensure that the projects are selected in such a way that the program outcomes and program specific outcomes are mapped with the themes of the project works.
- A document consisting of project titles, area of specialization, project guides should be prepared and submitted to the concerned HOD and should be put on the website. The theme of the work may be changed with the consent of the project guide.

C. Continuous monitoring mechanism and evaluation

1. Project slots (24 hours per week) should be allocated as per the existing scheme and curriculum.
2. A laboratory or a class room should be identified for executing the project works. It is preferred to have a separate laboratory for the purpose of conducting the project works.
3. Each project batch is allowed to consult their respective guide to discuss about their Progress during the project slot.
4. At the end of every month there will be an overall assessment of each project by the PWC by scheduling project reviews in association with project guides.
5. The performance of the students should be evaluated in each review and should be documented.
6. Department staff meeting should be conducted to discuss the performance of the students in the projects and should be documented.

D. Methodology to assess individual as well as collective Contribution/understanding of Project:

1. The project guide should monitor the presence (attendance) of each student in the project work
2. The project guide should ensure that the batch allocated to him is able to understand the objectives of the project. The guide should also identify the requirements (hardware and software) of the project. If a particular software or hardware is not available, same may be communicated to the HOD and may be procured based on the financial and budgetary requirements.
3. Evaluation of the project is based on
    i. Understanding the objectives of the project.
    ii. Day to day work done by the students (Should be documented)
    iii. Partial/Full completion of the project
    iv. Students presentation and demonstration
    v. Results and documentation
4. Evaluation is intimated to the students for further improvement

F. Papers published/Awards won/conferences attended

1. It is encouraged for every project batch to publish/communicate a paper in any national/ international conference/journal. The project guide may encourage the students so that the work of their batch is published as a research paper.
2. Students must be given some awareness/training program for effective writing of a research paper. The research papers should be checked with anti-plagiarism software before the submission to the concerned journal or conference.
3. A report should be prepared by the concerned coordinator comprising all the research papers published and should be made available in the library and soft copies must be put on the website for availability to the students.

Department of Electronics & Communication Engineering
R-20 Course Structure Summary

S. No	Category	Description	Credits	% of Credits
1	HS	Humanities & Social Science including Management Courses	10.5	6.56
2	BS	Basic Science Courses	21	13.12
3	ES	Engineering Science courses including workshop, drawing, basics of electronics/ mechanical/ computer etc.	19.5	12.18
4	PC	Professional Core Courses	55.5	34.68
5	PE	Professional Elective Courses	15	9.37
6	OE/JO	Open Elective Courses/ Job Oriented Courses	12	7.50
7	PW	Project work, seminar, and internship in industry or elsewhere	16.5	10.31
8	MC	Mandatory Courses [Environmental Indian Traditional Knowledge etc]	-	-
9	SO	Skill Oriented Courses	10	6.25
Total			160	100

Composition of courses with reference to credits and number of contact hours in R20 regulation

S. No	Category	Curriculum Content(% of total number of credits of the program)	Total number ofcontact hours	Total numberof credits
1	Humanities & Social Science includingManagement Courses	10.5	12	10.5
2	Basic Science Courses	21	24	21
3	Engineering Science courses including workshop, drawing, basics of electrical /mechanical /computer etc.	19.5	24	19.5
4	Professional Core Courses	55.5	72	55.5
5	Professional Elective Courses	15	15	15
6	Open Elective Courses/Job OrientedCourses	12	14	12
7	Project work, seminar, and internship in industry or elsewhere	16.5	24	16.5
8	Mandatory Courses [Environmental Science, PEHV, Indian Constitution, Essence of IndianTraditional Knowledge etc]	10.5	9	-
9	Skill Oriented Courses	10	12	10
Total		100	206	160

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Effective from the Academic Year 2020-2021 (R20 Regulations)
First Year B. Tech (SEMESTER – I)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC101 /MA01	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	30	70	100	3
20EC102 /PH01	BS	Waves and Modern Physics	3	0	0	3	30	70	100	3
20EC103 /CY01	BS	Engineering Chemistry	3	0	0	3	30	70	100	3
20EC104 /CS01	ES	Programming for Problem Solving	3	0	0	3	30	70	100	3
20ECL101 /CYL01	BS	Chemistry Lab	0	0	3	3	30	70	100	1.5
20ECL102	ES	Hardware Lab	0	0	3	3	30	70	100	1.5
20ECL103 /CSL01	ES	Programming for Problem Solving Lab	0	0	3	3	30	70	100	1.5
20EC105 /MC01	MC	Environmental Studies	3	0	0	3	30	-	30	0
		TOTAL	14	1	9	24	240	490	730	16.5
Induction Program	First 3 weeks (Physical activity, Creative arts, Universal Human values, Literary, Proficiency Module, Familiarization with branch/dept)									

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
BS	Basic Science	P	Practical
ES	Engineering Science	MC	Mandatory Course

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

First Year B. Tech (SEMESTER – II)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC201 /MA02	BS	Numerical Methods and Advanced Calculus	2	1	0	3	30	70	100	3
20EC202	ES	Basic Instrumentation	3	0	0	3	30	70	100	3
20EC203 /EL01	HS	Communicative English	3	0	0	3	30	70	100	3
20EC204 /CS02	ES	Programming with C++	3	0	0	3	30	70	100	3
20EC205	ES	Circuit Theory	2	1	0	3	30	70	100	3
20EC206	PC	Fundamentals of Digital Electronics	2	1	0	3	30	70	100	3
20ECL201/ PHL01	BS	Physics Lab	0	0	3	3	30	70	100	1.5
20ECL202/ ELL01	HS	English Communication Skills Lab	0	0	3	3	30	70	100	1.5
20ECL203/ CSL02	ES	Programming with C++ Lab	0	0	3	3	30	70	100	1.5
NSS	-	National Service Scheme	-	-	-	-	-	-	-	-
		TOTAL	15	3	9	27	270	630	900	22.5

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
BS	Basic Science	P	Practical
ES	Engineering Science	PC	Professional Core
HS	Humanities & Social Science		

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Second Year B. Tech (SEMESTER – III)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC301 /MA03	BS	Probability and Statistics	2	1	0	3	30	70	100	3
20EC302	PC	Signals & Systems	2	1	0	3	30	70	100	3
20EC303	PC	Electronic Devices and Circuits	3	0	0	3	30	70	100	3
20EC304	PC	Electromagnetic Field Theory	3	0	0	3	30	70	100	3
20EC305	PC	Digital Logic Design	3	0	0	3	30	70	100	3
20EC306 /SOC1	SO	Data structures Using Python **(Skill Oriented Course-I)**	2	0	0	2	30	70	100	2
20ECL301	PC	Data Structures using Python Lab	0	0	3	3	30	70	100	1.5
20ECL302	PC	Electronic Devices Lab	0	0	3	3	30	70	100	1.5
20ECL303	PC	Signals & Systems Lab	0	0	3	3	30	70	100	1.5
20EC307 /MC03	MC	Indian Constitution	2	0	0	2	30	0	30	0
		TOTAL	17	2	9	28	300	630	930	21.5

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
BS	Basic Science	P	Practical
PC	Professional Core	MC	Mandatory Course
SO	Skill Oriented Course		

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Second Year B. Tech (SEMESTER – IV)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC401 /MA04	BS	Complex Analysis and Special Functions	2	1	0	3	30	70	100	3
20EC402	PC	Electronic Circuit Analysis	3	0	0	3	30	70	100	3
20EC403	PC	EM Waves and Transmission Lines	3	0	0	3	30	70	100	3
20EC404	ES	Analog Communication	3	0	0	3	30	70	100	3
20EC405 /SOC2	SO	Microprocessor and Microcontroller **(Skill Oriented Course-II)**	2	0	0	2	30	70	100	2
20EC406 /EL02	HS	Technical English	3	0	0	3	30	70	100	3
20ECL401	PC	Electronic Circuits Lab	0	0	3	3	30	70	100	1.5
20ECL402	PC	Digital Logic Design lab	0	0	3	3	30	70	100	1.5
20ECL403	PC	Microprocessor and Microcontroller lab	0	0	3	3	30	70	100	1.5
		TOTAL	16	1	9	26	270	630	900	21.5
20EC4H /20EC4M	Honors/Minor Course		3	1	0	4	30	70	100	4

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
BS	Basic Science	P	Practical
PC	Professional Core	ES	Engineering Science
HS	Humanities and Social Science	SO	Skill Oriented Course

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Third Year B. Tech (SEMESTER– V)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC501	PC	Linear Integrated Circuits	3	0	0	3	30	70	100	3
20EC502	PC	Antennas and Wave Propagation	2	1	0	3	30	70	100	3
20EC503	PC	Digital Communication	2	1	0	3	30	70	100	3
20EC504 /JO1	JO	Job Oriented Elective-I	2	0	2	4	30	70	100	3
20EC505 /PE1	PE	Professional Elective-I	3	0	0	3	30	70	100	3
20ECL501 /SOC3	SO	Machine Learning **(Skill Advanced Course-I)**	1	0	2	3	30	70	100	2
20ECL502	PC	Analog & Digital Communications Lab	0	0	3	3	30	70	100	1.5
20ECL503	PC	Linear Integrated Circuits Lab	0	0	3	3	30	70	100	1.5
20ECL504 /INT01	INT	Summer Internship*****	0	0	0	0	-	100	100	1.5
20EC506 /MC04	MC	Essence of Indian Traditional Knowledge	2	0	0	2	30	0	30	0
		TOTAL	15	2	10	27	270	660	930	21.5
20EC5H /20EC5M	Honors/Minor Course		3	1	0	4	30	70	100	4

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
PC	Professional Core	P	Practical
SO	Skill Advanced Course	MC	Mandatory Course
JO	Job Oriented Elective	PE	Professional Elective
INT	Internship		

*** Summer Internship done After completion of IV Semester, evaluation done in V Semester**

Job Oriented Elective - I	1A	Embedded System & Design
	1B	Data Communication & Computer Networks
	1C	Programming with JAVA
	1D	Computer Organization and Architecture
Professional Elective - I	1A	Information Theory and Coding
	1B	Telecommunication Switching Systems and Networks
	1C	Pulse and Switching Circuits
	1D	Optical Communications

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Third Year B. Tech (SEMESTER–VI)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC601	PC	VLSI Design	3	0	0	3	30	70	100	3
20EC602	PC	Linear Control Systems	2	1	0	3	30	70	100	3
20EC603	PC	Digital Signal Processing	2	1	0	3	30	70	100	3
20EC604 /SOC4	SO	Internet of Things **(Skill Advanced Course-II)**	2	0	0	2	30	70	100	2
20EC605 /JO2	JO	Job Oriented Elective-II	2	0	2	4	30	70	100	3
20EC606 /PE2	PE	Professional Elective-II	3	0	0	3	30	70	100	3
20ECL601	PC	Digital Signal Processing Lab	0	0	3	3	30	70	100	1.5
20ECL602	PC	Internet of Things Lab	0	0	3	3	30	70	100	1.5
20ECL603	PC	VLSI Design Lab	0	0	3	3	30	70	100	1.5
20EC607 /MC02	MC	Professional Ethics and Human Values	2	0	0	2	30	0	30	0
		TOTAL	16	2	11	29	300	630	930	21.5
20EC6H/ 20EC6M	Honors/Minor Course		3	1	0	4	30	70	100	4

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
PC	Professional Core	P	Practical
SO	Skill Advanced Course	MC	Mandatory Course
JOE	Job Oriented Elective	PE	Professional Elective

Job Oriented Elective-II	2A	Digital Design Using Verilog HDL
	2B	Artificial Intelligence
	2C	Biomedical Instrumentation
	2D	Advanced Microcontrollers
Professional Elective – II:	2A	Microwave Engineering
	2B	Mobile and Cellular Communications
	2C	Global Positioning Systems
	2D	Pattern Recognition and Applications

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Fourth Year B. Tech (SEMESTER– VII)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
20EC701 /PE3	PE	Professional Elective-III	3	0	0	3	30	70	100	3
20EC702 /PE4	PE	Professional Elective-IV	3	0	0	3	30	70	100	3
20EC703 /PE5	PE	Professional Elective-V	3	0	0	3	30	70	100	3
20EC704 /O	OE	Open Elective	3	0	0	3	30	70	100	3
20EC705 /JO3	JO	Job Oriented Elective-III	3	0	0	3	30	70	100	3
20EC706 /ME01	HS	Industrial Management and Entrepreneurship Development	3	0	0	3	30	70	100	3
20ECL701 / SOC5	SO	Artificial Neural Networks **(Skill Advanced Course -III)**	1	0	2	3	30	70	100	2
20ECL702 /INT02	INT	Industrial / Research Internship	0	0	0	0	-	100	100	3
		TOTAL	19	0	2	21	210	590	800	23
20EC7H /20EC7M	Honors/Minor Course		3	1	0	4	30	70	100	4

CIE	Continuous Internal Evaluation	L	Lecture
SEE	Semester End Examination	T	Tutorial
PE	Professional Elective	P	Practical
OE	Open Elective	JO	Job Oriented Elective
HS	Humanities and Social Sciences	SO	Skill Advanced Course

PE Elective – III:	3A	Radar Engineering
	3B	Speech Processing
	3C	FPGA Design
	3D	MEMS
PE Elective – IV:	4A	Satellite Communications
	4B	Wireless Networks
	4C	Advanced DSP
	4D	Cloud Computing
PE Elective – V:	5A	Low Power VLSI
	5B	Advanced Wireless Communications
	5C	Semiconductor Device Modelling
	5D	Advanced Sensors
	5E	System on Chip architecture
JO Elective-III *	3A	Digital Image Processing
	3B	Biomedical Signal Processing
	3C	Robotics
	3D	Deep Learning

OPEN ELECTIVES

***Offered to other departments**

Department	CODE	SUBJECT
AIML	CM1	Artificial Intelligence
	CM2	Introduction to Machine Learning
CIVIL	CE1	Air Pollution and Control
	CE2	Remote Sensing and GIS
CB	CB1	Digital Forensics
	CB2	Introduction to Information Security and Cyber Laws
CSE	CS1	Database Management System
	CS2	Java Programming
DS	DS1	Data Warehousing and Data Mining
	DS2	Social Network Analysis
ECE	EC1	Digital Image Processing
	EC2	Embedded System & Design
EEE	EE1	Non-Conventional Energy Sources
	EE2	Electrical Energy Conservation and Auditing
	EE3	Industrial Electrical Systems
EIE	EI1	Sensors and Signal Conditioning
IT	IT1	Cyber Security
	IT2	Web Technologies
MECH	ME1	Automobile Engineering
	ME2	Renewable energy sources
	ME3	Project Management
	ME4	Entrepreneurship Development
CHEMISTRY	CY1	Chemistry in Space technology
	CY2	Artificial Intelligence in Sustainable Chemistry
	CY3	Material Chemistry in daily life
ENGLISH	EL1	Professional Communication
MATHS	MA1	Graph Theory
	MA2	Abstract Linear Algebra
PHYSICS	PH1	Nano materials and Technology
	PH2	Optoelectronic devices and applications
	PH3	Fiber optics communication
NCC	NCC	National Cadet Corps

Fourth Year B. Tech (SEMESTER– VIII)

Course Code	Category	Course Title	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
20EC801/PW	PW	Project work& Internship	0	0	24	24	30	70	100	12
TOTAL			0	0	24	24	30	70	100	12
20ECHM1/ 20ECMM1	**Honors/Minor courses (MOOCS-I)**		-	-	-	-	-	-	-	2
20ECHM2/ 20ECMM2	**Honors/Minor courses (MOOCS-II)**		-	-	-	-	-	-	-	2

List of Minor Courses:

CODE	SUBJECT
A	Microprocessor and Microcontrollers
B	VLSI Design
C	Verilog HDL
D	Computer Architecture
E	Antennas and Wave Propagation
F	Analog Communication
G	Radar Engineering
H	Digital Communication
I	Satellite Communication
J	Image Processing
K	Digital Signal Processing
L	Signals and Systems

LINEAR ALGEBRA AND ORDINATRY DIFFERENTIAL EQUATIONS
I B.Tech. I Semester (Code:20EC101/MA01)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn how to	
➢	Solve a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors
➢	Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order ordinary differential equations.
➢	Create and analyze mathematical models using higher order differential equations to solve application problems that arise in engineering.
➢	Solve a linear differential equation with constant coefficients with the given initial conditions using Laplace Transforms.

Course Outcomes: After studying this course, the students will be able to	
CO1	Find the eigen values and eigen vectors of a given matrix and its inverse.
CO2	Apply the appropriate analytical technique to find the solution of a first order ordinary differential equation.
CO3	Solve higher order linear differential equations with constant coefficients arise in engineering applications.
CO4	Apply Laplace transforms to solve differential equations arising in engineering

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2									2			
CO2	3	3	3									2			
CO3	3	3	3									2			
CO4	3	3	3									2			
AVG	3	3	2.75									2			

Syllabus

UNIT-1 (12 Hours)

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Consistency of linear System of equations: Rouches theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof). [Sections: 2.7.1; 2.7.2; 2.7.6; 2.10.1; 2.10.2; 2.10.3; 2.12.1; 2.13.1; 2.14; 2.15.]

UNIT-2 (12 Hours)

Differential Equations of first order: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree; variables separable; Linear Equations; Bernoulli's equation; Exact Differential equations; Equations

reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the equation M dx+ N dy = 0, $\frac{\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}}{N}$ is a function of x and $\frac{\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}}{M}$ is a function of y. Applications of a first order Differential equations: Newton's law of cooling; Rate of decay of Radio-active materials.
[Sections: 11.1; 11.3; 11.4; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6; 12.8]

UNIT-3 (12 Hours)

Linear Differential Equations: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Oscillatory Electrical Circuits.
[Sections: 13.1; 13.2.1; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5].

UNIT-4 (12 Hours)

Laplace Transforms: Definition; conditions for the existence; Transforms of elementary functions; properties of Laplace Transforms; Transforms of derivatives; Transforms of integrals; Multiplication by t^n; Division by t; Inverse transforms- Method of partial fractions; Other methods of finding inverse transforms; Convolution theorem(without proof); Application to differential equations: Solution of ODE with constant coefficients using Laplace transforms.
[Sections:21.2.1; 21.2.2; 21.3; 21.4; 21.7; 21.8; 21.9; 21.10; 21.12; 21.13; 21.14; 21.15.1]

Text Books : 1. B.S.Grewal,"Higher Engineering Mathematics",44th edition, Khanna Pub.,2017

References :
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

WAVES AND MODERN PHYSICS

I B.Tech. I Semester (Code:20EC102/PH01)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Familiarize the students in getting knowledge about modern optics and their Engineering applications
➢	Make aware of the students to obtain circuit knowledge regarding electrical, Electronics and Magnetism
➢	Understand the quantum theory and solving the various Physical problems using quantum mechanics.
➢	Gain the knowledge of various methods of analytical techniques for material testing

Course Outcomes: After studying this course, the students will be able to	
CO1	Learn about principle and working of different types of lasers and their applications. Know about principle, types of optical fibers and their effective utilization in optical communications.
CO2	Analyze the electromagnetic principles in electrical and electronic circuits and Maxwell's equations.
CO3	Study about quantum mechanics and its applications.
CO4	Read about properties and applications of ultrasonic in various fields. Know about radio isotopes and their applications

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3			2		2									
CO2	3			3		3	2					2			
CO3	2	3		2											
CO4	2	3		2											
AVG	2.5	3		2.25		2.5	2					2			

Syllabus

UNIT-1

(12 Hours)

Lasers: Interaction of radiation with matter. Einstein co-efficient, Properties of laser, Population inversion, LASER principle, pumping schemes-Three level and four level laser, types of lasers: solid-state lasers (Ruby), gas lasers (He-Ne), Semiconductor lasers; applications of lasers in industry and medicine.

Fibre Optics: Importance of optical fibre, Structure and principle of optical fibre, acceptance angle and numerical aperture, Types of optical fibres based on modes and refractive index, V number, losses associated with optical fibres, fibre optical communication, advantages of optical fibres

UNIT-2 (12 Hours)

Maxwell's equations in vacuum and conducting medium. Velocity of electromagnetic wave in vacuum. Electromagnetic oscillations in LC circuit, LCR series resonance in A. C circuit and resonant frequency, Quality factor. Concept of skin effect, Energy in an electromagnetic field; Flow of energy and Pointing vector. Principle of circulating charge and cyclotron, Hall Effect

UNIT-3 (12 Hours)

Dual nature of light, Debroglie concept of matter waves, Davission – Germer experiment, Heisenberg uncertainty principle and applications (non existence of electron in nucleus and finite width of spectral lines), one dimensional time independent and dependent Schrodinger wave equation, physical significance of wave function, application of Schrödinger wave equation to particle in a one dimensional potential box, concept of quantum tunnelling and construction and working of Scanning Tunnelling Electron Microscope.

UNIT-4 (12 Hours)

Ultrosonics: Properties of ultrasonics, Production of ultrasonic waves by magnetostriction and piezo-electric method, Determination of velocity of ultrasonic wave in liquids by Ultrasonic interferometer. Medical applications, Ultrasonic Imaging technique (Doppler Ultrasound Imaging advantages and limitations), industrial applications, **NDT**: Pulse echo technique, Time of flight diffraction technique.

Nuclear Techniques: Radio isotopes and its applications (medical and Industrial), GM counter, Scintillation counter.

Text Books :
1. Engineering physics, M. V. Avadhanulu, P.G.Kshirsagar S.Chand & Company Pvt. Ltd.
2. Engineering physics, PalaniSwamy, Scitech publication

References :
1. Basic Engineering Physics – Dr.P.srinivasaRao, Dr.K.Muralidhar, Himalaya Publication.
2. Applied Physics – Dr. P. Srinivasa Rao, Dr. K. Muralidhar, Himalaya publication. Basic engineering physics – Dr.P.srinivasaRao, Dr.K.Muralidhar, Himalaya Publication.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ENGINEERING CHEMISTRY

I B.Tech. I Semester (Code:20EC103/CY01)

Lectures :	3 Hours/Week	Tutorial :	0 Hour/Week	Practical :	0
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn The principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.
➢	Understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
➢	Know the conventional energy sources, solid, liquid and gaseous Fuels & Knowledge of knocking and anti-knocking characteristics
➢	Gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

Course Outcomes: After studying this course, the students will be able to	
CO1	Develop and innovative methods to produces of water for industrial use and potable water at cheaper cost.
CO2	Apply their knowledge in converting various energies of different systems and protection of different metals from corrosion.
CO3	Have the capacity of applying energy sources efficiently and economically for Various needs.
CO4	Design economically and new methods of organic synthesis and substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	2	3		2	3					3			
CO2	2	3	2	3		2	3					3			
CO3	2	3	2	3		2	3					3			
CO4	2	3	3	3		2	3					3			
AVG	2	3	2.25	3		2	3					3			

Syllabus

UNIT-1 (12 Hours)

Introduction: water quality parameters

Characteristics: Alkalinity, Hardness-Estimation & simple numerical problems,

Boiler Troubles- Sludges, Scales, Causticem brittlement, boilercorrosion, Primingand foaming.

Internal conditioning- phosphate, calgon and carbonate methods.

External conditioning- Ion exchange process & Zeolite process WHO Guidelines, Potable water, Sedimentation, Coagulation, Filtration.

Disinfection methods: Chlorination, ozonization and UV treatment.

Salinity–Treatment of Brackish water by Reverse Osmosis and Electro dialysis.

UNIT-2 (12 Hours)

Thermo dynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications.

Corrosion: Types of corrosion- Chemical ordry corrosion, Electro chemical orwet corrosion; Galvanic, stress, pitting and differential aeration corrosion; Factors effecting corrosion, Corrosion control– Cathodic protection, and electroplating(Au)& electrodes Niplating

UNIT-3 (12 Hours)

Fuels: Classification of fuels; Calorific value of fuels (lower, higher)

Solidfuels: Determination of calorific value (Bomb Calorimeter) & related Problems, Coal ranking.

UNIT-4 (12 Hours)

Organic reactions and synthesis of a drug molecule: Introduction to reaction sin volving substitution (SN1,SN2), addition (Markownikoff's and anti- Markwnikoff's rules), elimination (E1&E2), Synthesis of a commonly used drug molecule. (Aspirin and Paracetamol)

Polymers: Conducting polymers: Classification, Intrinsic and Extrinsic conducting polymers and their applications.

Plastics: Thermoplasts and thermo setting plastics, Bskelite and PVC.

Biodegradable polymers: types, examples- Poly Hydroxy Buterate (PHB), Poly Hydroxy Buterate-co-β-Hydroxy Valerate (PHBV), Applications.

Text Books :

1. P.C.Jainand MonicaJain, "Engineering Chemistry" Dhanpat Rai Pub, Co., NewDelhi 17th edition (2017).
2. Seshi Chawla, "Engineering Chemistry" Dhanpat Rai Pub, Co. LTD, New Delhi 13th edition, 2013.

References :

1. Essential of Physical Chemistry by ArunBahl, B.S. Bahl, G.D.Tuli, by ArunBahl, B.S. Bahl, G.D.Tuli, Published by S Chand Publishers, 12th Edition,2012.
2. Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
3. Engineering Chemistry by K.Maheswaramma, Pearson publishers 2015.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMMING FOR PROBLEM SOLVING

I B.Tech. I Semester (Code:20EC104/CS01)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand basic concepts of C-Programming such as: C-tokens, Operators, Input/ output, and Arithmetic rules.
➢	Develop problem solving skills to translate "English" described problems into Programs written using C language
➢	Apply pointers for parameter passing, referencing and differencing and linking data structures
➢	Know how to Manipulate variables and types to change the problem state, including numeric, character, array & pointer types, as well as the use of structures and unions, File

Course Outcomes: After studying this course, the students will be able to	
CO1	Formulate simple algorithms for arithmetic and logical problems and remember the basics of computer fundamentals of computer history.
CO2	Translate the algorithms to programs also to test and execute the programs and correct syntax and logical errors and implementing conditional branching, iteration and recursion.
CO3	Analyze the problem for its decomposition into functions.
CO4	Understand the file handling and dynamic memory allocation using c programming language.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3			3							1			
CO2	3	3			3							1			
CO3	3	3			3							1			
CO4	3	3			3							1			
AVG	3	3			3							1			

Syllabus

UNIT-1 (12 Hours)

Introduction to C: Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing I/O Operations. Decision Making and Branching.

Programming Exercises for Unit- I: C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic and logical errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, Programs using Scientific and Engineering formulae. Finding the largest of the three given numbers. Computation of discount amount on different types of products with different

discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, finding given year is leap year or not, and conversion of lower case character to its uppercase.

UNIT-2 (12 Hours)

Decision Making and Looping, Arrays, Character Arrays and Strings.

Programming Exercises for Unit-II: To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number. To print graphic patterns of symbols and numbers. To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not with and without using String Handling Functions. Transpose of a matrix and sorting of names using arrays.

UNIT-3 (12 Hours)

User-defined Functions, Structures and Unions, Pointers

Programming Exercises for Unit -III: Functions-Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic. Swapping two variable values. Sorting a list of student records on register number using array of pointers.

UNIT-4 (12 Hours)

File Management in C, Dynamic Memory Allocation, Preprocessor

Programming Exercises for Unit - IV: Operations on complex numbers, and to read an input file of marks and generate a result file, sorting a list of names using command line arguments. Copy the contents of one file to another file. Allocating memory to variables dynamically.

Text Books :
1. "Programming in ANSIC" by E. Balaguruswamy, Fifth Edition, McGraw Hill Education India.
2. "Let us C" by Yashavant P.Kanetkar, 14th Edition, BPB Publications.

References :
1. Kernighan BW and Dennis Ritchie M, "C programming language", 2nd edition, Prentice Hall.
2. Herbert Schildt, "C:The Complete Reference",4thedition,Tata Mcgraw-Hill.
3. Ashok N.Kamthane,"Programming in C", PEARSON 2nd Edition.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ENGINEERING CHEMISTRY LAB

I B.Tech. I Semester (Code:20ECL101/CYL01)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will learn	
➢	The basics of chemistry lab to carry out the qualitative and quantitative analysis of any given sample.
➢	To determine the percentage purity of washing soda bleaching powder and given salt. The measurement of quality parameters of water to check its suitability for domestic and industrial purpose
➢	To estimate the characteristic properties of oil for its use at various level
➢	To synthesize the Soap, Resin and Aromatic Ester followed by their applications. The use and utility of some instruments like PH meter, Conductometer and Potentiometer for various applications

Course Outcomes: At the end of the course, student will be able to	
CO1	Familiar with fundamental basics of Chemistry lab
CO2	Estimate purity of washing soda, bleaching powder and quantity of Iron and other salts.
CO3	Gain the knowledge regarding the quality parameters of water& oil like salinity, hardness, alkalinity saponification and iodine value.etc.
CO4	Prepare high polymers and soap & Instrumentation techniques

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2								2						
CO2	2	2	2	2		2			2			2			
CO3	2	2	2	2		2			2			2			
CO4	2	2	2	2					2			2			
AVG	2	2	2	2		2			2			2			

LIST OF EXPERIMENTS 36 Hours

1. Introduction to Chemistry Lab (the teachers are expected to teach fundamentals like Calibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molalityetc. And error, accuracy, precision, theory of indicators, use of volumetric titrations).

2. **Volumetric Analysis:**
   a. Estimation of Washing Soda.
   b. Estimation of Active Chlorine Content in Bleaching Powder
   c. Estimation of Mohr's salt by per manganometry.
   b. Estimation of given salt by using Ion-exchange resin using Dowex-50.

3. **Analysis of Water**:
   a. Determination of Alkalinity of Tap water.
   b. Determination of Total Hardness of ground water sample by EDTA method
   c. Determination of Salinity of water sample.

4. **Estimation of properties of oil:**
   a. Estimation of Acid Value
   b. Estimation of Saponification value.

5. **Preparations:**
   a. Preparation of Soap
   b. Preparation of Urea-formal dehyderesin
   c. Preparation of Phenylbenzoate.

6. **Demonstration Experiments (Any two of the following):**
   a. Determination of pH of given sample.
   b. Determination of conductivity of given sample by conductometer.
   c. Potentiometric Determination of Iron.

TextBooks:
1. Practical Engineering Chemistry by K.Mukkanti, Etal, B.S. Publicaitons, Hyderabad, 2009.
2. In organic quantitative analysis, Vogel, 5thedition, Long man group Ltd. London, 1979.

References:
1. TextBook of engineering chemistry by R.n.Goyal and Harrmendra Goel.
2. A text book on experiments and calculations-Engineering Chemistry. S.S.Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

HARDWARE LAB

I B.Tech. I Semester (Code: 20ECL102)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn How Identification and Testing of Various Circuit Elements.
➢	Know How to Measure Voltage, Frequency and Phase of Any Waveform Using CRO
➢	Learn How to Calculate Voltage & Current using Circuit Theorems.
➢	Observe Characteristics of Electronic Devices.

Course Outcomes: At the end of the course, student will be able to	
CO1	Identify and Test Various Electronic Circuit Components.
CO2	Measure Voltage, Frequency and Phase of Different Waveforms Using CRO
CO3	Plot the characteristics of P-N Junction and Zener Diode and Measure the performance characteristics.
CO4	Calculate the Currents and Voltages of a circuit using Thevenin's & Norton's Theorems

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2			3					3				3	1	
CO2		2		3					3				3	1	
CO3	2			3					3				3	1	
CO4		3		3					3				3	1	
AVG	2	2.5		3					3				3	1	

LIST OF EXPERIMENTS 36 Hours

1. Identification and testing of various circuit elements.
2. Study of CRO and Function Generator.
3. Study of RPS and Multimeter.
4. Verification of KCL and KVL.
5. Testing of basic gates.
6. Realization of basic gates using discrete components.
7. V-I characteristics of Diode.
8. V-I characteristics of Zener Diode.
9. Verification of Thevenin's Theorem.

10. Component testing using CRO.
11. Verification Of Norton's Theorem
12. How Frequency And Phase Measured Using CRO
13. Lissajious Figures In
14. Simulation Software Introduction
15. Small Circuits Design Using Simulation Software

Note: *A minimum of Ten Experiments are to be executed and recorded to attain eligibility for S E E Practical examination.*

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMMING FOR PROBLEM SOLVING LAB

I B.Tech. I Semester (Code:20ECL103/CSL01)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will	
➢	Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, Arithmetic rules.
➢	Develop problem solving skills to translate "English" described problems into Programs written using C language
➢	Apply pointers for parameter passing, referencing and differencing and linking data structures.
➢	Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File

Course Outcomes: At the end of the course, student will be able to	
CO1	Learn the challenge, pick and analyze the appropriate data representation formats and algorithms.
CO2	Choose the best programming construct for the job at hand by comparing it to other structures and considering their constraints.
CO3	Develop the program on a computer, edit, compile, debug, correct, recompile and run it.
CO4	Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3			3				3						
CO2		2	3		3				3						
CO3		2	3		3				3						
CO4		3	2		3				3						
AVG	3	2.5	2.67		3				3						

LIST OF EXPERIMENTS

36 Hours

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if else statement).

Domestic Customer		
Consumption Units	**Consumption Units**	
0 – 200	0.50 per unit	
201 – 400	100 plus	0.65 per unit
401 – 600	230 plus	0.80 per unit
601 and above	390 plus	1.00 per unit

Domestic Customer		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 50	0.50 per unit	
100 – 200	50 plus	0.60 per unit
201 – 300	100 plus	0.70 per unit
301 and above	200 plus	1.0 per unit

1. Write a C program to evaluate the following (using loops):
   a. $1 + x^2/2! + x^4 / 4!+ \ldots$upto ten terms
   b. $x + x^3/3! + x^5/5!+ \ldots$ upto 7 digit accuracy
2. Write a C program to check whether the given number is
   a. Prime or not.
   b. Perfect or Abundant or Deficient.
3. Write a C program to display statistical parameters (using one – dimensional array).
   a. Mean b) Mode c) Median d) Variance.
4. Write a C program to read a list of numbers and perform the following operations
   a. Print the list. b)Delete duplicates from the list. c)Reverse the list.
5. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message "Element not found in the List".
6. Write a C program to read two matrices and compute their sum and product.
7. A menu driven program with options (using array of character pointers).
   a. To insert a student name
   b. To delete astudent name
   c. To print the names of students
8. Write a C program to read list of student names and perform the following operations
   a. To print the list of names.
   b. To sort them in ascending order.
   c. To print the list after sorting.
9. Write a C program that consists of recursive functions to
   a. Find factorial of a given number

ENVIRONMENTAL STUDIES
I B.Tech. I Semester (Code:20EC105/MC01)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	--	Credits	: 0

Pre-Requisite: None

Course Objectives: Students will	
➢	Develop an awareness, knowledge, and appreciation for the natural environment
➢	Understand different types of ecosystems exist in nature.
➢	Understand different types of pollutants present in Environment
➢	Gain awareness among the youth on environmental concerns important in the long- term interest of the society

Course Outcomes: After studying this course, the students will be able to

CO1	Develop an appreciation for the local and natural history of the area.
CO2	Hope for the better future of environment in India which is based on many positive factors like Biodiversity, successive use of renewable energy resources and other resources, increasing number of people's movements focusing on environment.
CO3	Know how to manage the harmful pollutants. Gain the knowledge of Environment.
CO4	Create awareness among the youth on environmental concerns important in the long-term interest of the society

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						3	3					2			
CO2						3	3					2			
CO3						3	3					2			
CO4						3	3					2			
AVG						3	3					2			

Syllabus

UNIT-1 (12 Hours)

Introduction: Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries).

Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation. Chipko movement case study

UNIT-2 (12 Hours)

Natural resources: Land: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. **Forest**: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. **Water**: Uses, floods and drought, Dams -

benefits and problems. **Energy**: Importance of energy, Environmental Impacts of Renewable and Non-renewable energy resources. Silent Valley Project and Narmada Bachao Andolan case studies

Sustainability: Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management. Fieldwork on Rain water harvesting and Watershed management.

UNIT-3 (12 Hours)

Pollution: Definition; Causes, effects and control of air, water and nuclear pollution; Chernobyl Nuclear Disaster case study; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermi composting.

Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act.

UNIT-4 (12 Hours)

Environmental issues: Green House effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment. Environmental Standards (ISO 14000, etc.)

Case Studies: Bhopal Tragedy, Mathura Refinery and TajMahal, and Ralegan Siddhi (Anna Hazare).

Field work: Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture.

Text Books :
1. "Environmental Studies " by Benn y J oseph, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
2. "Comprehensive environmental studies"- JP Sharma, Laxmi Publications.
3. Text Book of environmental Studies – Erach Bharucha

References :
1. "Environmental studies", R.Rajagopalan, Oxford University Press.
2. "Introduction to Environmental Science", Anjaneyulu Y, B S Publications
3. "Environmental Science", 11th Edition – Thomson Series – By Jr. G. Tyler Miller.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NUMERICAL METHODS AND ADVANCED CALCULUS

I B.Tech. II Semester (Code:20EC201/MA02)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Solve algebraic, transcendental and system of linear equations with the help of numerical methods.
➢	Apply the techniques of numerical integration whenever and wherever routine methods are not applicable and solve the first order ordinary differential equations numerically with the given initial condition using different methods.
➢	Evaluate double and triple integrals and apply them to find areas and volumes.
➢	Evaluate the line, surface and volume integrals and learn their inter-relations and applications.

Course Outcomes: After studying this course, the students will be able to	
CO1	Solve non-linear equations and system of linear equations with the help of Numerical techniques.
CO2	Solve the first order ordinary differential equations numerically with the given initial condition.
CO3	Find the area and volume of plane and three dimensional figures using multiple integrals.
CO4	Apply vector integral theorems to obtain the solutions of engineering problems

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2									2			
CO2	3	3	2									2			
CO3	3	3	2									2			
CO4	3	3	2									2			
AVG	3	3	2									2			

Syllabus

UNIT-1 (12 Hours)

Numerical Solution of Equations: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss elimination method, Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi's iterative method, Gauss-Seidel iterative method. [Sections:28.1; 28.2; 28.3; 28.5; 28.6; 28.7.1;28.7.2].

UNIT-2 (12 Hours)

Finite differences and Interpolation: Finite differences: Forward differences, Backward differences; Newton's interpolation formulae: Newton's forward interpolation formula, Newton's backward interpolation formula; Interpolation with unequal intervals;

Lagrange's interpolation formula; Divided differences; Newton's divided difference formula; Numerical integration; Trapezoidal rule; Simpson's one-third rule; Simpson's three-eighth rule; Numerical solution of ODE's: Introduction; Picard's method; Euler's method; Runge-Kutta method.
[Sections:29.1; 29.1-1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1; 32.2;32.4; 32.7].

UNIT-3 (12 Hours)

Multiple Integrals: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enclosed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integral, Change of variables.
[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2; 7.7.2].

UNIT-4 (12 Hours)

Vector calculus and its Applications: Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green's theorem in the plane (without proof); Stokes theorem (without proof); Gauss divergence theorem(without proof).
[Sections: 8.4; 8.5; 8.5.1; 8.5.3; 8.6; 8.11.1; 8.12.2; 8.12.3; 8.13; 8.14; 8.16]

Text Books :
1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

References :
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BASIC INSTRUMENTATION

I B.Tech. II Semester (Code:20EC202)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn basic concepts of measurements and Instrumentation.
➢	Outline working of various bridges and their applications
➢	Summarize the uses of CRO in measurements
➢	Describe the different types of transducers and data acquisition systems

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze the basic Measurement standards and the concepts of Electro mechanical Indicating Instruments.
CO2	Summarize the concepts of Bridge Circuits for measuring the instrumental parameters.
CO3	Demonstrate the working of various Oscilloscopes.
CO4	Illustrate the functionality of several transducers and Data Acquisition Systems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3											2	2	
CO2	3	2											2	2	
CO3	3	2											2	2	
CO4	3	3											2	2	
AVG	3	2.5											2	2	

Syllabus

UNIT-1 (12 Hours)

Definitions: Measurement, Standard, Instrument, Calibration, Instrumentation Accuracy, Precision, Significant figures, Sensitivity, Resolution, Threshold, and Linearity. Types of errors.

Limiting Errors: Definition, Combination of Limiting errors, Statistical analysis, Probability of errors.

Electromechanical Indicating Instruments: Permanent Magnet Moving Coil Mechanism, DC Ammeters, DC Voltmeters, Voltmeter Sensitivity, Series type Ohmmeter, Shunt type Ohmmeter.

UNIT-2 (12 Hours)

Bridge Measurements: Introduction, Wheatstone Bridge, Kelvin Bridge, Kelvin's Double Bridge,

AC Bridges: Maxwell Bridge, Hay Bridge, Schering Bridge, Wein Bridge. **Electronic Instruments for measuring Basic Parameters:** AC Voltmeter using rectifiers, True RMS-Responding voltmeter,

Q-Meter: Basic Q-meter circuit, Measurement methods, Sources of error.

UNIT-3 (12 Hours)

Oscilloscopes: Introduction, Block diagram and working of CRO and Cathode Ray Tube (CRT),

Oscilloscope Techniques: Frequency determination, Phase angle and Time delay measurement.

Special Oscilloscopes: Working of Storage Oscilloscope, Sampling Oscilloscope, and Digital Storage Oscilloscope

UNIT-4 (12 Hours)

Transducers as Input Elements to Instrumentation Systems: Classification of Transducers, Selection criteria of Transducer. **Strain gauges:** Principle of Strain gauge, Derivation for gauge factor of a strain gauge, **Displacement Transducers:** Resistive potentiometers, LVDT, Capacitive transducers

(i) Variable gap type (ii) Variable area type (iii) Variable dielectric type.

Temperature Measurements: Principle and operation of RTD, Thermistor, Thermocouples

Analog and Digital Data Acquisition Systems: Introduction to Instrumentation systems, Block diagram and working of Digital data acquisition system

Text Books:
1. Modern Electronic Instrumentation and Measurement Techniques by W.D Cooper & A.D Helfrick PHI, 2008.
2. A Course in Electrical and Electronics Measurements and Instrumentation bySawhney.A. K,18thEdition, Dhanpat Rai& Company Private Limited, 2007.

References:
1. Electronic Instrumentation by HSKalsi, TataMcGraw-Hill Education, 1995.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COMMUNICATIVE ENGLISH

I B.Tech. II Semester (Code:20EC203/EL01)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn how	
➢	To comprehend the importance, barriers and strategies of listening skills in English.
➢	To illustrate and impart practice Phonemic symbols, stress and intonation.
➢	To practice oral skills and receive feedback on learners' performance.
➢	To practice language in various contexts through pair work, role plays, group work and dialogue conversations.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand how to build academic vocabulary to enrich their writing skills
CO2	Produce accurate grammatical sentences
CO3	Analyze the content of the text in writing
CO4	Produce coherent and unified paragraphs with adequate support and detail

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1								2	2	3		2			
CO2								2	2	3		2			
CO3								2	2	3		2			
CO4								2	2	3		2			
AVG								2	2	3		2			

Syllabus

UNIT-1 (12 Hours)

1.1 **Vocabulary Development:** Word formation-Formation of Nouns, Verbs & Adjectives from Root words-Suffixes and Prefixes

1.2 **Essential Grammar:** Prepositions, Conjunctions, Articles

1.3 **Basic Writing Skills:** Punctuation in writing

1.4 **Writing Practices:** Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

UNIT-2 (12 Hours)

2.1 **Vocabulary Development:** Synonyms and Antonyms

2.2 **Essential Grammar:** Concord, Modal Verbs, Common Errors

2.3 **Basic Writing Skills**: Using Phrases and clauses

2.4 **Writing Practices**: Hint Development, Essay Writing

UNIT-3 (12 Hours)

3.1 **Vocabulary Development:** One word Substitutes

3.2 **Essential Grammar:**Tenses, Voices

3.3 **Basic Writing Skills:** Sentence structures (Simple, Complex, Compound)
3.4 **Writing Practices:** Note Making

UNIT-4 (12 Hours)

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors
4.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
4.4 **Writing Practices**: Paraphrasing &Summarizing

Text Books:
1. Communication Skills, Sanjay Kumar & Pushpa Latha. Oxford University Press: 2011.
2. Practical English Usage, Michael Swan. Oxford University Press:1995.
3. Remedial English Grammar, F.T.Wood. Macmillan:2007.

References:
1. Study Writing,Liz Hamplyons&BenHeasley.Cambridge University Press.: 2006

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMMING WITH C++

I B.Tech. II Semester (Sub. Code: 20EC204/CS02)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: C Language

Course Objectives: Students will learn to	
➢	Develop a greater understanding of the issues involved in programming language design and implementation
➢	Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms.
➢	Implement several programs in languages other than the one emphasized in the core curriculum (C++).
➢	Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing.

Course Outcomes: After studying this course, the students will be able to	
CO1	Learn the features of C++ supporting object-oriented programming.
CO2	Understand the relative merits of C++ as an object oriented programming language.
CO3	Apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism.
CO4	Analyze advanced features of C++ specifically stream I/O, templates and operator over loading.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3				3							1			
CO2	3	2			3							1			
CO3	3	2			3							1			
CO4	2	3			3							1			
AVG	2.67	2.33			3							1			

Syllabus

UNIT-1 (12 Hours)

Introduction: Basic concepts of OOP, benefits and applications of OOP, what is C++, applications of C++, C++ statements, structure of a C++ program, creating the source file, compiling and linking. C++ tokens, keywords, identifiers and constants, data types in C++, operators in C++, symbolic constants, type compatibility, declaration of variables, dynamic initialization of variables, reference variables, scope resolution operator, member dereferencing operator, memory management operator, type cast operator, expressions and their types, special assignment expressions, implicit conversions, operator overloading, operator precedence, control structures. C++ streams and stream classes, unformatted I/O operations, formatted I/O operations, managing output with manipulators

UNIT-2 (12 Hours)

Functions in C++: main function, function prototyping, call by reference, return by reference, inline functions, default arguments, const arguments, function overloading, friend and virtual functions.

Classes and objects: specifying a class, defining member functions, nesting member functions, private member functions, static data members and member functions, arrays of objects, objects as function arguments, returning objects, local classes.

UNIT-3 (12 Hours)

Constructors and Destructors: constructors, parameterized constructors, multiple constructors in a class, constructors with default arguments, dynamic initialization of objects, Copy constructor, dynamic constructor, const objects, and destructors. Defining Operator Overloading, overloading unary and binary operators, overloading binary operators using friends, rules for operator overloading, manipulation of strings using operators.

UNIT-4 (12 Hours)

Pointers: pointers to objects, this pointer, pointers to derived classes, pure virtual functions. **Inheritance:** single inheritance, making a private member inheritance, multilevel inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes

Text Books:
1. Object oriented programming with C++, Balagurusamy, 4th edition, Tata McGraw-Hill publications, 2008.
2. Object oriented programming with ANSI and turbo C++, Ashok N. Kamthane, Pearson Education, 2005.

References:
1. C++ programming language by Bjarne Stroustup, 3rd edition, Pearson education, 2009.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CIRCUIT THEORY

I B.Tech. II Semester (Code:20EC205)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Engineering Physics

Course Objectives: Students will	
➢	Learn basics of circuit analysis-KVL, KCL, Mesh analysis and Nodal Analysis
➢	Learn basics of circuit analysis using star and delta models
➢	Analyze dc/ac electric circuits and important theorems of circuit analysis
➢	Illustrate the transient response of source free and driven RL, RC circuits

Course Outcomes: After studying this course, the students will be able to	
CO1	Solve various DC circuits by applying network reduction & analysis techniques
CO2	Apply Nodal and Mesh Analysis techniques to analyze electrical circuits.
CO3	Analyze circuits using network theorems.
CO4	Analyze RL and RC circuits, including the transient response, to understand their time-dependent behavior and responses under different driving conditions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											2		
CO2	3	3											2		
CO3	3	3											2		
CO4	3	3											2		
AVG	3	2.75											2		

Syllabus

UNIT-1 (12 Hours)

VOLTAGE AND CURRENT LAWS: Introduction, nodes, paths, loops and branches, Kirchhoff's current and voltage laws, series and parallel connected sources, resistors in series and parallel, voltage and current division.

UNIT-2 (12 Hours)

BASIC NODAL AND MESH ANALYSIS: Nodal analysis, the super node, Mesh analysis, and The super mesh, Nodal vs. Mesh analysis: A comparison

UNIT-3 (12 Hours)

USEFUL CIRCUIT ANALYSIS TECHNIQUES: Linearity and superposition, source transformations, Thevenin and Norton equivalent circuits, maximum power transfer Theorem, Reciprocity Theorem, and delta-wye conversion.

UNIT-4 (12 Hours)

BASIC RL AND RC CIRCUITS: The source free RL circuit, properties of the exponential response, the source free RC circuit, driven RL circuits, natural and forced response, driven RC circuits.

Text Books:
1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, 8th Edition, Tata McGraw Hill, 2016.
2. Circuits & Networks: Analysis and Synthesis, A.Sudhakar and Shyammohan S.Pilli, Tata Mc Graw Hill, 2007.

References:
1. Network Analysis, M. E.Vanvalkenburg, 3rdEdition, PHI, 2003.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FUNDAMENTALS OF DIGITAL ELECTRONICS

I B.Tech. II Semester (Code:20EC206)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Acquire the basic knowledge of digital logic levels and application of knowledge To understand digital electronic circuits
➢	Learn how to realize digital Circuits using Gates.
➢	Analyze the implementation of combinational logic circuits.
➢	Explore the knowledge on MSI circuits.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand different Number systems, Complements and various binary codes.
CO2	Simplify Boolean function using Boolean algebraic rules and laws, K-Map and Tabulation Method.
CO3	Design of various combinational logic circuits using logic gates.
CO4	Design of combinational logic circuits using MSI circuits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3											3	2	
CO2	3	3											3	2	
CO3	3	3	2										3	2	
CO4	3	3	2										3	2	
AVG	3	3	2										3	2	

Syllabus

UNIT-1 (12 Hours)

Number Systems and Codes: Decimal, Binary, Octal and Hexadecimal number systems and their conversion. Number systems arithmetic; Complements: The r's Complement, the (r- 1)'s Complement, Subtraction using method of complements. Sign-magnitude representation,1's&2's complement representations, Codes: Introduction, Classification of Binary codes; BCD code, Excess-3 code, Gray code, Error detection and Correction codes.

UNIT-2 (12 Hours)

Boolean Algebra and Logic gates: Boolean Postulates & theorems, Digital Logic gates, Simplification of Boolean expressions, Implementation of Boolean expressions using logic gates, Canonical and Standard forms.

Minimization of Switching Functions: Simplification of logical functions using Karnaugh map method (Up to five variables), Don't-Care conditions, Quine- McCluskey minimization technique.

UNIT-3 (12 Hours)

Combinational Logic Design: General design Procedure, Design of: Half-Adder, Full-Adder, Half - Subtractor, Full – Subtractor. Design of Code converters, Ex-OR and Ex-NOR circuits, NAND and NOR implementation of Boolean functions.

UNIT-4 (12 Hours)

Combinational Logic Design Using MSI Circuits: Multiplexer, Combinational logic design using multiplexers, Demultiplexers / Decoders and their use in combinational logic design, Design of BCD to7 segment decoder, Magnitude comparator, Encoders.

Text Books:
1. M.Morris Mano, "Digital Logic and Computer Design", PHI 2003.
2. A.Anand Kumar, "Fundamentals of Digital Circuits", PHI 2006.

References:
1. R P Jain "Modern Digital Electronics", IVth ed., TMH.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PHYSICS LAB

I B.Tech. II Semester (Code: 20ECL201/PHL01)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical	: 3 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	: 1.5

Pre-Requisite: None.

Course Objectives: Students will Learn	
➢	Basic experiments such as Magnetic Field Measurements, Hall Effect and LCR resonance give the knowledge to apply them in magnetic applications
➢	The experiments CRO, Solar Cell, LASER diode provides the thorough understanding of OPTO Electronic devices useful in Engineering and Industrial applications
➢	The measurements relating to various physical parameters of materials make the student to understand their utility, design and fabrication of several devices.

Course Outcomes: At the end of the course, student will be able to	
CO1	Acknowledge the important aspects of earth magnetic field, realize the use of Maxwell's equations in various magnetic applications
CO2	Realization of material properties and parameters.
CO3	Get hands on experience in various opto-electronic devices like Solar Cell, Photo Cell and their applications.
CO4	Study The All Electronic Components like Diode, CRO

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2		3					2						
CO2	3	2		3					2						
CO3	3	2		3					2						
CO4	3	2		3					2						
AVG	3	2		3					2						

LIST OF EXPERIMENTS 36 Hours

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. Determination of thickness of thin wire using air wedge interference bands
4. Determination of radius of curvature of a Plano convex lens by forming Newton's rings..
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. Determination of dispersive power of a given material of prism using prism minimum deviation method.
7. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonant frequency.

8. Draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using sonometer.
10. Determine the rigidity modulus of the given material of the wire using Torsional pendulum.
11. Draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si & Ge.
15. Determination of wavelength of laser source using Diode laser.

Note: *Ten experiments compulsory in that any three experiments are virtual.*

Text Books : 1. Engineering physics laboratory manual: P.Srinivasarao & K.Muraldhar, Himalaya Publications.

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ENGLISH COMMUNICATION SKILLS LAB
I B.Tech. II Semester (Code: 20ECL202/ELL01)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical	: 3 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	: 1.5

Pre-Requisite: None.

Course Objectives: Students will be able	
➢	To comprehend the importance, barriers and strategies of listening skills in English
➢	To illustrate and impart practice Phonemic symbols, stress and intonation.
➢	To practice oral skills and receive feedback on learners' performance.
➢	To practice language in various contexts through pair work, role plays, group work and dialogue conversations

Course Outcomes: At the end of the course, student will be able to	
CO1	Better understand the nuances of English language through audio- visual experience and group activities
CO2	Develop neutralization of accent for intelligibility
CO3	Build confidence to enhance their speaking skills
CO4	Use effective vocabulary both in formal and informal situations

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1									3	2		2			
CO2									3	2		2			
CO3									3	2		2			
CO4									3	2		2			
AVG									3	2		2			

LIST OF EXPERIMENTS 36 Hours

1.1 Listening Skills; Importance – Purpose- Process- Types
1.2 Barriers to Listening
1.3 Strategies for Effective Listening

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds
2.2 Stress
2.3 Rhythm
2.4 Intonation

3.1Formal and Informal Situations
3.2 Expressions used in different situations
3.3 Introducing Yourself & Others-Greeting & Parting-Congratulating-Giving Suggestions & Advices-Expressing Opinions-Inviting People-Requesting-Seeking Permission-Giving Information- Giving Directions- Sympathizing- Convincing People- Complaining & Apologizing-Thanking Others- Shopping- Travelling- Conversational Gambits

4.1 JAM Session
4.2 Debates
4.3 Extempore

Text Books :
1. Communication Skills, Sanjay Kumar and PushpaLata. Oxford University Press. 2011
2. Better English Pronunciation, J.D. O' Connor. Cambridge University Press:1984
3. New Interchange (4rth Edition), Jack C Richards. Cambridge University Press:2015
4. English Conversation Practice, Grant Taylor. McGraw Hill:2001

Software:
1. Buzzers for conversations, New Interchange series
2. English in Mind series, Telephoning in English Speech Solutions, A Course in Listening and Speaking

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMMING WITH C++ LAB
I B.Tech. II Semester (Code: 20ECL203/CSL02)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will	
➢	Understand advantages of C++ programming over procedural oriented programming learn the basics of variables, operators, control statements, arrays, classes and objects.
➢	Understand, write and implement the following concepts: Inheritance, Interfaces, Packages, Strings and Collections
➢	Understand and write programs on Exception Handling, I/O, and Multithreading
➢	Understand and implement applications using Applets, AWT, Swings and Events

Course Outcomes: At the end of the course, student will be able to	
CO1	Understand basics of variables and operators such as variables, conditional and iterative execution methods etc.
CO2	Identify classes, objects, members of a class and relationships among them needed for a specific problem and Write C++ principles and proper program structuring.
CO3	Demonstrate the concepts of polymorphism, inheritance, packages and interfaces.
CO4	Write C++ to implement error-handling techniques using exception handling

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3				3				3						
CO2	3				3				3						
CO3	3				3				3						
CO4		2	2		3				3						
AVG	3	2	2		3				3						

LIST OF EXPERIMENTS 36 Hours

Write C++ programs to illustrate the concept of the following:

1. Arrays
2. Structures
3. Pointers
4. Objects and Classes
5. Console I/O operations
6. Scope resolution and memory management operators
7. Inheritance

8. Polymorphism
9. Virtual Functions
10. Friend Functions
11. Operator overloading
12. Function overloading
13. Constructors and Destructors
14. This pointer
15. File I/O operations

Note: *A minimum of ten programs are to be executed and recorded to attain eligibility for Practical examination.*

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROBABILITY AND STATISTICS

II B.Tech. III Semester (Code: 20EC301/MA03)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Apply the continuous probability densities to various problems in science and engineering.
➢	Estimate the point and interval estimators of the mean, variance and proportion for the given Sample data and apply Z-test, T-test to various real-life problems
➢	Apply various sample tests like F-test and $\chi 2$ -test for decision making regarding the Population based on sample data.
➢	Compute the level of correlation, the best fit curve to the given data by the method of least squares and also perform ANOVA arising in the field of engineering.

Course Outcomes: After studying this course, the students will be able to	
CO1	Apply discrete and continuous probability distributions to various problems arising in Engineering applications.
CO2	Perform Test of Hypothesis for a population parameter for single sample.
CO3	Perform Test of Hypothesis for population parameters for multiple samples.
CO4	Interpret the results of correlation, regression and one way ANOVA for the given data.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3										2			
CO2	3	3	2									2			
CO3	3	3	2									2			
CO4	3	3	3									2			
AVG	3	3	2.33									2			

Syllabus

UNIT-1 (12 Hours)

Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Gamma Distribution and its applications, Beta Distribution and its applications, Weibull distribution, Joint Distributions (Discrete), Joint Distributions (Continuous).

(Sections 5.1, 5.2, 5.3, 5.5,5.7, 5.8, 5.9, 5.10)

UNIT-2 (12 Hours)

Populations and Samples, The sampling distribution of the mean (σ known), The sampling distribution of the mean (σ unknown), The sampling distribution of the variance, Point estimation, Interval estimation, Tests of Hypotheses, Null Hypothesis and Tests of hypotheses, Hypothesis concerning one mean.

(Sections 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.4, 7.5, 7.6)

UNIT-3 (12 Hours)

Comparisons-Two independent Large samples, Comparisons-Two independent small samples, matched pairs comparisons, The estimation of variances, Hypotheses concerning one variance, Hypotheses concerning two variances.
(Sections 8.2, 8.3, 8.4, 9.1, 9.2, 9.3) .

UNIT-4 (12 Hours)

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions. The method of least squares, curvilinear regression, multiple regression, correlation, Completely Randomized Designs.
(10.1, 10.2, 10.3, 11.1, 11.3, 11.4, 11.6, 12.1, 12.2)

Text Books:
1. Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 8th Edition, PHI.

Reference:
1. R.E Walpole, R.H. Myers & S.L. Myers 'Probability & Statistics for Engineers and Scientists', 6th Edition, PHI.
2. Murray R Spiegel, John J.Schiller, R. AluSrinivasa, 'Probability &Satistics', Schaum's outline series.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SIGNALS AND SYSTEMS

II B.Tech. III Semester (Code:20EC302)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn how to	
➢	Perform basic mathematical operations on basic signals and classifying the systems
➢	Analyze the LTI system, Can evaluate systems response and Represent a continuous time periodic signal as a Fourier series and determine response of the LTI system to any input signal
➢	Use the Fourier transform to analyze continuous time signals and systems
➢	Perform sampling of low pass signals; verify correlation and computation of spectral densities.

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe the mathematical operations on standard signals and classification of systems.
CO2	Apply Fourier series for periodic continuous time signals to the frequency spectrum.
CO3	Apply the Fourier transform to continuous time signals and systems.
CO4	Convert the continuous time domain signals into discrete version, compute spectral densities and correlation of signals.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3		2											3
CO2	3	3		2											3
CO3	3	3		2											3
CO4	3	3		2											3
AVG	3	3		2											3

Syllabus

UNIT-1 (12 Hours)

Introduction: Signals and systems different types of signals, systems.

Mathematical description of Continuous–Time Signals: Functions and functional notation, signal functions, scaling and shifting, differentiation and integration, even and odd functions, periodic functions, signal energy and power.

Properties of Continuous –Time systems: Block diagram and system terminology, system modeling, system properties.

UNIT-2 (12 Hours)

Time-Domain Analysis of Continuous-Time Systems: The convolution integral, block diagram realization of differential equations.

The Continuous-Time Fourier Systems: Periodic excitation and response of LTI systems, Basic concepts and development of the Fourier series, Numerical computation of the Fourier series,

convergence of the Fourier series, properties of the Fourier series, band limited signals, responses of LTI systems with periodic excitation.

UNIT-3 (12 Hours)

The Continuous-Time Fourier Transform: Aperiodic excitation and response of LTI systems, Basic concepts and development of the Fourier transform. Convergence and the generalized Fourier transform, Numerical computation of the Fourier transform, Properties of the continuous time Fourier transform.

Continuous-Time Fourier Transform analysis of signals and systems: Frequency response, Ideal filters, and Practical passive filters.

UNIT-4 (12 Hours)

Sampling: Representing a continuous time signal by samples, Impulse sampling.

Correlation, Energy Spectral Density and Power Spectral Density: correlation and the correlogram, autocorrelation, cross correlation, correlations and the Fourier series, energy spectral density, power spectral density.

Text Books:

1. Fundamentals of Signals and Systems, 2nd Edition , Michel J Roberts, Govind Sharma, Tata McGraw Hill, 2010

References:

1. Signals and Systems, Simon Haykin, John Wiley,2004
2. Signals and Systems, A V Oppenheim, A S Wilsky& IT Young, PHI/Pearson, 2003
3. Signal, Systems and Communications, B P Lathi, BSP, 2003

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTRONIC DEVICES AND CIRCUITS

II B.Tech. III Semester (Code:20EC303)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Describe the characteristics of the p-n junction diode and some special function diodes.
➢	Obtain knowledge about the operation of different types of Rectifiers.
➢	Understand the operation and characteristics of B.J.T and the concepts of Transistor biasing and thermal stabilization.
➢	Understand the operation and characteristics of FET, MOSFET and the Operation Characteristics of PNPN and other electronic devices.

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe the characteristics of various semiconductor diodes.
CO2	Analyze and Design various rectifier circuits with and without filters.
CO3	Analyze the BJT characteristics and different biasing techniques.
CO4	Interpret the characteristics of FET and PNPN devices.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											2		
CO2	3	3	2										2		
CO3	3	3											2		
CO4	3	2											2		
AVG	3	2.5	2										2		

Syllabus

UNIT-1 (12 Hours)

The P-N Diode: Volt-Ampere equation, The Temperature Dependence of P-N characteristics, Diode Resistance (Static and Dynamic), Space Charge Capacitance, Diffusion Capacitance.

Special Diodes: Varactor Diode, Break Down diodes, Tunnel Diode, V-I characteristics of Tunnel Diode with the help of Energy Band Diagrams, Photo Diode, Light emitting diode.

UNIT-2 (12 Hours)

Rectifiers: Half wave, Full wave and Bridge Rectifiers without filter and with inductor filter, Capacitor filter, L-section and π-section filters.

UNIT-3 (12 Hours)

Transistors Characteristics: The Junction transistor, Transistor current components, Transistor as an amplifier, Common Base Configuration, Common Emitter Configuration, CE cut off region, CE Saturation region, CE current gain, Common Collector Configuration, Photo Transistor.

Transistor Biasing and Thermal Stabilization: Operating point, Bias Stability, Self Bias, Stabilization against variations in I_{CO}, V_{BE}, and β, Bias Compensation, Thermistor and Sensistor compensation, Thermal runaway, Thermal stability.

UNIT-4 (12 Hours)

Field Effect Transistors: The Junction Field Effect Transistor, Pinch-Offvoltage, JFET V-I Characteristics, FET Small signal model, Metal-Oxide-Semiconductor FET.

PNPN and Other Devices: SCR, DIAC, TRIAC, UJT and The Photo transistor (their characteristics only).

Text Books:

1. Integrated Electronics- Jacob Millman, Chritos C.Halkies, Tata Mc- Graw Hill, 2009.
2. Electronic Devices and Circuits – Salivahanan, Kumar, Vallavaraj, Tata McGraw Hill, SecondEdition.

References:

1. Electronic Devices and Circuits– J.Millman,C. C.Halkias, Tata Mc- Graw Hill.
2. Robert L Boylested and Louis Nashelsky, Electronic Devices and Circuit Theory, 8th Edition, PHI, 2003

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTROMAGNETIC FIELD THEORY

II B.Tech. III Semester (Code:20EC304)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand basic laws of electrostatics to determine electric field intensities and other parameters for various charge distributions.
➢	Learn the Maxwell's equations for static electric fields and apply the boundary conditions.
➢	Use the basic laws of magnetostatics for computing magnetic field intensities and understand the use of defining flux densities, magnetic potential and the energy density.
➢	Study the EM wave propagation in free space and various material media and use the Poynting vector for power calculations.

Course Outcomes: After studying this course, the students will be able to	
CO1	Determine electric field intensities and flux densities, electric potential and the energy density using the basic laws of electrostatics
CO2	Apply the Maxwell's equations on static electric fields to determine boundary conditions across different media and analyze the different capacitor problems.
CO3	Apply the basic laws of magnetostatics to determine magnetic field intensities and flux densities, magnetic potential and the energy density.
CO4	Analyze the EM wave propagation in free space, dielectric and conducting media and derive the expression for Poynting vector.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													2
CO2	3	2													2
CO3	3	2													2
CO4	2	3													2
AVG	2.75	2.25													2

SYALLABUS

UNIT-1 (12 Hours)

ELECTROSTATICS–I

The experimental law of coulomb, Electric field intensity, Field due to a continuous volume charge distribution, Field of a line charge, sheet of charge. Electric Flux Density, Guass's law, Applications of Gauss law, Divergence, Maxwell's First equation (Electrostatics), Energy expended in moving a point charge in an electric field, The line integral, Definition of potential and potential difference. The potential field of a point charge, system of charges, potential gradient, the dipole and Energy density in electrostatic field.

UNIT-2 (12 Hours)

ELECTROSTATICS –II

The nature of dielectric materials, boundary conditions for perfect dielectric materials. Capacitance. Several capacitance examples. Capacitance of a two wire line. Derivations of Poisson's and Laplace's equations, Examples of the solution of Laplace's equation. Current and current density, continuity of current, conductor properties and boundary conditions.

UNIT-3 (12 Hours)

THE STEADY MAGNETIC FIELD

Biot-Savart Law, Ampere's Circuital Law, Magnetic Flux and Magnetic Flux Density, The scalar and vector magnetic potentials. Magnetic Forces and Materials: Force on a moving charge, Force on a differential current element, Force between differential current elements, Force and torque on a closed circuit, the nature of magnetic materials, Magnetization and Permeability. Magnetic boundary conditions. Potential energy in magnetic fields

UNIT-4 (12 Hours)

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS

Faraday's law, Displacement current, Maxwell's equations in point form, integral form.

THE UNIFORM PLANE WAVE

Wave propagation in free space, dielectrics. Poynting theorem and wave power. Propagation in good conductors: skin effect. Wave polarization

Text Books :
1. W H Hayt, J A Buck, J Akhtar Engineering Electromagnetics, 8th Edition McGraw Hill Education, 2014.
2. EC Jordan and KG Balmain, Electromagnetic Waves and Radiating Systems, 2nd Edition, Prentice Hall of India

References :
1. Mathew NO Sadiku, Elements of Electromagnetics, Oxford University Press, 2003.
2. Joseph A Edminister, Theory and Problems of Electromagnetics, 2nd Edition, Schaum's Outline Series, Mc-Graw Hill International, 1993.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL LOGIC DESIGN

II B.Tech. III Semester (Code: 20EC305)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Fundamentals of Digital Electronics

Course Objectives: Students will	
➢	Understand the basic knowledge of flip flops and its application
➢	Design of various digital circuits.
➢	Illustrate the importance of different Logic Families
➢	Implement PLD's

Course Outcomes: After studying this course, the students will be able to	
CO1	Learn the concept of flip-flops and its functionality.
CO2	Design of different sequential circuits like counters, Registers.
CO3	Compare various digital logic families for IC implementation
CO4	Design of digital circuits using various Programmable Logic Devices (PLDs)

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2												2	
CO2		2	3											2	
CO3	3	2											2	2	
CO4	2	2	3											2	
AVG	2.67	2	3										2	2	

Syllabus

UNIT-1 (12 Hours)

Synchronous Sequential Logic:

Architectural Distinctions between Combinational and Sequential circuits, Latches, Flip-Flops, RS- Latch using NAND and NOR Gates, Characteristic Tables, Excitation Tables and Characteristic equations of SR, JK, D, T and Master slave JK flip-flop, Conversion from one type of Flip-Flop to another.

UNIT-2 (12 Hours)

Synchronous Sequential Circuits:

Introduction, Analysis procedure, Circuits with latches, Design procedure.

Registers and Counters:

Registers, shift Registers, Left shift, Right shift, SISO, SIPO, PIPO, PISO, Bidirectional Shift Register, Universal Shift Register, Design of Asynchronous and Synchronous Counters, Modulus of the Counters, Ripple Counters, Ring Counter, Johnson Counter, up-down counter

UNIT-3 (12 Hours)

Logic Families: Significance of families, Characteristic parameters, types of Logic families: RTL, DTL, I^2L, TTL, TTL NAND gate with totem pole output, TTL TRI STATE logic ECL, MOS, CMOS, NMOS and PMOS. Comparison between various logic families.

UNIT-4 (12 Hours)

Memory and Programmable Logic Devices: Classification of memories, ROM: ROM organization, PROM, EPROM, EEPROM, RAM: RAM organization, Write operation, Read operation, Static RAM, Programmable Logic Devices: Programmable Logic Array (PLA) Programmable Array Logic, Implementation of Combinational Logic circuits using ROM, PLA, PAL.

Text Books:
1. M. Morris Mano "Digital Logic and Computer Design", PHI2003.
2. RP Jain "Modern Digital Electronics", IVth ed., TMH.

References:
1. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI2006.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DATA STRUCTURES USING PYTHON

II B.Tech. III Semester (Code:20EC306/SOC1)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	2

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn the features of python and fundamentals of python programming.
➢	Implement the linear data structures like linked list, stacks, queues and double ended queues using python.
➢	Study the concept of trees, tree traversal techniques and its implementations using python
➢	Understand the Concept of graph representations and searching techniques implementations using python

Course Outcomes: After studying this course, the students will be able to	
CO1	Demonstrate the Python programming skills to solve engineering problems.
CO2	Apply python programming to linear and non-linear data structures for efficient memory management.
CO3	Analyze various trees and demonstrate tree traversal techniques.
CO4	Interpret graphs and evaluate various traversal algorithms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3			2									2	2
CO2	2	3			2									2	2
CO3	2	3			2									2	2
CO4	2	3			2									2	2
AVG	2	3			2									2	2

Syllabus

UNIT-1 (12 Hours)

Python Primer: Python overview, objects in Python, Expressions, operators and precedence, Control flow, functions, simple Input and Output, iterators and generators, additional python conveniences, Scopes and namespaces, Modules and the import statement.

Array-Based Sequences: python's sequence types, low-level arrays, dynamic arrays and amortization, efficiency of python's sequence types: python's list and tuple classes, python's string class.

UNIT-2 (12 Hours)

Linked lists: Singly linked list, circularly linked list, doubly linked list.

Stacks: The stack abstract data type, Simple array-based stack implementation, reversing data using a stack, implementing stack with a linked list.

Queues: The queue abstract data type, Array based queue implementation, implementing queue with a linked list.

Double-ended queues: the DE queue abstract data type, implementing a de queue with a circular array, implementing de queue with a linked list, de queues in the python collections module.

UNIT-3 (12 Hours)

Trees: Tree definitions and properties, tree abstract data type, computing depth and height, binary trees, linked structure for binary tree, Array-based representation of a binary tree, tree traversal algorithms, binary search trees, AVL trees.

UNIT-4 (12 Hours)

Graph: The Graph ADT, Edge list structure, Adjacency list structure, Adjacency map structure, Adjacency matrix structure, Graph traversal algorithms: depth first search, breadth first search, minimum spanning trees

Text Books :
1. Michael T. Good Rich, Roberto Tamassia, Michael H. Gold wasser. "Data Structures & Algorithms", John Wiley & sons 2013.
2. Y. Daniel Liang, "Introduction to programming using python", Pearson, 2013.

References :
1. Bill Lubanovic," Introducing Python Modern Computing in Simple Packages", O Reilly Publication, 1st Edition, 2015.
2. R. Nageswara Rao, "Core python programming", Dream tech, 2017
3. Mark Summer field, "Programming in Python3", Pearson Education, 2nd Edition.
4. Magnus Lie Hetland "Beginning Python – From Novice to Professional", A Press Publication, 3rd Edition, 2017

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DATA STRUCTURES USING PYTHON LAB

II B.Tech. III Semester (Code: 20ECL301)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical	: 3 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	: 1.5

Pre-Requisite: Data Structures.

Course Objectives: Students will be able to	
➢	Implement different searching and sorting techniques.
➢	Create different linear data structures like linked lists, stacks, and queues.
➢	Create non-linear data structures like trees and graphs.
➢	Understand the searching mechanism like depth first search and breadth first search.

Course Outcomes: At the end of the course, student will be able to	
CO1	Compose different sorting and searching algorithms
CO2	Implement linear data structures like linked list, stacks, and queues.
CO3	Develop non-linear data structures like trees and graphs.
CO4	Demonstrate traversal techniques on non-linear data structures.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3			2				3					2	2
CO2	2	3			2				3					2	2
CO3	2	3			2				3					2	2
CO4	2	3			2				3					2	2
AVG	2	3			2				3					2	2

LIST OF EXPERIMENTS

36 Hours

1. Python program to implement bubble sort, selection sort, insertion sort.
2. Python program to implement merge sort, quick sort
3. Python program on linear search and binary search.
4. Python program to implement Singly Linked List
5. Python program to implement Doubly Linked List
6. Python program to implement Circular Linked List
7. Python programs to implement stacks using arrays and linked lists.
8. Python programs to implement queues using arrays and linked lists.
9. Python programs to implement double ended queues.
10. Python program to perform Binary Tree traversal operations.
11. Python programs to perform Binary search tree operations

12. Python program to create different types of graphs using graph ADT.
13. Python program to Traversing graph using Depth first search.
14. Python program to Traversing graph using breadth first search.

Note: *A minimum of 10 (Ten) Programs have to be performed and recorded by the candidate to attain eligibility for Semester End Examination.*

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTRONIC DEVICES LAB

II B.Tech. III Semester (Code: 20ECL302)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical	: 3 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	: 1.5

Pre-Requisite: None.

Course Objectives: Students will	
➢	Study the V-I characteristics of various semiconductor devices
➢	Simulate the V-I characteristics of various semiconductor devices using Software
➢	Learn the various bias circuits of B.J.T.
➢	Simulate the various bias circuits of B.J.T using software

Course Outcomes: At the end of the course, student will be able to	
CO1	Plot the V-I characteristics of various semiconductor devices
CO2	Simulate the characteristics of various semiconductor devices using software.
CO3	Design of fixed, collector to base and self-bias circuits for BJT.
CO4	Simulate fixed, collector to base and self-bias circuits for B.J.T using Software.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2			3					3				2		
CO2					2				3				2		
CO3	2			3					3				2		
CO4					2				3				2		
AVG	2			3	2				3				2		

LIST OF EXPERIMENTS 36 Hours

1. Characteristics of Silicon and Germanium diodes (Hardware)
2. Characteristics of Zener diode and its regulation characteristics (Hardware)
3. Characteristics of BJT in Common Base configuration.(Hardware)
4. Characteristics of BJT in Common Emitter configuration.(Simulation /Hardware)
5. Characteristics of Emitter follower circuit..(Simulation/Hardware)
6. Output and Transfer Characteristics of JFET.(Hardware)
7. Characteristics of UJT. (Hardware)
8. Design and verification of self-bias circuit for BJT. .(Simulation/Hardware)
9. Design and verification of collector to base bias circuit for BJT.(Simulation/Hardware)
10. Design and verification of Fixed bias circuit for BJT.(Hardware)

11. Voltage Regulator using BJT. (Simulation/Hardware)
12. Characteristics of SCR.
13. Study of CRO.
14. Characteristics of Triac.
15. Characteristics of Photo Transistor.

NOTE: *A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examination*

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SIGNALS AND SYSTEMS LAB

II B.Tech. III Semester (Code: 20ECL303)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to	
➢	Describe the MATLAB syntax, functions and programming
➢	Simulate various continuous and discrete time signals using MATLAB
➢	Perform basic operations on signals and sequences by using MATLAB
➢	Compute convolution, correlation between signals and sequences

Course Outcomes: At the end of the course, student will be able to	
CO1	Demonstrate the MATLAB syntax, functions and programming.
CO2	Generate and characterize various continuous and discrete time signals by using MATLAB
CO3	Examine basic operations on signals and sequences by using MATLAB
CO4	Analyze LTI systems by using convolution and correlation

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2				3				3						3
CO2	2				3				3						3
CO3	2				3				3						3
CO4	2				3				3						3
AVG	2				3				3						3

LIST OF EXPERIMENTS 36 Hours

1. Basic Operations on Matrices
2. Program to show how to create a variety of 2-D plots in MATLAB.
3. Generation of basic continuous time signals namely unit impulse, step, ramp, exponential and Sinusoidal signals.
4. Generation of basic discrete time signals namely unit impulse, step, ramp, exponential and Sinusoidal signals.
5. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
6. Finding the Even and Odd Parts of Signal or Sequence and Real and Imaginary Parts of Signal.

7. Verification of linearity and time invariance properties of a given Continuous/discrete system.
8. Convolution between Signals and Sequences.
9. Auto-correlation and Cross-correlation between Signals and Sequences.
10. Sampling Theorem Verification.

NOTE: *All the experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examination*

BAPATLA ENGINEERING COLLEGE:: BAPATLA

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INDIAN CONSTITUTION

II B.Tech. III Semester (Code:20EC307/MC03)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	--	Credits	:	0

Pre-Requisite: None

Course Objectives: Students will learn	
➢	The importance of fundamental rights as well as fundamental duties
➢	The powers of Union government in Indian federal system
➢	The functioning of Indian Parliamentary System at State level
➢	The administration of local government and activities of election commission of India

Course Outcomes: After studying this course, the students will be able to

CO1	Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen and to implant morality, social values, and their social responsibilities.
CO2	Analyze the distribution of powers between Center and State and differentiate the roles of President and Cabinet.
CO3	Differentiate the functioning of Indian Parliamentary System at State level.
CO4	Get acquainted with Local Administration and Election Commission.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						3		3							
CO2						3		3							
CO3						3		3							
CO4						3		3							
AVG						3		3							

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION: Constitution meaning of the term, Indian Constitution: Sources, Features, Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-2 (12 Hours)

UNION GOVERNMENT AND ITS ADMINISTRATION: Structure of the Indian Union: Federal System, Centre- State relations, President: Role, power and position, PM and Central Council of ministers, Central Secretariat

UNIT-3 (12 Hours)

STATE GOVERNMENT AND ITS ADMINISTRATION: Governor: Role and Position, CM and State Council of ministers, State Secretariat: Organization, Structure and Functions

UNIT-4 (12 Hours)

LOCAL ADMINISTRATION: District's Administration head: Role and Importance, Municipalities: 74Th Amendment Act of 1992, Panchayati raj: 73rd Amendment Act of 1992,Role and functioning of ECI

Text Books :
1. Laxmikanth 'Indian Polity'-6th edition- McGraw- hill, India.
2. Dr.P.K.Agrawal, 'Constitution of India', Dr. K. N. Chaturvedi -Kindle Edition..

References :
1. D.D. Basu,'Indian Constitution'-24th edition-lexis nexis publishers.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COMPLEX VARIABLES AND SPECIAL FUNCTIONS

II B.Tech. IV Semester (Code:20EC401/MA04)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Perceive the importance of acquiring sufficient knowledge on underlying principles of complex analysis and their prominent roles in various applications of numerous concepts.
➢	Determine Taylor and Laurent series expansions of the given functions and utilize residue concept to evaluate many difficult real integrals.
➢	Apply the ideas of Fourier Integrals, Fourier Transforms and their Inverses for addressing the real world problems in an effective manner.
➢	Analyze the properties of Special Functions for the empirical principles of effect hierarchy in recurrence relations and obtain the relevant Series Solutions for differential equations in different cases to overcome the challenging circumstances.

Course Outcomes: After studying this course, the students will be able to	
CO1	Make use of fundamentals of Complex Analysis like n roots of Complex number, Analytic Function, Continuity, Harmonic Conjugates and their important role of applicability in various concepts.
CO2	Evaluate certain complicated real integrals under Contour integration using residue calculus and also derive the series expansions of given functions by Taylor series and Laurent Series.
CO3	Utilize various properties and applications of Fourier transforms, their inverses including Convolution Theorem in handling scientific and technical applications.
CO4	Identify the meaningful Series Solutions for Differential Equations and analyze the Properties of Special Functions in solving specific engineering problems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2									3			
CO2	3	3	2									2			
CO3	3	3	2									3			
CO4	3	3	2									2			
AVG	3	3	2									2.5			

Syllabus

UNIT-1 (12 Hours)

Complex Numbers and functions: Complex Numbers; Geometric Representation of Imaginary numbers; Roots of a complex number; Complex function; Real and imaginary parts of circular and hyperbolic functions.

Calculus of complex functions: Introduction; Limit of a complex function; Derivative of f(z); Analytic functions; Harmonic functions; Complex integration; Cauchy's theorem; Cauchy's integral formula.
[Sections: 19.1; 19.2; 19.5; 19.7; 19.12; 20.1; 20.2; 20.3; 20.4; 20.5;20.12; 20.13; 20.14]

UNIT-2 (12 Hours)

Calculus of complex functions: Series of complex terms; Taylor series; Laurent's series; Zeros of an analytic function; Singularities of an analytic function; Residues; Residue theorem; Calculation of residues; Evaluation of real definite integrals: Evaluation around the unit circle, Evaluation around a small semi-circle.
[Sections: 20.16.1; 20.16.2; 20.16.3; 20.17.1; 20.17.2; 20.18.1; 20.18.2; 20.19; 20.20]

UNIT-3 (12 Hours)

Fourier transforms: Introduction; Definition; Fourier integral theorem (without proof); Fourier sine and cosine integrals; Complex form of Fourier integrals; Fourier integral representation of a function; Fourier transforms; Properties of Fourier transforms; Convolution theorem (without proof); Fourier transforms of the derivative of a function.
[Sections: 22.1; 22.2; 22.3.1; 22.3.3; 22.3.4; 22.4; 22.5; 22.6.2; 22.9]

UNIT-4 (12 Hours)

Series Solution of Differential Equations and Special Functions: Introduction; Validity of series solution; Series solution when x = 0 is ordinary point of the equation; Frobenius method; Bessel's function; recurrence formula for Jn(x); expansions for J0 and J1; value of J1/2; generating function for Jn(x); Orthogonality of Bessel functions.
[Sections: 16.1;16.2;16.3;16.4;16.5,16.6;16.7;16.8;16.9;16.11]

Text Books:
1. B.S.Grewal, "Higher Engineering Mathematics", 44th edition, Khanna publishers, 2017.

References:
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. P.Bali and M.Goyal,"A Text book of Engineering Mathematics" Laxmi Publications, 2010.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTRONIC CIRCUIT ANALYSIS

II B.Tech. IV Semester (Code:20EC402)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Electronic Devices and Circuits

Course Objectives: Students will	
➢	Design and analyze transistor circuits at low frequencies using the hybrid model.
➢	Analyze distortion in multistage amplifiers and also develop skills in identifying and mitigating performance limitations.
➢	Evaluate the impact of feedback on amplifier circuit parameters gain, resistance, and distortion factors
➢	Understand the principle of oscillation and design different types of oscillators.

Course Outcomes: After studying this course, the students will be able to	
CO1	Apply h-parameter methods to design and analyze transistor circuits at low frequencies.
CO2	Identify and address distortion and frequency response issues in transistor amplifiers..
CO3	Evaluate feedback impact on amplifier circuits, optimizing performance by considering gain, resistance, and distortion factors.
CO4	Select appropriate oscillator configurations for targeted applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											3		
CO2	3	2											3		
CO3	3	3											3		
CO4	3	3	2										3		
AVG	3	2.5	2										3		

Syllabus

UNIT-1 (12 Hours)

BJT at low frequency: Transistor Hybrid model, Determination of h-parameters from characteristics, Analysis of transistor amplifier using h-parameter model, Emitter follower, Millers theorem and its dual, Cascading transistor amplifiers, Simplified CE & CC Hybrid models, CE Amplifier with an Emitter Resistance, High Input Resistance Transistor Circuits – Darlington pair, Boot strapped Darlington pair.

FET at low frequency: FET Small signal model, Common Source and Common Drain configurations at low frequencies.

UNIT-2 (12 Hours)

Multi stage amplifiers: Classification of amplifiers, Distortion in amplifiers, Frequency response of an amplifier, Methods of Coupling (Direct, Transformer, RC Coupling), RC-coupled

amplifier, Effect of emitter bypass capacitor on low-frequency response.

Power amplifiers: Class-A large-signal amplifier, Second-harmonic distortion, Higher-order harmonic distortion, Transformer coupled audio power amplifier, Efficiency, Push-pull amplifiers, Class-B amplifier, Class-AB operation.

UNIT-3 (12 Hours)

Feedback amplifiers: Classification of amplifiers, The feedback concept, Transfer gain with feedback, General Characteristics of Negative Feedback Amplifiers, Input & Output resistance, Method of analysis of a feedback amplifier, Voltage-series feedback, Voltage-series feedback pair, Current- series feedback, Current- shunt feedback, Voltage-shunt feedback.

UNIT-4 (12 Hours)

Oscillators: Barkhausen criterion for sinusoidal oscillators, RC-Phase shift oscillator using FET and BJT, Wien-bridge Oscillator. General form of LC oscillators, Hartley, Colpitts oscillators using BJT Crystal oscillator, Frequency stability criterion for oscillators.

Text Books:
1. Jacob Millman and Christos C Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw-Hill Education, 2003.
2. S. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits by, 3rd Edition, Tata McGraw-Hill Education, 2012.

References:
1. N.N.Bhargava, D.C.Kulshrestha and S.C.Gupta Basic Electronics and Linear Circuits by, TTTISeries, TataMcGraw-Hill Education, 2003.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTRO MAGNETIC WAVES AND TRANSMISSION LINES

II B.Tech. IV Semester (Code:20EC403)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand concepts related to reflections and transmission of plane wave at different interfaces.
➢	Study the characteristics of various transmission lines and use the Smith chart to solve various parameters.
➢	Analyze the different modes of propagation in rectangular waveguides
➢	Deduce the wave equations for different modes of propagation in circular waveguides.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze the reflection and refraction mechanisms of plane waves in different media.
CO2	Analyze the characteristics the lossy, lossless and distortion less microwave transmission lines and apply the Smith chart to solve various transmission line parameters.
CO3	Solve the wave equations for different modes of propagation in rectangular waveguides and analyze its characteristics.
CO4	Derive the wave equations for different modes of propagation in circular waveguides and analyze its characteristics.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3													2
CO2	2	3													2
CO3	2	3													2
CO4	2	3													2
AVG	2	3													2

Syllabus

UNIT-1 (12 Hours)

REFLECTION AND REFRACTION OF PLANE WAVES

Reflection by a perfect conductor-Normal incidence, Reflection by a perfect conductor-oblique incidence, Reflection by a perfect dielectric-Normal incidence, Reflection by a perfect insulator-oblique incidence, Reflection at the surface of a conductive medium, surface impedance.

UNIT-2 (12 Hours)

MICROWAVE TRANSMISSION LINES

Introduction, transmission line equations and solutions, reflection coefficient and transmission

coefficient, standing wave and standing wave ratio, line impedance and admittance, smith chart, impedance matching-single stub matching.

UNIT-3 (12 Hours)

RECTANGULAR WAVEGUIDES

Solutions of wave equations in rectangular coordinates, TE modes in rectangular waveguides, TM modes in rectangular waveguides, power transmission in rectangular waveguides, power losses in rectangular waveguides, excitations of modes in rectangular waveguides, characteristics of standard rectangular waveguides.

UNIT-4 (12 Hours)

CIRCULAR WAVEGUIDES

Solutions of wave equations in cylindrical coordinates, TE modes in circular waveguides, TM modes in circular waveguides, TEM modes in circular waveguides, power transmission in circular waveguides or coaxial lines, power losses in circular waveguides, excitations of modes in circular waveguides, characteristics of standard circular waveguides

Text Books:

1. Edward Jordan, Keith G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI India. (Unit I).
2. Samuel Y Liao, Microwave Devices & Circuits, 3rd edition, PHI India (Unit II, III, IV).

References:

1. R.K.Shevgaonkar Electromagnetic waves by, Tata McGraw Hill.
2. P A Rizzi, Micro Wave Engineering: Passive Circuits, PHI, 2002.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANALOG COMMUNICATION

II B.Tech. IV Semester (Code:20EC404)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn	
➢	Fundamental concept of analog communication systems.
➢	Bandwidth and power requirements for various analog modulation schemes.
➢	Various analog modulation and demodulation techniques in analog communication systems.
➢	The importance of noise considerations in communication systems.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand Amplitude Modulation in time and frequency domains.
CO2	Analyze SSB &VSB modulation in time and frequency domains
CO3	Analyze transmission of signals using frequency modulation techniques
CO4	Evaluate the noise performance of different modulation techniques by calculating SNR

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2										2		3
CO2	3	2	2										2		3
CO3	3	2	2										2		3
CO4	3	2	2										2		3
AVG	3	2	2										2		3

Syllabus

UNIT-1 (12 Hours)

AMPLITUDE MODULATION: Time domain description, Frequency domain description, Single tone modulation, Generation of AM wave, Square law modulator, Switching Modulator, Detection of AM waves, Square law detector, Envelope detector, DSB-SC Modulation, Time domain and frequency domain descriptions of DSB-SC, Generation of DSB-SC: Balanced modulator, Coherent detection of DSBSC modulated waves, Costas loop, Quadrature-Carrier multiplexing.

UNIT-2 (12 Hours)

SSB AND VSB MODULATIONS: Band-pass transmission, Complex low-pass representation of Narrow-band signals, Concepts of pre-envelope, Complex envelope and Natural envelope, Equivalent low-pass transmission model, Single side band modulation: Frequency domain description, Generation of SSB-SC wave, Frequency-discrimination method, Phase discrimination method, Demodulation of SSB-SC waves, Vestigial side-band modulation, Frequency domain description, Generation of VSB modulated wave, Envelope detection of VSB wave plus carrier, Comparison of AM techniques, Frequency Division Multiplexing (FDM).

UNIT-3 (12 Hours)

ANGLE MODULATION: Introduction to Angle modulation, Relation between frequency Modulation and phase modulation, Single tone frequency modulation, Spectrum analysis of sinusoidal FM wave, Narrow Band FM and Wide Band FM, Transmission bandwidth of FM waves, Carson's Rule, Generation of FM waves, Indirect FM (Armstrong Method), Direct FM, Demodulation of FM waves, Balanced frequency discriminator – Zero-crossing detector, Linearized model of PLL, FM demodulation employing first order PLL, Practical Considerations, FM limiters, Applications

UNIT-4 (12 Hours)

DISCRETE MODULATION: Generation and Demodulation of PAM, PWM and PPM;TDM, Comparison of Discrete Modulation Techniques.

NOISE IN ANALOG MODULATION: AM Receiver model, Signal to noise ratios for coherent reception. DSB-SC receiver, SSC-SC receiver, Noise in AM receivers using envelope detection. AM threshold effect, FM receiver model, Noise in FM reception, Capture effect in FM, Threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM

Text Books:
1. Simon Haykin, Introduction to Analog and Digital Communication Systems, John Wiley and Sons, 3rd Edition, 2001
2. LeonWCouch-II, Digital and Analog Communication Systems, Pearson Education, 2004

References:
1. Taub and Schilling, Principles of Communication Systems, TMH, 2nd Edition, 1986
2. Sam Shanmugam, Analog and Digital Communication Systems, John Wiley,1992

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICRO PROCESSORS AND MICRO CONTROLLERS

II B.Tech. IV Semester (Code:20EC405/SOC2)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 2

Pre-Requisite: Digital Electronics

Course Objectives: Students will	
➢	Illustrate the architecture of 8086 microprocessor.
➢	Introduce the programming and interrupts of 8086 microprocessor.
➢	Understand the interfacing circuits for various applications of 8086 microprocessor.
➢	Analyze the basic concepts and programming of 8051 microcontroller.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze Architecture, Instruction set, Addressing modes and assembler directives of Intel 8086 to realize control applications.
CO2	Interpret IDE usage for developing efficient assembly language programs for 8086. .
CO3	Interface various programmable peripherals with 8086 to realize microcomputer based system.
CO4	Analyze Architectural features, Instruction Set and on-chip and off-chip peripherals using 8051 for control applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3		2									2	3	
CO2	2	3	2		2									3	
CO3	2	3	2											3	
CO4	2	3											2	3	
AVG	2	3	2	2	2								2	3	

Syllabus

UNIT-1 (12 Hours)

MICROPROCESSOR:

Introduction to microcomputers and microprocessors, introduction and architecture of 8086 family, addressing modes, instruction description and assembler directives of 8086 microprocessors, 80386, 80486 and introduction to ARM processor.

UNIT-2 (12 Hours)

8086 PROGRAMMING AND SYSTEM CONNECTIONS:

Program development steps, writing programs for use with an assembler, assembly language program development tools, writing and using procedures and assembler macros. 8086 interrupts and interrupt responses.

UNIT-3 (12 Hours)

DIGITAL INTERFACING:

Programmable parallel ports, handshake IO, 8255 programmable peripheral interface. Interfacing microprocessor to keyboards.

ANALOG INTERFACING:

DAC principle of operation and interfacing.

PROGRAMMABLE DEVICES:

Introduction to Programmable peripheral devices 8254,8259, 8251, DMA data transfer, 8237 DMA controller, RS232 communication standard and maximum mode of 8086 operation.

UNIT-4 (12 Hours)

INTRODUCTION TO MICROCONTROLLERS:

Comparing microprocessors and microcontrollers, Architecture of 8051, pin configuration of 8051microcontroller, hardware input pins, output pins ports and external memory, counters and timers, serial data input and output and interrupts. Programming &amp.

INTERFACING 8051:

Addressing modes of 8051 microcontroller, Instruction set of 8051 microcontroller, simple programs using 8051 microcontroller. Interfacing a stepper motor, ADC.

Text Books :
1. Douglas V. Hall, Microprocessor and Interfacing, Revised 2 nd Edition, TMH, 2006.
2. Mohammed Ari Mazidi and JanciGillispie, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi.

References :
1. AK Ray and KM Bhurchandi Advanced Microprocessors and Peripherals 2nd Edition, TMH.
2. Kenneth Ayala The 8051 Microcontroller, 3rd Edition, Cengage Learning

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

TECHNICAL ENGLISH

II B.Tech. IV Semester (Code:20EC406/EL02)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn how to	
➢	At enhancing the vocabulary competency of the students
➢	To enhance the understanding of the elements of grammar
➢	To enable the students to use proper spelling, grammar in constructing the sentences
➢	To enhance the learner's ability to communicate accurately

Course Outcomes: After studying this course, the students will be able to	
CO1	Make use of contextual clues to infer meanings of unfamiliar words from context
CO2	Understand how to apply technical information and knowledge in practical documents for a variety of purposes
CO3	Analyze the content of the text in writing use grammatical, stylistic, and mechanical formats and conventions appropriate to various audiences and disciplines
CO4	Build confidence to participate actively in writing activities (individually and in collaboration) that model effective technical communication in the workplace

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1								2	2	3		2			
CO2								2	2	3		2			
CO3								2	2	3		2			
CO4								2	2	3		2			
AVG								2	2	3		2			

Syllabus

UNIT-1 (12 Hours)

1.1 Vocabulary Development: Familiarizing Idioms &Phrases
1.2 Grammar for Academic Writing: Making Requests
1.3 Language Development: Using Transition & Link words
1.4 Technical Writing: Letter Writing &Email Writing

UNIT-2 (12 Hours)

2.1 Vocabulary Development: Analogous words, Gender Sensitive language
2.2 Grammar for Academic Writing: Tenses: Simple Past /Present Perfect, The Future: Predicting &Proposing
2.3 Language Development: Cloze tests
2.4 Technical Writing: Technical Reports

UNIT-3 (12 Hours)

3.1 Vocabulary Development: Abbreviations &Acronyms
3.2 Grammar for Academic Writing: Describing (People/Things/Circumstances): Adjectival

&Adverbial groups
3.3 Language Development: Transcoding (Channel conversion from chart to text)
3.4 Technical Writing: Circular, Memos, Minutes of Meeting

UNIT-4 (12 Hours)

4.1 Vocabulary Development: Corporate vocabulary
4.2 Grammar for Academic Writing: Inversions &Emphasis
4.3 Language Development: Reading Comprehension
4.4 Technical Writing: Resume Preparation

Text Books :
1. Communication Skills, Sanjay Kumar & Pushpa Latha. Oxford University Press: 2011.
2. Technical Communication Principles and Practice. Oxford University Press: 2014.

References :
1. Advanced Language Practice, Michael Vince. Macmillan Publishers: 2003.
2. Objective English (Third Edition), Edgar Thorpe & Showick. Pearson Education: 2009
3. English Grammar: A University Course (Second Edition), Angela Downing Philip Locke, Routledge Taylor &Francis Group 2016

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTRONIC CIRCUITS LAB

II B.Tech. IV Semester (Code: 20ECL401)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: Fundamentals of EDC Lab .

Course Objectives: Students will	
➢	Acquire a basic knowledge in solid state electronics including diodes, BJT,FET and their applications
➢	Develop the ability to analyze and design analog electronic circuits using discrete Components
➢	Generate simulations for the desired circuits using OrCAD PSpice circuit design software.

Course Outcomes: At the end of the course, student will be able to	
CO1	Illustrate the characteristics of the diodes and its diverse applications including rectifiers and clippers and compare with the simulated outputs.
CO2	Design small signal amplifiers for given specifications using discrete components and verify using PSpice circuit design software
CO3	Distinguish the working of small signal amplifiers and power amplifiers.
CO4	Design the different types of oscillator circuits using BJT.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3		3	3				3				3		
CO2	3	3		3	3				3				3		
CO3	3	3		3					3				3		
CO4	3	3		3					3				3		
AVG	3	3		3	3				3				3		

LIST OF EXPERIMENTS 36 Hours

1. Rectifiers (**Simulation/Hardware)**
2. Clippers and Clampers (**Simulation/Hardware**)
3. Frequency response of CE amplifier (**Simulation/Hardware**)
4. Frequency response of Common-Source Amplifier Using FET(**Simulation/Hardware)**
5. Frequency response of Two stage RC-coupled amplifier (**Simulation/Hardware)**
6. Class A Power Amplifier (**Simulation/Hardware**)
7. Complementary Symmetry Push pull Power Amplifier **(Hardware)**

8. Voltage shunt feedback amplifier **(Hardware)**
9. RC-phase shift oscillator **(Hardware)**
10. Colpitt's oscillator **(Hardware)**

NOTE: *All the experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examination*

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL LOGIC DESIGN LAB

II B.Tech. IV Semester (Code: 20ECL402)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: Fundamentals of Digital Electronics.

Course Objectives: Students will be able	
➢	To apply knowledge of Boolean algebra fundamentals to realize digital systems
➢	To design and conduct experiments related to various combinational logic circuits
➢	To implement various sequential logic circuits.
➢	To design and conduct experiments related to counters and registers.

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

CO1	Realize different logic gates using discrete components and universal gates
CO2	Design and test various combinational logic circuits experimentally
CO3	Realize various operations using Digital ICs experimentally
CO4	Design and test various sequential logic circuits experimentally

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2		3					3				2	2	
CO2	2	2	3	3					3				2	2	
CO3	2	2		3					3				2	2	
CO4	2	2	3	3					3				2	2	
AVG	2	2	3	3					3				2	2	

LIST OF EXPERIMENTS

36 Hours

1. Realization of Gates using Discrete Components.
2. Realization of Gates using Universal Building Block (NAND only).
3. Design of Combinational Logic Circuits like Half–adder, Full–adder, Half– Subtractor and Full-Subtractor.
4. Verification of 4-bit Magnitude Comparator.
5. Design of Encoders like 4:2 and 8:3encoder.
6. Design of Decoders like BCD to Decimal decoder.
7. Design of Code Converters (Binary to Gray).
8. Design of Multiplexers/ De Multiplexers.
9. Verification of Truth Table of Flip-Flops using Gates.

10. Design of Shift register (To Verify Serial to parallel, parallel to Serial, Serial to Serial and parallel to parallel Converters) using Flip-Flops.
11. Design of Ring & Johnson Counters using Flip-Flops.
12. Conversion of Flip-Flops (JK-T, JK –D).
13. Design of Binary/Decade Counter.
14. Design of Asynchronous Counter, Mod Counter, Up Counter, Down Counter & Up/Down Counter.
15. Design of Synchronous Counter, Mod Counter, Up Counter, Down Counter & Up/Down Counter.

NOTE: *A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examination*

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICROPROCESSOR AND MICROCONTROLLER LAB

II B.Tech. IV Semester (Code: 20ECL403)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to	
➢	Understand the basic programming of 8086 Microprocessor.
➢	Interface the 8086 microprocessor with various peripherals for different applications.
➢	Understand the basic programming of 8051 microcontroller.
➢	Interface the 8051 microcontroller with various peripherals for different applications

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

CO1	Demonstrate skill on usage of modern tools such as TASM for 8086 microprocessor and KEIL for 8051 microcontroller.
CO2	Develop assembly language programs for various applications using 8086 Microprocessor.
CO3	Develop assembly language programs for various applications using 8051 microconstroller
CO4	Analyze the interfacing of Programmable peripheral devices with 8051 Micro controller.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3		2	3				3					3	
CO2	2	3		2	3				3					3	
CO3	2	3		2	3				3					3	
CO4	2	3		2	3				3				2	3	2
AVG	2	3		2	3				3				2	3	2

LIST OF EXPERIMENTS 36 Hours

Experiments Based on ALP (8086)

1. Programs on Data Transfer Instructions.
2. Programs on Arithmetic and Logical Instructions.
3. Programs on Branch Instructions.
4. Programs on Subroutines.
5. Sorting of an Array.
6. Programs on Interrupts (Software and Hardware).

7. 8086 Programs using DOS and BIOS Interrupts.
8. Programs on 80386, 80486
9. ARM processor

Experiments Based on Interfacing & Microcontroller (8051)

10. DAC Interface-Waveform generations.
11. Stepper Motor Control.
12. Keyboard Interface / LCD Interface.
13. Data Transfer between two PCs using RS.232 C Serial Port
14. Programs on Data Transfer Instructions using 8051 Microcontroller.
15. Programs on Arithmetic and Logical Instructions using 8051 Microcontroller.
16. Applications with Microcontroller 8051

NOTE: *A minimum of 10(Ten) experiments, choosing 5 (Five) from each part, have to be Performed and recorded by the candidate to attain eligibility for Semester End Examination.*

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

LINEAR INTEGRATED CIRCUITS

III B.Tech. V Semester (Code:20EC501)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Electronic Circuit Analysis

Course Objectives: Students will	
➢	Understand the basic fundamentals of operational amplifier and its linear and non-Linear applications
➢	Design and working principles of oscillators, wave form generators and comparators
➢	Analyze Nonlinear Wave shaping circuits and different data convertors
➢	Examine the functioning of special ICs-555, 723, PLL, VCO and design of active filters

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe the basic operations of an op-amp to perform linear and non-linear applications
CO2	Design different types of oscillators, waveform generators and comparators and their basic working
CO3	Analyze the concepts of Clippers and Clampers and Data Converters
CO4	Illustrate the functioning of special IC's and able to design different types of Active Filters.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											2		
CO2	2	3	3										2		
CO3	2	3											2		
CO4	3	3	3										2		
AVG	2.5	2.75	3										2		

Syllabus

UNIT-1 (12 Hours)

OPERATIONAL AMPLIFIERS: Operational amplifier and block diagram representation op-amp with negative feedback. Block diagram representation of feedback configurations, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier with one op-amp, input offset voltage, input bias current, input offset current, total output offset voltage, frequency response of op-amp, stability, slew rate.

OP-AMP APPLICATIONS: The summing amplifier, Differential and instrumentation amplifiers, Voltage to current and current to voltage conversion, The Op-amp with complex impedances, Differentiators and integrators, Non Linear Op-Amp circuits, Precision rectifiers

UNIT-2 (12 Hours)

OSCILLATORS & COMPARATORS: Oscillator principles, Oscillator types, Frequency stability, Phase shif oscillator, Wein bridge oscillator, Quadrature oscillator, Square-wave generator, Triangular wave generator, Sa-tooth wave generator, and Voltage controlled oscillator. Introduction to comparator, Basic comparator, Zero-crossing detector, Schmitt Trigger, Comparator characteristics, Limitations of Op-Amps as comparators, Voltage limiters.

UNIT-3 (12 Hours)

CLIPPERS, CLAMPERS & CONVERTERS: Positive and negative clippers, Positive &negative clampers Absolute value output circuit, Peak detector, S/H circuit. D/A conversion fundamentals, weighted resistor summing R-2R Ladder D/A converters, A/D conversion: Ramp type, Successive Approximation, Dual slope converters, Parallel &Tracking A/D converters

UNIT-4 (12 Hours)

APPLICATIONS OF SPECIALICS & ACTIVE FILTERS: The 555timer, 555 as Monostable and Astable Multivibrator and applications. Phase Locked Loops, Operating principles, Monolithic PLLs, 565 PLL applications, A 723 Voltage Regulator and its design. Active LP and HP filters, Band pass filters: Wideband, Narrow Band pass filters, Band stop filters, State variable filters, and All pass filters

Text Books :

1. Op-Amps & Linear Integrated Circuits by RamaKant A.Gayakwad 4th Edition, PHI/Pearson Education, 2003.
2. Linear Integrated Circuits by D.RoyandChoudhury,ShailB.Jain,,2ndEdition, NewAgeInternational,2003.

References :

1. Microelectronics: Circuit Analysis and Design,Donald A. Neamen,4thEdition, McGraw Hill,2010.
2. Microelectronic Circuits, Sedra Smith, 7th Edition Oxford University Press, 2010.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANTENNAS AND WAVE PROPAGATION

III B.Tech. V Semester (Code:20EC502)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Apply various approaches to determine the potential functions to evaluate the radiated power and radiation resistance of alternating current element and quarter wave Monopole / half wave dipole
➢	Attain the knowledge of basic antenna parameters and analyze the fundamental parameters of two-element, N-element and Binomial antenna arrays.
➢	Analyze the characteristics of HF, VHF, UHF, wideband and special purpose antennas.
➢	Interpret various radio wave propagation mechanisms and understand the effects of earth's curvature on wave propagation

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze the radiation pattern of various basic antennas and mechanism associated with it.
CO2	Evaluate the basic parameters that are important in the design of antennas and parameters of antenna arrays.
CO3	Design and construction of different practical antennas used for wireless applications.
CO4	Analyze the importance of radio wave propagation required for communication

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													3
CO2	2	3													3
CO3	2	3	3												3
CO4	3	2													3
AVG	2.5	2.5	3												3

Syllabus

UNIT-1 (12 Hours)

RADIATION

Radiation Mechanism, Potential functions-heuristic approach, Maxwell's equation approach, Potential functions for sinusoidal oscillations, Alternating current element, Power radiated by current element, Application to short antennas, Assumed current distribution, Radiation from quarter wave Monopole / half wave dipole, Traveling wave antennas

UNIT-2 (12 Hours)

ANTENNA FUNDAMENTALS

Isotropic, Directional, Omni-directional patterns, Principle patterns, Field regions, Radiation density, Radiation intensity, Directive gain, Power gain, Half power Beam width, Antenna polarization, Power loss factor, Radiation efficiency, Effective aperture of antenna, Relation between maximum effective aperture and directivity, Friss transmission equation.

ARRAY ANTENNAS

Two-element array, Uniform linear array, Side lobe level and beam width of broadside array, Beam width of end fire array, Principle of multiplication of patterns, Effect of earth on vertical patterns, Binomial array

UNIT-3 (12 Hours)

CHARACTERISTICS OF TYPICAL ANTENNAS

Rhombic antennas, Folded Dipole, Loop antenna, Yagi- Uda array, Helical antenna, Log periodic antenna, Pyramidal and conical Horn antenna, Corner reflector antenna, Parabolic reflector antennas – Paraboloid, Cassegrain system of reflectors, Basic principles of slot antennas and micro strip antennas

UNIT-4 (12 Hours)

RADIO WAVE PROPAGATION

Ground wave Propagation, Space-wave Propagation, Effect of curvature of an Ideal Earth, Variations of Field strength with height in space-wave Propagation, Atmospheric effects in space-wave Propagation, Radio-Horizon, Duct Propagation, Extended-range Propagation resulting from Tropospheric Scattering, lonospheric Propagation, Gyro frequency, Refraction and reflection of Sky Waves by the Ionosphere, Critical Frequency, Skip Distance, Maximum Usable Frequency

Text Books :
1. Edward C Jordan and Keith G Balmain, Electromagnetic Waves and Radiating Systems,2ndEdition, PHI, 2003.
2. Constantine A Balanis, Antenna Theory: Analysis and Design, Harper and Row Publishers,2002.

References :
1. J. D. Kraus and Ronald J Marhefka, Antennas For all Applications, TMH, 2003.
2. G.S.N. Raju, Antennas & Wave Propagation, 1st Edition, Pearson Publication

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL COMMUNICATION

III B.Tech. V Semester (Code:20EC503)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Analog Communications, Probability and Statistics.

Course Objectives: Students will	
➢	Learn the fundamental concepts of Pulse Modulation
➢	Analyze the basics of baseband and pass band modulation
➢	Evaluate the performance of various pass band techniques with respect to probability of error.
➢	Describe and analyze the digital communication system with spread spectrum modulation and error control coding techniques.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand pulse modulation principles for signal encoding and transmission.
CO2	Describe the baseband modulation and pass band modulation techniques
CO3	Evaluate the probability of error for different pass band modulation techniques.
CO4	Analyze digital communication system with spread spectrum modulation and error control coding techniques.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2											2		2
CO2	2	2											2		2
CO3	3	2	2										2		3
CO4	3	2	2										2		3
AVG	2.5	2	2										2		2.5

Syllabus

UNIT-1 (12 Hours)

PULSE MODULATION: Introduction, Sampling Process (ideal and flat-top), Pulse- Amplitude Modulation, Pulse-Position Modulation, Quantization Process, Quantization Noise, Pulse Code Modulation: Encoding, Regeneration, Decoding, Delta Modulation, Differential Pulse Code Modulation, Line Codes

UNIT-2 (12 Hours)

BASE BAND PULSE TRANSMISSION: Matched filter, Properties, Inter symbol interference, Correlative level coding: Duo binary & Modified Duo binary signalling.

DIGITAL PASS BAND TRANSMISSION: Introduction, Pass band transmission model, Gram Schmidt Orthogonalization procedure.

UNIT-3 (12 Hours)

PROBABILITY OF ERROR: Coherent Binary Amplitude Shift Keying (BASK), Phase Shift Keying (BPSK, QPSK), Frequency-Shift Keying (BFSK, MSK), Non-coherent Digital Modulation Schemes (BASK, BFSK, DPSK), M-ary Digital Modulation Schemes (M-ary PSK).

UNIT-4 (12 Hours)

SPREAD SPECTRUM TECHNIQUES: PN Sequences, Notion of Spread Spectrum, DSSS: DSSS with CBPSK, Processing gain, Probability of error.
FHSS: Slow frequency hopping, fast frequency hopping.
INFORMATION THEORY: Uncertainty, Information, Entropy, Properties of Entropy, Source Coding Theorem, Huffman Coding, shannon-fano coding.

Text Books :
1. Simon Haykin, Communication Systems, 3rd Edition, John Wiley & Sons.
2. Taub and Schilling, Principles of Communication Systems, 2nd Edition, TMH, 1986.

References :
1. Bernard Sklar, Digital Communication, 2nd Edition, Pearson Education, 2001

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EMBEDDED SYSTEM & DESIGN

III B.Tech. V Semester (Code:20EC504/JO1-A)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hour/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn basic design and architectural concepts of embedded systems.
➢	Understand the concepts of Real-Time Operating Systems and provide the scheduling Algorithms.
➢	Familiarize with the fundamentals of prevalent IP-Core: ARM Cortex M3/M4 & Design of an embedded system using ARM Cortex Processor.
➢	Be able to use the instruction set of ARM Cortex M3/M4 processor and explain the ALP's Using ARM processor.

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe different methodologies and approaches in the design of embedded systems
CO2	Analyze the concepts of Real-Time Operating systems and scheduling Algorithms.
CO3	Illustrate the features, basic architecture and memory management unit of ARM Processors
CO4	Simulate ARM Programming models using Keil µVision for different embedded Applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3													3	
CO2	2	3												3	
CO3	3													3	
CO4	2	3	2		3									3	
AVG	2.5	3	2		3									3	

Syllabus

UNIT-1 (12 Hours)

EMBEDDED SYSTEMS DESIGN: Introduction to Embedded System, categories of embedded system, specialties, and recent trends in Embedded System.

ARCHITECTURE OF AN EMBEDDED SYSTEM: Hardware Architecture, Software Architecture, application Software, Communication Software, Development/Testing Tools

UNIT-2 (12 Hours)

OVERVIEW OF RTOS: Architecture of the Kernel, Tasks, Task scheduler, real-time tasks, Task scheduling, Interrupt Service Routine, Memory Management, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes.

CLASSIFICATION OF SCHEDULING ALGORITHMS: Clock driven Scheduling, Event-driven Scheduling, Resource sharing, Priority inversion problem, Deadlock.

UNIT-3 (12 Hours)

EMBEDDED PROCESSORS: Introduction to ARM family, ARM Architecture-Pipeline, Registers, Operation modes, Big Endian and Little Endian. Cache Mechanism, Memory Management Unit

UNIT-4 (12 Hours)

ARM INSTRUCTIONS: ARM and Thumb Instruction Sets, Data Processing Instructions, Data Transfer Instructions, Control Flow Instructions, Basic Assembly Language Programs.
Case Study: Smart Phone, Digital Camera, and Automatic Washing Machine

PRACTICAL EXERCISES

1. Exploring the features of Keil and RTX51
2. Task Creation and Deletion usingRTX51in Keil
3. TaskschedulingusingRTX51in Keil
4. Processing Critical Section using RTX51inKeil
5. Task Synchronization using RTX51semaphores in Keil
6. Task Communication using shared memory in Keil
7. Task Communication using RTX51 mailbox in Keil
8. Introduction to ARM Cortex M3Processor
9. ALP to multiplytwo16-bit binary numbers
10. ALP to find the sum of the first 10integers.
11. ALP to find the number of 0'sand 1'sin32-bit data.
12. ALP to determine whether the given16-bitnumber is ODD or EVEN.
13. ALP to write data in RAM(CO4)
14. Display Hello World message using Internal UART.
15. Interface a Stepper motor and rotate it in clock wise and anti-clock wise direction.

Note - Any Ten programs Compulsory.

Text Books :
1. K.V.K.K. Prasad, "Embedded /Real Time Systems" Dream tech Press, 2005.
2. Andrew N. Sloss/ Dominic Symes / Chris Wright, "ARM System Developer's Guide Designing and Optimizing" Elsevier, 2004

References :
1. Frank Vahid / Tony Givargis, "Embedded System Design A unified Hardware / Software Introduction" John Wiley & Sons, Inc.
2. 2. Jonathan W Valvano, "Embedded Systems: Real-Time Operating Systems for ARM Corte-M Microcontrollers" Create Space,Volume3, 5thEdition, 2019

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DATA COMMUNICATION & COMPUTER NETWORKS

III B.Tech. V Semester (Code:20EC504/JO1-B)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hour/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn various protocols, Network hardware, and Network software.
➢	Gain knowledge about functionality of each layer in OSI, TCP/IP protocols.
➢	Study about the different types of LANS
➢	Interpret the operation of the protocols that are used in Internet.

Course Outcomes: After studying this course, the students will be able to	
CO1	Classify the fundamental underlying principles of computer networking
CO2	Illustrate the details and functionality of layered network architecture.
CO3	Compare different types of network topologies and routing algorithms
CO4	Analyze performance of various internet protocols.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													2
CO2	2	2													2
CO3	2	3													2
CO4	2	3													2
AVG	2.25	2.5													2

Syllabus

UNIT-1 (12 Hours)

Introduction to Data Communication and Networking: Uses of Computer Networks, Network Hardware, Network Software Internet Reference Models (OSI and TCP/IP). Physical Layer: Basis for Data Communication, Guided Transmission Media, Wireless Transmission Medium, Circuit Switching and Telephone Network, High Speed Digital Access

UNIT-2 (12 Hours)

Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Data Link Control and Protocols, Example Data Link Protocol. Medium Access Layer: Channel Allocation Problem, Multiple Access, CSMA, CSMA/CD, CSMA/CA.

UNIT-3 (12 Hours)

Local Area Network: Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, Blue tooth, Connecting devices:-Repeaters, Hub, Bridges, Switch, Router, Gateways, Virtual LAN, Network Layer: Network Layer Design Issues, Routing Algorithms Congestion control Algorithms,

UNIT-4 (12 Hours)

Transport Layer: Transport Layer Service, Elements of Transport protocols, Internet protocols (UDP and TCP)

Application Layer: DNS-Domain Name System, Electronic Mail, World Wide Web, Multimedia (Audio Compression, Streaming Audio, Voice over IP, Video Compression, Video on Demand).

LIST OF EXPERIMENTS

1. Design and Build a Small Network
2. Test Network Latency with Ping and Traceroute
3. Secure Network Devices
4. Configure IPv4 Addresses on Network Devices
5. Troubleshoot IPv4 Static and Default Routes
6. Troubleshoot Inter-VLAN Routing
7. Configure VLANs and Trunking
8. Basic Switch Configuration
9. Switch Security Configuration
10. Implement DHCPv4
11. Configure Router-on-a-Stick Inter-VLAN Routing
12. Subnet an IPv4 Network
13. Implement Port Security
14. OSPF Multiarea Exploration
15. Configure and Verify Extended IPv4 ACLs

Note - Any Ten programs Compulsory.

Text Books :
1. Andrew S. Tanenbaum, David. J.Wetherall, “Computer Networks”, Prentice-Hall, 5th Edition, 2010.
2. Behrouz A. Foruzan, Data Communication and Networking, 4th Edition,TMH, 2004

References :
1. W.Tomasi, ”Introduction to Data Communications and Networking” Pearson education.
2. G.S.Hura and M.Singhal, "Data and Computer Communications”, CRC Press, Taylor and Francis Group

Software :
1. CISCO- Packet Tracer 6.0

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMMING WITH JAVA

III B.Tech. V Semester (Code:20EC504/JO1-C)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hour/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: C ++ Fundamentals

Course Objectives: Students will learn the	
➢	Basics of Object Oriented Programming concepts used in JAVA.
➢	Usage of classes and objects in developing JAVA programs.
➢	Various inheritance concepts along with packages and interfaces in JAVA programs
➢	Exception handling mechanisms and Multithreading concepts in JAVA

Course Outcomes: After studying this course, the students will be able to	
CO1	Write and implement simple JAVA programs using Object Oriented Programming concepts
CO2	Understand the concepts of classes and objects to develop JAVA programs
CO3	Develop reusable programs using the concepts of inheritance, interfaces and packages.
CO4	Apply the concepts of Exception handling and Multithreading while implementing JAVA programs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2			3										2
CO2	3	2	2		3										2
CO3	3	2	2		3										2
CO4	3	2			3										2
AVG	3	2	2		3										2

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION: Creation of Java, importance of Java to internet, byte code, Java buzzwords, OOP Principles, Encapsulation, Inheritance and Polymorphism, data types, variables, declaring variables, dynamic initialization, scope and life time of variables, arrays, operators, control statements, type conversion and casting, compiling and running of simple Java program.

UNIT-2 (12 Hours)

CLASSES AND OBJECTS: Concepts of classes and objects, class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, usage of static with data and methods, usage of final with data, access control, this key word, garbage collection, overloading methods and constructors, parameter passing - call by value, recursion, nested classes and inner classes, exploring the String class

UNIT-3 (12 Hours)

INHERITANCE: Basic concepts, member access rules, usage of super key word, forms of inheritance, method overriding, abstract classes, dynamic method dispatch, using final with inheritance, the Object class.

PACKAGES AND INTERFACES: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces

UNIT-4 (12 Hours)

EXCEPTION HANDLING AND MULTITHREADING: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks, thread groups.

Practical Exercise:

1. Java Basic Programs
2. Java Array Programs
3. Implement the concept of Scope and lifetime of a variable
4. Implement the concept of polymorphism
5. Implement the concept of objects and classes
6. Illustrate the different types of Constructors
7. Write a Java program using static, this and final keyword
8. Implement the concept of Method overloading
9. Implement reusability concept using inheritance
10. Develop Java programs using Abstract Class
11. Implement multiple inheritance using interface
12. Write a Java program to demonstrate packages
13. Implement User defined Exceptions in java
14. Implement Built-in Exceptions in java
15. Develop Java programs using Multithreading

Text Books :
1. The Complete Reference Java J2SE 7th Edition by Herbert Schildt, McGraw-Hill Companies.
2. Big Java 2nd Edition, Cay Horstmann, John Wiley and Sons

References :
1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COMPUTER ORGANIZATION AND ARCHITECTURE

III B.Tech. V Semester (Code:20EC504/JO1-D)

Lectures :	2 Hours/Week	Tutorial :	0 Hour/Week	Practical :	2 Hour/Week
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Evaluate Instruction Set Architecture (ISA) of Million Instructions per Second (MIPS) Computer and various subsystems
➢	Understand Arithmetic units, Pipelining in digital computers
➢	Learn various Memory systems and different ways of communicating with I/O Devices.

Course Outcomes: After studying this course, the students will be able to	
CO1	Interpret efficient commercial digital computer and its constituents.
CO2	Analyze functionality of sub-systems for realizing computing applications
CO3	Implement concepts of pipelining & different arithmetic units for improved execution Speeds.
CO4	Compare and evaluate trends in memory & I/O Interfaces systems for modern Architectures.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3			3								2	2	
CO2	3	3	2		3								2	2	
CO3	3	3	3		3								2	2	
CO4	2	3	3		3								2	2	
AVG	2.5	3	2.67		3								2	2	

Syllabus

UNIT-1 (12 Hours)

BASIC STRUCTURE OF COMPUTER:

Computer types, Functional Unit, Basic operational concepts, Bus structures, Performance, multiprocessors and multi computers. Instructions: Language of the Computer – Introduction, Operations of Computer Hardware, Operands of Computer Hardware, MIPS Instructions – Arithmetic, Logical, Stored program concept, Branch, JAL, RA, Stack/frame pointers. Introduction to Lab VIEW & VHDL.

UNIT-2 (12 Hours)

DESIGN OF COMPUTERS:

Register Transfer & Micro operations – Register Transfer, Bus & Memory Transfers, Arithmetic Logic Shift Unit. Basic Computer Organization & Design – Computer Registers, Timing and Control (Hardwire control), Instruction Cycle, Design of basic computer (flow chart for computer operation), Micro programmed Control – control memory, address sequencing, micro program example (compute hardware configuration), Central Processing Unit – General Register Organization, Reduced Instruction Set.

UNIT-3 (12 Hours)

ARITHMETIC AND PIPELINING:

ARITHMETIC: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer division.

PIPELINING: Basic concepts, Data hazards, Instruction hazards, Influence of instruction sets, Data path and control considerations, Superscalar operation, speculative execution, Parallel Processing.

UNIT-4 (12 Hours)

Memory System & I/O Interfaces:

THE MEMORY SYSTEM: Some basic concepts, Semiconductor RAM memories- Internal Organization of memory chips, Read only memories, Speed, size and cost, Cache memories - mapping techniques & replacement algorithms, Performance considerations, Virtual memories, address translations.

STANDARD I/O INTERFACES: PCI, SCSI, and USB; SMT – Hyper threading, Trends in Computer Architecture.

PRACTICAL EXERCISES

1. Arithmetic/Numerical Operations (CO1)
2. Logical/Boolean Operations (CO1)
3. Branch – Conditional statements, Stack/frame pointers (CO1)
4. Register Transfer /Sub VI or Modular Design (CO2)
5. Bus or Memory transfer (CO2)
6. Arithmetic Unit Implementation (CO2)
7. Logical/Shift Unit Implementation (CO2)
8. Micro programmed control (CO2)
9. Implementation of Adders/Fast Adders (CO3)
10. Implementation of Subtractor (CO3)
11. Implementation of Multiplicators (CO3)
12. Implementation of Data Path & Control (CO3)
13. Pipeline Implementation (CO3)
14. Demonstration of Parallel processing(CO3)
15. ROM/RAM Memory Implementation (CO4)
16. Mapping algorithms Implementation(CO4)
17. I/O Interfaces (CO4)

Note- Any Ten experiments are compulsory

Text Books :
1. Computer Organization Carl Hamacher, ZvonkoVranesic, 6th Edition, MGH, 2012.
2. Computer Systems Architecture M. Moris Mano, Third Edition, Pearson/PHI.

References :
1. Computer Organization and Design, The Hardware/Software Interface, 5th Edition, D.A. Patterson and J.L. Hennessy (P and H),
2. Computer Architecture, A Quantitative Approach, Sixth Ed, J.L Hennessy and D.A.Patterson (H and P), Morgan Kaufmann Publishing 2019

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INFORMATION THEORY AND CODING

III B.Tech. V Semester (Code:20EC505/PE1-A)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn	
➢	Information Theory essentials and Source Coding concepts.
➢	Channel Coding Techniques to Combat Errors – Block Codes, Cyclic Codes, Convolutional Codes.
➢	To implement Encoder and Decoders for Error Free Transmission and Reception.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze fundamental information and source coding techniques for improving efficiency of a communication system.
CO2	Develop channel coding schemes to improve the reliability of a communication system.
CO3	Analyze and evaluate various cyclic redundancy codes suitable in Digital Communication.
CO4	Apply Convolutional coding techniques for error correction in telecommunication systems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3													2
CO2	3	3													2
CO3	3	3													2
CO4	3	3													2
AVG	3	3													2

Syllabus

UNIT-1 (12 Hours)

SOURCE CODING:

Mathematical models of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, coding for discrete memory less Sources, Properties of Codes, Huffman Code, Run Length Codes.

UNIT-2 (12 Hours)

CHANNEL CODING:

Introduction to Linear Block Codes, Generated Matrix, Systematic Linear Block Codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome Testing, Error Detecting and Correcting Capability of Linear Block Codes, Hamming Codes.

UNIT-3 (12 Hours)

CYCLIC CODES:

Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties,Encoding in Systematic

Form, Syndrome Computation and Error Detection, Decoding of Cyclic Codes, Cyclic Hamming Codes BCH Codes: Description of the Codes, Minimum Distance and BCH Bounds, Decoding Procedure for BCH Codes.

UNIT-4 (12 Hours)

CONVOLUTIONAL CODES:

Encoding of Convolutional Codes, Structural Properties of Convolutional Codes, State Diagram, Tree Diagram, Trellis Diagram, Maximum, Likelihood Decoding of Convolutional Codes, Viterbi Algorithm.

Text Books :
1. Error Control Coding – Fundamentals and Applications by SHU LIN and Daniel J.
2. Simon Haykin – Communication Systems, 4th edition.

References :
1. Digital Communications – Fundamentals and Applications by Bernard Sklar, Pearson
2. Digital Communications – John G. Proakis, Mc. Graw Hill Publications.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

TELECOMMUNICATION SWITCHING SYSTEMS AND NETWORKS

III B.Tech. V Semester (Code:20EC505/PE1-B)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Describe the fundamentals of telecommunication systems
➢	Explain the working principle of various switching systems in Telecommunication.
➢	Discuss working of various data networks.
➢	Recognize differences among telephone network, data network and ISDN.

Course Outcomes: After studying this course, the students will be able to	
CO1	Discuss the Fundamentals of telecommunication systems with n-stage networks.
CO2	Analyze Working principle of various switching systems in Telecommunication by switching techniques.
CO3	Build various Modern digital data networks like PSTN, LAN, and MAN.
CO4	Explore various data networks and Integrated Service Digital Network with their co-existence.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3														3
CO2	2	3													3
CO3	2	3													3
CO4	3	2													3
AVG	2.5	2.67													3

Syllabus

UNIT-1 (12 Hours)

Introduction: Evolution of Telecommunications, Simple telephone communication, Basics of a switching system, Manual Switching System, Major Telecommunication Networks.

Electronic space division switching: Stored Program Control, Centralized SPC, Distributed SPC, Two stage networks, Three stage networks, n stage networks.

UNIT-2 (12 Hours)

Time division switching: Basic time division space switching, Basic time division time switching, Combination switching, Three stage combination switching, n-stage combination switching.

Telephone Networks: Subscriber Loop System, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering Plan, Charging Plan, Signaling Techniques, In-channel Signaling, Common Channel Signaling, Cellular Mobile Telephony.

UNIT-3 (12 Hours)

Data Networks: Data Transmission in PSTNs, Switching techniques for Data Transmission, Data Communication Architecture, Link-to-Link Layers, End-to-End Layers, Satellite based Data Networks, Local Area Networks, Metropolitan Area Networks, Fibre Optic Networks, Data Network Standards, Protocol Stacks, Internetworking.

UNIT-4 (12 Hours)

Integrated Services Digital Network: Motivation for ISDN, New Services, Network and Protocol Architecture, Transmission Channels, User- Network Interfaces, Signaling, Numbering and Addressing, Service Characterization, Interworking, ISDN Standards, Expert Systems in ISDN, Broadband ISDN, Voice Data Integration

Text Books :

1. T.Viswanathan, "Telecommunication Switching Systems and Networks", PHI, 2004.
2. Roger L.Freeman, "Telecommunication System Engineering"–, 4th Ed., Wiley-Inter Science, John Wiley & Sons, 2004.

References :

1. "Digital Telephony"- J. Bellamy, 2nd Edition, 2001, John Wiley.
2. "Data Communications and Networks"- Achyut S. Godbole, 2004, TMH.
3. "Principles of Communication Systems"- H. Taub& D. Schilling, 2nd Edition, 2003, TMH.
4. "Data Communication & Networking"- B. A. Forouzan, 3rd Edition, 2004, TMH.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PULSE AND SWITCHING CIRCUITS

III B.Tech. V Semester (Code:20EC505/PE1-C)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Calculate the response of low-pass and high-pass RC circuits.
➢	Explain the concept of nonlinear wave shaping
➢	Acquire knowledge in multivibrators and their applications.
➢	Familiar with the working of voltage time base and current time base generator.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze the response of lowpass and highpass circuits by applying different inputs.
CO2	Apply the knowledge of Kirchhoff's voltage and Current laws to design various nonlinear wave shaping circuits.
CO3	Design Bi-stable, Mono-stable and Astable Multivibrators using discrete components.
CO4	Discuss the methods for generating time based sweep signals.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3											3		
CO2	3	3	2										3		
CO3	3	3	2										3		
CO4	3	2											3		
AVG	3	2.75	2										3		

Syllabus

UNIT-1 (12 Hours)

LINEAR WAVE SHAPING:

The high- pass RC circuit, Response of RC high- pass circuit to sinusoidal, step, pulse, square wave, exponential and ramp input, The high-pass RC circuit as a differentiator, Double differentiation, low- pass RC circuit, Response of RC low-pass circuit to sinusoidal, step, pulse, square-wave, exponential and Ramp inputs, The low-pass RC circuit as an integrator, Attenuators.

UNIT-2 (12 Hours)

NON-LINEAR WAVE SHAPING:

Clipping (Limiting) circuits, Diode clippers, Clipping at two independent levels, Comparators, Diode- differentiator comparator, Applications of voltage comparators, the clamping operation, Positive clamper, Negative clamper, a clamping circuit theorem, Transistor as a switch.

UNIT-3 (12 Hours)

BISTABLE MULTIVIBRATORS:

The stable states of a binary, A fixed bias transistor binary, A self-biased transistor binary, Commutating capacitors, Methods of improving resolution, Unsymmetrical triggering of the

binary, Triggering Un symmetrically through a unilateral device, Symmetrical triggering, Direct – connected binary circuit, Schmitt Trigger circuit, Emitter-coupled binary.

MONOSTABLE AND ASTABLE MULTIVIBRATORS:

The Monostable Multivibrator, Gate width of a collector-coupled Monostable Multivibrator, Waveforms of the collector-coupled Monostable Multivibrator, Triggering of the Monostable Multivibrator, Astable collector- coupled Multivibrator.

UNIT-4 (12 Hours)

VOLTAGETIMEBASEGENERATORS:

General features of a time-base signal, Exponential sweep circuit, Miller and Bootstrap Sweep circuits.

CURRENT TIME-BASE GENERATORS:

A simple current sweep, Linearity correction through adjustment of driving waveform, a transistor current time-base generator.

Text Books :
1. Millman and H Taub, Pulse, Digital and Switching Circuits, TMH, 2003.
2. J Millman and H Taub, Mothiki S.Prakash Rao, Pulse Digital and Switching Waveforms, 2nd Edition, TMH.

References :
1. DavidA Bell, Solid State Pulse Circuits4thEdition, PHI,2003.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

OPTICAL COMMUNICATIONS

III B.Tech. V Semester (Code:20EC505/PE1-D)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn basic elements of optical fiber transmission link, modes configurations & structures
➢	Understand the different kind of losses, signal distortion, SM fibers
➢	Understand the construction and working of Optical sources and Detectors
➢	Explain the construction of optical communication system and also measurement of various losses

Course Outcomes: After studying this course, the students will be able to	
CO1	Illustrate the basic principles of optics and different types of fibers
CO2	Analyzing various losses and Dispersion in optical communications
CO3	Explain the construction and working of Optical sources and Detectors
CO4	Analyze the construction of optical communication system and also measurement of various losses

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2											2		
CO2	2	3											2		
CO3	2	2											2		
CO4	2	3											2		
AVG	2	2.5											2		

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION:
Historical development, The general system, Advantages of Optical Fiber Communications, **OPTICAL FIBER WAVEGUIDES:** Introduction, Ray Theory Transmission: Total internal reflection, Acceptance angle, Numerical Aperture, Skew rays.
CYLINDRICAL FIBER: Modes, Mode coupling, Step index fibers, Graded index fibers, Fiber materials

UNIT-2 (12 Hours)

TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS:
Introduction, Attenuation, Material absorption losses in Silica glass fibers, Linear scattering losses Non- Linear scattering losses, Fiber bend losses, Dispersion, Intramodal dispersion, Intermodal dispersion.
OPTICAL FIBER CONNECTION: Joints and Couplers: Introduction, Fiber alignment and joint loss, Fiber splices, Fiber Connectors, Expanded beam connectors, Fiber Optical couplers.

UNIT-3 (12 Hours)

OPTICAL SOURCES1: THE LASER: Introduction, Basic concepts, Optical emission for semiconductors, and some injection laser structures, Injection laser characteristics, DH Laser, Strip Geometry Laser, DFB and DBR Lasers.

OPTICAL SOURCES2: THE LIGHT EMITTIMG DIODE: Introduction, LED power and efficiency

LED STRUCTURES: Planar LED, Dome LED, Surface emitter LEDs, Edge emitter LEDs, Super luminescent LEDs, LED characteristics. Optical Detectors: Introduction, device types, optical detection principles,. Semiconductor Photo Diodes Without internal Gain**:** PN, P-I N-Photo diode, Semiconductor Photo Diodes with Internal Gain**:** Avalanche Photodiode, Optical Power Budgeting Schemes

UNIT-4 (12 Hours)

OPTICAL FIBER SYSTEMS1: Intensity Modulation/Direct Detection: Introduction, The Optical Transmitter Circuit: Source limitations, LED drive circuits. The Optical Receiver Circuit: The preamplifier, AGC, Advanced Multiplexing Strategies Optical Time Division Multiplexing (OTDM), Wavelength Division Multiplexing (WDM).

OPTICAL FIBER MEASUREMENTS: Optical Time Domain Reflectometry (OTDR). Introduction to Li-Fi

Text Books :
1. John M Senior, Optical Fiber Communications: Principles and Practice, 2nd Edition, PHI,2005.
2. Henry Zanger and Cynthia Zanger, Fiber Optics: Communication and other applications,Maxwell Macmillan Edition.

References :
1. JC Palais, Fiber Optic Communications, 2nd Edition, PHI, 2001.
2. W.Tomasi, Advanced Electronic Communication Systems, Pearson Education, 2002.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MACHINE LEARNING

III B.Tech. V Semester (Code:20ECL501/SOC3)

Lectures :	1 Hours/Week	Tutorial :	0 Hour/Week	Practical :	2 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	2

Pre-Requisite: None

Course Objectives: Students will learn how to	
➢	Understand how a machine learns and various applications of machine learning
➢	Distinguish between classification and regression
➢	Fundamentals of Artificial neural networks
➢	Gain knowledge in Support Vector Machine and Baye's classifier principles.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze the mathematical and statistical prospective of machine learning algorithms through python programming
CO2	Evaluate the machine learning models pre-processed through various features
CO3	Design and develop the code for recommender system using Natural Language Processing.
CO4	Apply various Baye's techniques for data clustering.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	3		3										3
CO2	3	3			3										3
CO3	3	3			3										3
CO4	2	2			3										3
AVG	2.5	2.5	3		3										3

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION - Towards Intelligent Machines, Well-Posed Machine Learning Problems, Examples of Applications in Diverse Fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Machine Learning and Data Mining.

UNIT-2 (12 Hours)

DECISION TREE LEARNING – Introduction, Decision tree representation, Appropriate problems for decision tree learning. Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification Minimum Description Length Principle.

UNIT-3 (12 Hours)

ARTIFICIAL NEURAL NETWORKS– Neural network representation, Appropriate problems for neural network learning, Perceptrons - Gradient descent and the Deltarule, Multilayer networks and The back propagation algorithm.

UNIT-4 (12 Hours)

BAYESIAN LEARNING – Bayes theorem, Learning with Support Vector Machines (SVM), Variants of Basic SVM Techniques.

PRACTICAL EXERCISES

1. Write sample programs using a) NumPy b) Pandas
2. Write sample programs using a) Matplotlib b) Scikit Learn
3. Write a program to implement the linear regression using

a) Stochastic gradient descent approach of training for a sample training data set.

b) Batch gradient descent approach of training for a sample training data set

4. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the performance of the classifier.
5. Write a program to implement the Logistic regression for a sample training data set and test the same using appropriate data sets.
6. Write a program to demonstrate the working of the decision tree based on ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Compute the performance of the classifier, considering few test data sets.
7. Write a program to implement the Random Forest classifier for a sample training data set stored as a .CSV file. Compare the performance of the classifier with any weak classifier, considering few test data sets.
8. Write a program to implement the AdaBoost classifier for a sample training data set. Compare the performance of the classifier with Random Forest classifier, considering few test data sets.
9. Apply k-Means algorithm to cluster a dataset.
10. Apply Hierarchical clustering algorithm to cluster a dataset

Text Books :
1. Applied Machine Learning, M.Gopal, McGraw Hill Education, 1st Edition, 2018, ISBN-13:978-93-5316-025-8.
2. Machine Learning by Tom Mitchell, McGraw Hill1997, 1st edition

References :
1. Pattern Recognition and Machine Learning by Bishop, 2006 1st Edition , ISBN: 978-0-387-31073-2

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANALOG & DIGITAL COMMUNICATIONS LAB

III B.Tech. V Semester (Code: 20ECL502)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: Analog Communications.

Course Objectives: Students will	
➢	Realize Amplitude Modulation (AM) and demodulation for various message signals.
➢	Construct a circuit for angle modulation and demodulation (FM and PM).
➢	Explore the various pulse modulation and demodulation techniques
➢	Describe some important digital band-pass modulation techniques used in practice

Course Outcomes: At the end of the course, student will be able to	
CO1	Demonstrate various continuous modulation and demodulation techniques.
CO2	Verify angle modulation and demodulation techniques.
CO3	Analyze the pulse modulation and demodulation techniques.
CO4	Simulate digital band-pass modulation techniques

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2		3					3				2		2
CO2	2	2		3					3				2		2
CO3	2	2		3	3				3				2		2
CO4	2	2		3	3				3				2		2
AVG	2	2		3	3				3				2		2

LIST OF EXPERIMENTS

36 Hours

1. Amplitude Modulation and Demodulation.
2. DSB SC Modulation and Demodulation.
3. SSB SC Modulation and Demodulation.
4. Frequency Modulation and Demodulation.
5. Pre-Emphasis and De-Emphasis Circuits.
6. Frequency Demodulation using Phase Locked Loop.
7. PAM Generation and Reconstruction.
8. PWM and PPM: Generation and Reconstruction.
9. Generation and Detection of PCM.
10. Generation and Detection of FSK.
11. Generation and Detection of PSK.

12. Write a program to generate digital modulation (Binary & M-ary) and Demodulation
13. Synchronous Detector.
14. Verification of sampling theorem.
15. Delta Modulation and Demodulation

NOTE: *A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examination.*

LINEAR INTEGRATED CIRCUITS LAB
III B.Tech. V Semester (Code: 20ECL503)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None

Course Objectives: Students will	
➢	Perform experiments based on 741 op-amp
➢	Realize the circuits related to the applications of 555 Timer
➢	Test the functionality of voltage regulators using IC 723
➢	Measure the lock range of IC 556 (Phase Locked Loop)

Course Outcomes: At the end of the course, student will be able to	
CO1	Design different linear applications of Op-Amp like Adder, Integrator, Active filters
CO2	Demonstrate different non-linear applications of operational amplifiers like Oscillators, Waveform Generators, DAC
CO3	Construct multivibrator and oscillator circuits using IC555 and IC556 and perform measurements of frequency and time
CO4	Design and demonstrate a Variable Voltage Regulator using IC 723

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1		2	3	3					3				2		
CO2	2			3					3				2		
CO3	2			3					3				2		
CO4	2		3	3					3				2		
AVG	2	2	3	3					3				2		

LIST OF EXPERIMENTS 36 Hours

1. Measurement of Op-amp Parameters.
2. Applications of Op-amp (Adder, Subtractor, Integrator, Differentiator).
3. Design of Full Wave Rectifier using Op-Amp.
4. Design of Low Frequency Oscillators using Op-Amp (Wein-Bridge &RC Phase Shift Oscillators).
5. Waveform Generation using Op-amp (Square, Triangular).
6. Instrumentation Amplifier using Op-Amp IC741.
7. Design and Verification of Schmitt Trigger using Op-AmpIC741.
8. Design of Active Filters (First Order LPF&HPF).

9. Design of State Variable Filter using Op-Amps.
10. Applications of 555 Timer ICs (Astable, Monostable, Schmitt Trigger).
11. PLL using IC556.
12. Design of Fixed Voltage Regulators.
13. Design of Variable Voltage Regulatorusing IC723.
14. Design of VCO using IC566.
15. Design of 3 bit DAC using R-2R Ladder Network.

NOTE: *A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Examination.*

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SUMMER INTERNSHIP

III B.Tech. V Semester (Code: 20ECL504/INT01)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	0 Hours/Week
CIE Marks :	--	SEE Marks :	100	Credits :	1.5

Pre-Requisite: None.

Course Outcomes: At the end of the course, student will be able to	
CO1	Improve Communication skills and Soft Skills.
CO2	Improve the domain knowledge.
CO3	Develop report writing skills
CO4	Analyze the information, concepts, and ideas

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1									3	3		3	3	3	3
CO2									3	3		3	3	3	3
CO3									3	3		3	3	3	3
CO4									3	3		3	3	3	3
AVG									3	3		3	3	3	3

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

III B.Tech. V Semester (Code:20EC506/MC04)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	--	Credits	: 0

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the concept of Indian Traditional Knowledge in Medicine.
➢	Learn the concept of Indian Traditional Knowledge in Engineering.
➢	Know the contribution of India in Mathematics, Astronomy
➢	Realize the importance of Yoga in holistic living.

Course Outcomes: After studying this course, the students will be able to	
CO1	Demonstrate the effect of pre-colonial and colonial period on Indian Traditional Knowledge System, traditional Medicine.
CO2	Extend the knowledge of ITK in Production, Construction, Physics, Chemistry, Architecture and Vastu
CO3	Relate the contribution of India in Mathematics, Astronomy
CO4	Explain the importance of Yoga in holistic living.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						2	3	2				2			
CO2						2	3	2				2			
CO3						2	3	2				2			
CO4						2	3	2				2			
AVG						2	3	2				2			

Syllabus

UNIT-1 (12 Hours)

Traditional Knowledge: Introduction, Indian Traditional Knowledge System; Traditional Medicine: Ayurveda, Simple Definition, Origin, Texts, The Great Three Classics of Ayurveda, The Lesser Three Classics of Ayurveda, The Branches of Ayurveda, Basic Concepts of Ayurveda, Purusha/Prakruti, Manifestation of Creation, Space, Air, Fire, Water, Earth, Mental Constitution, Satvic Mental Constitutions, Rajasic Mental Constitutions, Tamasic Mental Constitutions, Vata, Pitta and Kapha: The Three Doshas; Qualities of Vata, Pitta and Kapha.

UNIT-2 (12 Hours)

Traditional Production and Construction Technology: Social Conditions and Technological Progress, the Impetus for Metallurgy, Social Needs and Technological Applications, Scientific Rationalism and Technological Efficacy, Limitations of Pre-Industrial Manufacturing, India and the Industrial Revolution.

History of Physics and Chemistry: Particle Physics, Experimentation versus Intuition, the Five Basic Physical Elements, Indian Ideas about Atomic Physics.

Traditional Art & Architecture & Vastu Shashtra: Vastu, the Principles of Vastu are Simple.

UNIT-3 (12 Hours)

Origin of Mathematics: Astronomy and Astrology, TKS and the Indian Union: Protection and the Legislative Frameworks in India, Trade Secrets and Know-how, Geographical Indications Bill, Protection of Plan varieties and Farmers Rights Bill, Rights of Communities, Monitoring Information on Patent Applications World-wide, Frameworks for Supporting R&D Activities in the Area of TKS.

UNIT-4 (12 Hours)

Common Yoga Protocol: Introduction, What is Yoga? Brief History and Development of Yoga, The fundamentals of Yoga, Traditional Schools of Yoga, Yogic practices for health and wellness **General Guidelines for Yoga Practice:** Before the practice, During the Practice, After the Practice, Food for Thought, How Yoga can help. Invocation; Sadilaja/CalanaKriyas /Loosening Practices.

Yogasanas: Standing Postures: Tadasana (Palm Tree Posture), Vrksasana (The Tree Posture), Pada-Hastasana (The Hands to Feet Posture), ArdhaCakrasana (The Half Wheel Posture) and Trikonasana (The Triangle Posture); Sitting Postures: Bhadrasana (The Firm/Auspicious Posture), Vajrasana (Thunderbolt Posture), Uṣṭrasana (Camel Posture), Śasakasana (The Hare Posture), Vakrasana (The Spinal Twist Posture); Prone Postures: Makarasana (The Crocodile Posture), Bhujangasana (The Cobra Posture), Salabhasana (The Locust Posture); Supine Postures: Setubandhasana (The Bridge Posture), UttanaPadasana (Raised feet posture), PavanaMuktasana (The Wind Releasing Posture), Savasana (The Corpse/ Dead Body Posture); Kapalabhati; Pranayama: nadisodhana or anulomaviloma pranayama (Alternate Nostril Breathing), SitaliPraṇayama, BhramariPraṇayama (BhrāmarīRecaka); . Dhyana; Sankalpa; Santihpatha.

Text Books :
1. Traditional Knowledge System in India, Amit Jha, 2009.
2. Common YOGA Protocol, Ministry of Ayush.

References :
1. Traditional Knowledge System & Technology in India, Basanta Kumar Mohanta, Vipin Kumar Singh, 2012.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VLSI DESIGN

III B.Tech. VI Semester (Code:20EC601)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: N o n e

Course Objectives: Students will	
➢	Understand fabrication Process and electrical characteristics of Metal Oxide Semiconductor (MOS) circuits.
➢	Learn how to draw stick diagrams and layout diagrams for various MOS circuits using lambda based design rules.
➢	Demonstrate the nature and approach to structured design with examples.
➢	Discuss various concepts like VLSI design flow, Types of ASICs, CPLDs, FPGA architectures

Course Outcomes: After studying this course, the students will be able to	
CO1	Examine various MOS fabrication processes and basic electrical properties of MOS and BiCMOS circuits
CO2	Analyze MOS and BiCMOS circuit design processes and basic circuit concepts like Sheet resistance Rs, Standard unit of capacitance and delay.
CO3	Characterize subsystems in structured design approach
CO4	Explain the concepts VLSI design flow, Types of ASICs, CPLDs, FPGA architectures to make simple designs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2												3	
CO2	3	2	2											3	
CO3	2	2												3	
CO4	2	3												3	
AVG	2.5	2.33	2											3	

Syllabus

UNIT-1 (12 Hours)

An Introduction to MOS Technology: Introduction to IC technology, Basic MOS transistors, nMOS fabrication, CMOS fabrication and BICMOS technology.

Basic Electrical Properties of MOS and BICMOS Circuits: Ids versus Vds relationships, threshold voltage Vt, Transconductance gm, Figure of merit W0, pass transistor, nMOS inverter, Pull-up to pull- down ratio, CMOS inverter, BICMOS inverters, Latch-up in CMOS circuits.

UNIT-2 (12 Hours)

MOS and BICMOS Circuit Design Processes: MOS layers, Stick diagrams, Design rules and layout, Sheet resistance Rs, Standard unit of capacitance, The Delay unit, Inverter delays, Propagation delays, Wiring capacitances, Scaling models, Scaling factors for device parameters.

UNIT-3 (12 Hours)

Subsystem Design and Layout: Architectural issues, Switch logic, Gate Logic, examples of Structured Design (combinational logic and sequential logic), Design of an ALU subsystem

UNIT-4 (12 Hours)

VLSI Design Flow: Introduction to ASICs, Full Custom ASICs, and Standard cell based ASICs, Gate array based ASICs, Programmable logic devices, ROM, PLAs, PALs, CPLDs and FPGAs.

Text Books :

1. "Basic VLSI Design" Douglas A. Pucknell and Kamran Eshraghian, Third Edition, PHI Learning Pvt. Ltd.
2. "Application-Specific Integrated Circuits" Michael John Sebastian Smith, Pearson India

References :

1. CMOS VLSI Design- A Circuits and Systems Perspective, Neil H. E. Weste, David Money Harris, 4th Edition, Pearson Education.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

LINEAR CONTROL SYSTEMS

III B.Tech. VI Semester (Code:20EC602)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Linear Algebra and Ordinarily Differential Equations

Course Objectives: Students will	
➢	Understand different types of control systems and obtain its transfer function.
➢	Study the Behavior of control systems for standard test signals.
➢	Determine the stability of the system from its analysis in the time and frequency domain using graphical method.
➢	Illustrate the concept of state space model for different control systems.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze transfer functions for different control systems and effect of feed back.
CO2	Analyze the response of controls system for various test signals and also obtain the time domain parameters and error constants.
CO3	Examine frequency characteristics, stability, and interpret system responses using graphical methods.
CO4	Plot root locus and analyze control systems by using state space analysis.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3											2		
CO2	2	3											2		
CO3	3	3											2		
CO4	3	3	2										3		
AVG	2.5	3	2										2.25		

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION: Basic concept of simple control system, open loop – closed loop control systems. Effect of feedback on overall gain – stability sensitivity and external noise. Types of feedback control systems–Linear time invariant, time variant systems.

MATHEMATICAL & MODELS TRANSFER FUNCTIONS OF PHYSICAL SYSTEMS: Differential equations – impulse response and transfer functions – translational and rotational mechanical systems. Transfer functions and open loop and closed-loop systems. Block diagram representation of control systems – block diagram algebra – signal flow graph - Mason's gain formula.

UNIT-2 (12 Hours)

TIME DOMAIN ANALYSIS: Standard test signals– step, ramp, parabolic and impulse response function–characteristic polynomial and characteristic equations of feedback systems,

transient response of first order and second order systems to standard test signals. Time domain specifications – steady state response – steady state error and error constants. Effect of adding poles and zeros on over shoot, rise time, bandwidth – dominant poles of transfer functions.

STABILITY ANALYSIS IN THE COMPLEX PLANE: Absolute, relative, conditional, bounded input– bounded output, zero input stability, conditions for stability, Routh – Hurwitz criterion

UNIT-3 (12 Hours)

FREQUENCY DOMAIN ANALYSIS: Introduction–frequency domain specifications, correlation between time and frequency responses. Polar plots– Bode plots- Nyquist stability criterion– Nyquist plots. Assessment of relative stability using Nyquist criterion–closed loop frequency response.

UNIT-4 (12 Hours)

ROOT LOCUS TECHNIQUE: Introduction– stability from root locus–construction of root loci.

STATE SPACE ANALYSIS: Concepts of stat, state variables and state models–digitalization– solution of state equations– state models for LTI systems. Concepts of controllability and Observability.

Text Books :

1. B.C.Kuo, Automatic control systems, 9th edition, PHI.
2. I.J.Nagrath & MGopal, Control Systems Engineering, 3rd Edition, New Age International

References :

1. Schaum Series, Feedback and Control Systems, TMH.
2. M.Gopal, Control Systems Principles and Design, TMH.
3. John Vande Vegta, Feedback Control Systems, 3rd Edition, PrenticeHall, 1993.
4. K.Ogata, Modern Control Engineering, 3rd edition, PHI.
5. Control Systems Engineering, Norman S.Nise, 6th Edition, Wiley, 2011.
6. Modern Control Systems, Richard C.Dorf and Robert H. Bishop, 12th Edition, Prentice Hall, 2011.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL SIGNAL PROCESSING

III B.Tech. VI Semester (Code:20EC603)

Lectures	:	2 Hours/Week	Tutorial	:	1 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Signals and Systems

Course Objectives: Students will	
➢	Study the various types of Digital signals and systems and their frequency domain representation.
➢	Learn and solve the concepts of DFT and FFT and their importance in signal processing applications
➢	Design IIR Digital filters through Approximation Procedures and their realizations.
➢	Design FIR Digital filters through windowing Techniques and study the basic concepts of Decimation and interpolation operations.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze various types of Digital signals and systems.
CO2	Determine and demonstrate the DFT and FFT of a given signal.
CO3	Design an IIR Digital Filter for given specifications.
CO4	Develop a FIR Digital Filter for given specifications and Realization of digital filters

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3													3
CO2	3	2													3
CO3	2	3	3												3
CO4	2	3	3												3
AVG	2.5	2.75	3												3

Syllabus

UNIT-1 (12 Hours)

DISCRETE-TIME SIGNALS AND SYSTEMS: Introduction to Digital Signal Processing, Advantages and Applications, Discrete time signals, LTI system: Stability and Causality. Frequency domain representation of discrete time signals and systems.

Z-TRANSFORMS: The Z Transform, Region of Convergence, Z-Transform theorems and Properties, Persaval's relation, Relation between Z-Transform and Fourier Transform, Inverse Z-transform using: (i) Cauchy's Integration theorem (ii) Partial fraction method (iii) Long division method. One sided Z- Transform, Solution of Difference equations using one sided Z-Transform.

UNIT-2 (12 Hours)

THE DFT AND FFT: Discrete Fourier Series (DFS), Properties of DFS, Discrete Fourier Transform (DFT), Properties of DFT, Computations for evaluating DFT, Decimation in time FFT algorithms (DITFFT), Decimation in Frequency FFT algorithms (DIFFFT), Computation of Inverse DFT.

UNIT-3 (12 Hours)

DESIGN OF IIR FILTERS: Introduction, Properties of IIR filter, Design of Digital Butterworth and Chebyshev filters using: (i) Bilinear transformation method (ii) Impulse invariance method. Design of Digital filters using frequency transform method.

UNIT-4 (12 Hours)

DESIGN OF FIR FILTERS: Introduction, Characteristics of Linear Phase FIR filters, Frequency response of FIR linear phase filters, Design of Linear-Phase FIR Filters Using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method.

REALIZATION OF DIGITAL FILTERS: Direct, Canonical, Cascade and Parallel realizations of Digital filters, Realization of Linear phase FIR filters

FUNDAMENTALS OF MULTIRATE SYSTEMS: Introduction, Decimation, Interpolation.

Text Books :
1. Lonnie C Ludeman, "Fundamentals of Digital Signal Processing," John Wiley & Sons, 2009.
2. Sanjit K Mitra, "Digital Signal Processing: A Computer Based Approach," 3rd Edition, TMH, SIE, 2008.

References :
1. John G. Proakis, Dimitris G Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications," 4th Edition, Pearson Education, 2007.
2. Alan V Oppenheim and Ronald W Schafer, Discrete Time Signal Processing, Pearson Education, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.
4. Johnny R.Johnson-Introduction to Digital Signal Processing, Prentice Hall, 1989

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INTERNET OF THINGS (IoT)

III B.Tech. VI Semester (Code:20EC604/SOC4)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 2

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn about the importance of the IOT system applications.
➢	Gain the knowledge of how to use various sensors in IoT real world scenario.
➢	Impart fundamental knowledge and programming of edge devices like Arduino and Raspberry Pi.
➢	Implement different case studies using cloud servers.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyzing the architecture of IoT along with statistical growth, levels and characteristics
CO2	Practicing how to interface various sensors in practical approach
CO3	Demonstrate the functionality and usage of Arduino and Raspberry pi
CO4	Examine the importance of IoT cloud in various applications using few case studies

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3												3	
CO2	3	2		3	2									3	
CO3	3	2		3	2									3	
CO4	3	2	3	2	2									3	
AVG	3	2.75	3	2.67	2									3	

Syllabus

UNIT-1 (12 Hours)

Introduction to IoT- IoT Growth, A statistical view, Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling techniques: Sensors, Cloud computing, Big Data analysis, Embedded computing boards, Communication protocols, User Interfaces. IoT challenges, IoT levels.

UNIT-2 (12 Hours)

Sensors and Their Interfacing- Introduction to sensor interfacing, Type of sensors: MQ-02/05-Gas sensor Interfacing with Node MCU/Arduino, Interfacing the Obstacle sensor, Interfacing the Heartbeat sensor, Interfacing the Ultrasonic sound sensor, Interfacing the Gyro sensor, Interfacing the LDR sensor, Interfacing the GPS, Interfacing the colour sensor, Interfacing the pH sensor.

UNIT-3 (12 Hours)

Getting Familiarized with Arduino IDE - Architecture, Arduino Programming, A simple application, Arduino playground.

Getting Familiarized with Raspberry-Pi - Story behind Raspberry-Pi, Architecture, Compatible peripherals, Add-Ons, and accessories. Operating system for Raspberry Pi, Setting up for Raspberry Pi, Initial configuration for Raspberry Pi.

UNIT-4 (12 Hours)

Cloud for IoT - Introduction, IoT with cloud-challenges, Selection of Cloud service provider for IoT Applications: An overview, Introduction to Fog Computing, Cloud Computing: Security aspects.

Case studies: Smart Lighting, smart irrigation, Smart parking

Text Books :
1. Shriram k Vasudevan, abhishek Nagarajan, RMD Sundaram, "Internet of Things", wiley, 1st Edition, 2019
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1stEdition, 2014.

References :
1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, Cambridge University Press, 1st edition, Nov 2020.
2. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley, 2013.
3. Simon Monk, Raspberry Pi Cookbook, O'Reilly 3rd Edition, 2019
4. Michael Margolis, Arduino Cookbook, 2nd Edition, December 2011, O'Reilly Media, Inc.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL DESIGN USING VERILOG HDL

III B.Tech. VI Semester (Code:20EC605/JO2-A)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hour/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the basics of Hardware Description Languages, Program structure and basic language elements of Verilog
➢	Gain experience by designing, modeling, implementing, and verifying several digital circuits using Verilog HDL.
➢	Know the gate-level modeling and dataflow modeling of combinational and simple sequential circuits
➢	Learn the behavioral modeling of combinational and sequential circuits , tasks and functions

Course Outcomes: After studying this course, the students will be able to	
CO1	Illustrate the design flow and design methodologies for a digital design.
CO2	Describe the basic conventions and interfaces for modules and ports.
CO3	Implement digital circuits using gate primitives and dataflow constructs.
CO4	Simulate digital circuits using behavioral description and with task and functions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2			3									3	
CO2	3				3									3	
CO3	2	3			3									3	
CO4	2	2			3									3	
AVG	2.5	2.33			3									3	

Syllabus

UNIT-1 (12 Hours)

Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-based design flow, importance of HDL.

Hierarchical Modeling Concepts: Top-down and bottom- up design methodology, differences between modules and module instances, components of a simulation, design block, stimulus block

UNIT-2 (12 Hours)

Basic Concepts: Lexical conventions, data types, system tasks, compiler directives.

Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing.

UNIT-3 (12 Hours)

Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and, orand, buffer, not type gates, rise, fall and turn-off delays, min, max, and typical delays, Examples

Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types, Examples.

UNIT-4 (12 Hours)

Behavioral Modeling: Structured procedures, initial and always, Procedural Assignments, timing controls, conditional statements, multi way branching, loops, sequential and parallel blocks, Examples.

Tasks and Functions: Differences between tasks and functions, declaration, invocation, automatic tasks, and functions

Practical Exercises

1. Introduction to Verilog Simulator, Adders – Structural
2. Adders - Data Flow & Subtractors – Behavioral
3. Full adder using Half Adder various types
4. Full adder testing using Test Bench
5. Priority Encoder 74x148 or 8x3 encoder using 4x2 encoder
6. Decoder 74x138 or 3x8 decoder using 2x4 decoder
7. Multiplexer 74x151, 8:1 mux using 4:1 using 2:1 mux
8. Multiplier
9. Arithmetic Unit Implementation 74x181
10. Logical Unit Implementation
11. Fast Adders, 74x283
12. 4-Bit Parity Generator, Comparator 74x85
13. Flip flops, Level, Edge triggered
14. 4-Bit Universal shift register 74x194
15. 3-bit Linear Feedback Shift Register
16. Counters 74x163, 74x169
17. 74x194, Mod-8 Counter, Ring counter
18. Bus Transceiver, 74x245, Bus/Register Transfer
19. Simulation/Study of Static/Dynamic electrical behavior
20. Simulation/Study of CMOS logic families, Low voltage CMOS interfacing.

Note: *Minimum of 10 experiments to be completed.*

Text Books :
1. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition, Prentice Hall PTR, 2003

References :
1. T.R.Padmanabhan, B.BalaTripura Sundari, Design through Verilog HDL– Wiley,2009.
2. Zainalabdien Navabi,VerilogDigital SystemDesign,TMH,2ndEdition

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ARTIFICIAL INTELLIGENCE

III B.Tech. VI Semester (Code:20EC605/JO2-B)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hour/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Machine Learning

Course Objectives: Students will	
➢	Gain a historical perspective of AI and its foundations and to learn the difference between optimal reasoning vs human like reasoning
➢	Understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities and to understand basic principles of AI toward problem solving, inference, perception, knowledge and learning.
➢	Learn different knowledge representation techniques and to explore the current scope, potential, limitations, and implications of intelligent systems and to explore the current scope, potential, limitations, and implications of intelligent systems.
➢	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models and to understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems

Course Outcomes: After studying this course, the students will be able to	
CO1	Demonstrate the ability to formulate an efficient problem space for a problem.
CO2	Exhibit the ability to select a search algorithm for a problem and characterize its time and space complexities.
CO3	Illustrate the skill of representing knowledge using the appropriate technique.
CO4	Utilize AI techniques to solve problems in Game Playing and Expert Systems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3														3
CO2	3	2													3
CO3	2	3	2												3
CO4	2	3	2		3										3
AVG	2.5	2.67	2		3										3

Syllabus

UNIT-1 (12 Hours)

Artificial Intelligence(AI): History and Foundation, AI Techniques, Problem Solving with AI Models, Data Acquisition and Learning Aspects in AI.

Problem Solving: Problem Solving Process, Formulating Problems, Problem Types and Characteristics, Problem Analysis and Representation, Performance Measuring, Problem Space and Search, Toy and Real-World Problems. General Search Algorithms, Unin formed Search.

UNIT-2 (12 Hours)

Informed Search Best First Search, Greedy Search, A*Search, AO*Search ,Local Search Algorithm and Optimization Problems.

Intelligent Agents: Rationality and Rational Agent, Performance Measure, Rationality and Performance, Flexibility and Intelligent Agents, Types of Agents.

UNIT-3 (12 Hours)

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-4 (12 Hours)

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools.

Practical Exercises

1. Write a python program to implement Breadth First Search Traversal?
2. Write a python program to implement Water Jug Problem?
3. Write a python program to remove punctuations from the given string?
4. Write a python program to sort the sentence in alphabetical order?
5. Write a program to implement Hangman game using python.
6. Write a program to implement Tic-Tac-Toe game using python.
7. Write a python program to remove stop words for a given passage from a text file using NLTK?
8. Write a python program to implement stemming for a given sentence using NLTK? Write a python program to POS (Parts of Speech) aging for the give sentence using NLTK?
9. Write a python program to implement Lemmatization using NLTK?
10. Write a python program to for Text Classification for the give sentence using NLTK?

Text Books :
1. Artificial Intelligence: Building Intelligent Systems ByParag Kulkarni and Prachi Joshi, PHI Publications.
2. Russell, Norvig: Artificial intelligence, A Modern Approach, Pearson Education, Second Edition. 2004.

References :
1. Rich, Knight, Nair: Artificial intelligence, Tata McGraw Hill, Third Edition 2009.
2. Introduction to Artificial Intelligence by Eugene Charniak, Pearson.
3. Introduction to Artificial Intelligence and expert systems Dan W.Patterson. PHI.
4. Artificial Intelligence by George Flugerrearson fifth edition.
5. Saroj Kaushik. Artificial Intelligence. Cengage Learning. 2011

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BIO-MEDICAL INSTRUMENTATION

III B.Tech. VI Semester (Code:20EC605/JO2-C)

Lectures :	2 Hours/Week	Tutorial :	0 Hour/Week	Practical :	2 Hour/Week
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: None

Course Objectives: Students will learn	
➢	About various types of physiological systems of the human body, and Bio-potentials related to the human body
➢	Working of devices used to pickup the bio-signals of the body such as ECG, EEG and EMG.
➢	Measuring cardiovascular parameters such as Blood pressure, blood flow, cardiac output and heart sounds.
➢	Handling of various types of medical instruments and modern technologies in medical field.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand the physiological nature of biological systems and bio-electric potentials in medical field
CO2	Analyze the ECG, EEG and EMG Waveforms.
CO3	Apply the techniques for the measurement of non-electrical parameters in the human body.
CO4	Gain the Knowledge about the performance of medical assisting and therapy equipment's, clinical instruments such as pacemakers, defibrillators, blood gas analyzers, CT scanner, MRI Scanner, USG.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3					3							2		
CO2	2	3				3						2	2		
CO3	3	3				2						2	2		
CO4	3					2						2	2		
AVG	2.75	3				2.5						2	2		

Syllabus

UNIT-1 (12 Hours)

Introduction: Introduction to Bio-Medical Engineering field, Components of Man-Instrument system, problems encountered in measuring a living system.

Physiological Systems of The Body: Basic features of cardiovascular system, Nervous system, muscular system, respiratory system.

Resting Potential & Action Potential Concepts: Resting potential concept, characteristics of resting potential, action potential concept, propagation of action potential.

Bio-Electric Potentials: Definition for Bio-electric Potential, Typical Examples of Bio-Electric Potential with important features.

UNIT-2 (12 Hours)

Bio-Medical Electrodes: Introduction to Bio-Medical Electrodes, Various types of Bio-Medical Electrodes: Surface electrodes, micro electrodes, needle electrodes depth electrodes.

Electro Cardio Grahphy (ECG): Introduction to electro cardiography, ECG LEAD Concept, various types of ECG Lead configurations, typical ECG wave form details, ECG recording, Analysis of Recorded ECG waveform.

Electro Encephalo Graphy (EEG): Introduction to Electro Encephalography, EEG Recording EEG in diagnostics.

Electro Myography: Introduction to Electro-Myography, EMG Recording, EMG Applications.

UNIT-3 (12 Hours)

Cardiovascular Measurements: Introduction to various cardiovascular parameters: Blood Pressure Blood flow, cardiac output, Heart sounds. Blood Pressure Measurement techniques : Direct methods & In-direct Methods.

Blood flow measurement techniques: Electro Magnetic Blood flow meter, ultrasonic Blood flow meter, Thermal convection method. Cardiac output Measurement techniques: Fick's technique, Indicator dilution method, thermal dilution method, Impedance change method. Phonocardiography: Heart sounds Recording.

UNIT-4 (12 Hours)

Therapeutic Instruments: Cardiac Pacemakers, Types of pacemakers: External pace makers, Internal Pacemakers, Pacing modes, lead wires & Electrodes for internal pacemakers, power sources for implantable cardiac pacemakers, hemo dialysis. Cardiac defibrillators, defibrillator electrodes, Introduction to diathermy. Various diathermy apparatus: Surgical, shortwave, microwave.

Instruments for clinical laboratory: Introduction to Bio-Chemical electrodes, Types of Bio-Chemical electrodes for measurement of various Blood gas parameters such as Blood P^{H}, P^{O2} P^{CO2} Blood gas analyzer, Blood cell counters.

Modern technologies in Bio-Medical field: Use of X-Rays in medicine, CT scan, ultrasound applications in medicine, MRI scan.

Practical Exercises:

1. ECG Recording
2. EEG Recording
3. EEG Recording
4. Measurement of various blood pressure parameters
5. Blood flow monitoring
6. Measurement of various blood gas parameters
7. Study and operation of Defibrillator

Text Books :
1. Leslie Cromwell, FredJ.Weibell and ErichA, Pleiffer, "Biomedical instrumentation and Measurements", IInded, Prentice Hall of India, 2004.
2. R.S Kandpur."Handbook of Biomedical Instrumentation, IInded, Tata McGraw Hill, 2011.

References :
1. Webster, Medical Instrumentation Application & Design, John Wiley & Sons.
2. Jog, Electronics in Medicine and Biomedical Instrumentation, Prentice Hall of India, 2006.
3. Dr.M.Armugam, "Biomedical Instrumentation" IInded, Anuradha Publications, 2009.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ADVANCED MICROCONTROLLERS

III B.Tech. VI Semester (Code:20EC605/ JO2-D)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hour/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn	
➢	PIC18 Architecture & Programming using MPLABX IDE
➢	Interfacing Peripherals to PIC18
➢	MSP430Architecture & Programming using Code Composer Studio
➢	Interfacing Peripherals to MSP430

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze PIC18 Architecture and Instruction Set to develop control applications.
CO2	Design microcomputer based systems with the knowledge of Interfaces and Peripherals of PIC18 to solve various engineering problems.
CO3	Analyze MSP430 Architecture, Instruction Set, Addressing modes to develop programs for various control applications using Assembly and Embedded C.
CO4	Realize Mixed Signal Processing and Networking Applications by analyzing on-Chip Resources such as Timers, ADC, Temperature Sensor, PWM and Communication Peripherals.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3												3	
CO2	3	2	3											3	
CO3	3	3												3	
CO4	3	2	3											3	
AVG	3	2.5	3											3	

Syllabus

UNIT-1 (12 Hours)

PIC18 Microcontroller:

Overview of PIC18 family, Features of PIC18F458, PIC18C801, PIC18F8720 & PIC18LF57K42. Typical architecture of PIC18, Register & Memory Organization: ROM& RAM Space. Instruction set of PIC18, Assembler Directives, I/O Port structure of Port B, basic assembly programs.

UNIT-2 (12 Hours)

PIC18 Peripherals:

Overview of Timers, structure of Timer0, Timer1&Timer2, Serialport, PIC-18 interrupt structure, Capture, Compare and PWMusing CCPmodule, parallel communication using PSP module, accessing flash and EEPROM and Interfacing external memory, basic interfacing programming using Assembly C.

UNIT-3 (12 Hours)

MSP430 Microcontroller:

Overview of MSP430 series, Features of MSP430G2553,MSP430F5529 & launch pad, Functional Block diagram, addressing modes, constant generator & emulated instructions, instruction set, typical port structure, basic programs, Clock system& generator, Low power modes, Exceptions–Interrupts &resets.

UNIT-4 (12 Hours)

MSP430 Peripherals:

Structure of internal Timers, Watchdog Timer, ADC, DAC, CCP& PWM, Comparator, USI& USCI (I2CorSPI) and basic interfacing programming using Assembly/C.

PRACTICAL EXERCISES

1. Arithmetic/Logical operations
2. Program control, bitwise operations
3. I/O Programming
4. EEPROM or Flash programming
5. Timers & Clock configurations
6. Capture/Compare using CCP
7. PWM–CCP or ECCP
8. Interrupt programming
9. Program control, bitwise operations
10. I/O Programming
11. Arithmetic/Logical operations
12. ADC or DAC
13. Low Power Modes
14. Interrupt programming
15. Timers & Clock configurations
16. Watch dog Timer
17. Capture / Compare using CCP
18. PWM
19. Comparator
20. USI/USCI – (I2C or SPI)

Note - Any 10 Compulsory

Text Books :
1. Muhammad Ali Mazidi, Danny causey, Rolin D.McKinlay, PIC Microcontroller and Embedded Systems Using Assembly and C for PIC18, PearsonEducation,2021.
2. John H.Davies, MSP430 Microcontroller Basics, Newnes, Publications, 2008.

References :
1. Ramesh Gaonkar, Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family),
2. Penram International, First edition, 2010. Chris Nagy, Embedded Systems Design using the TIMSP30Series, Newnes Publications, 2003.
3. Myke Predko, Programming and Customizing the PIC Microcontroller, 3rd Ed, McGraw HillTAB, 2017.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICROWAVE ENGINEERING

III B.Tech. VI Semester (Code:20EC606/PE2-A)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Use S-parameter terminology to describe various microwave circuits.
➢	Know the construction and operation of microwave solid-state devices.
➢	Comprehend the design aspects of O type tubes and M-type tubes and their characteristics.
➢	Understand the description of microwave bench setup and measures different microwave parameters using microwave bench setup.

Course Outcomes: After studying this course, the students will be able to	
CO1	Identify different microwave frequency band designations and analyze microwave passive devices using S-parameters
CO2	Describe the functioning, usage and applications of different microwave solid state devices.
CO3	Evaluate the parameters of various microwave tubes.
CO4	Discuss the measurement of different parameters using microwave bench set up.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													2
CO2	2	2													2
CO3	3	3													2
CO4	2	2													2
AVG	2.5	2.25													2

Syllabus

UNIT-1 (12 Hours)

Introduction: Microwave Frequencies, Advantages and Applications of Microwaves.

Microwave Components: Microwave Cavities - Rectangular and Circular cavity Resonators, Microwave Hybrid Circuits- Waveguide Tees E-plane, H- plane, Magic Tees (HybridTees),, Applications of magic Tee, Hybrid Rings, Significance of Scattering(S) parameters, Properties of a Scattering matrix, Scattering matrix calculations for E-plane Tee, H-plane Tee, Magic Tee Waveguide Corners, Bends and Twists, Directional couplers, Coupler parameters, S- matrix calculation for directional coupler, Applications of directional couplers, Circulators and Isolators.

UNIT-2 (12 Hours)

Microwave solid-state devices: Microwave Tunnel diode.

Transferred Electron Devices: GUNN-EFFECT Diodes, RWH Theory, Modes of operations.

Avalanche Transit Time Devices: IMPATT diode, TRAPATT diode, Pin diodes, Varactor diodes.

UNIT-3 (12 Hours)

Microwave Linear Beam Tubes (O-Type): Limitations of Conventional tubes at Microwave frequencies, Klystrons: Velocity modulation process, bunching process, output power and beam loading, Reflex Klystron: Velocity modulation, Power output and efficiency. Helix Traveling Wave tube: Slow Wave structures, Amplification process

Microwave Cross Field Tubes (M-Type): Magnetron Oscillators: M- Type Tubes- Eight cavity Cylindrical Magnetron, Modes of Resonance and π Mode operation, Hull Cut-off Voltage Equation, Separation of π mode, Sustained Oscillations in Magnetrons.

UNIT-4 (12 Hours)

Microwave Measurements: Components of Microwave Bench, Detection of Microwaves, Microwave power measurement, Impedance measurements, VSWR measurement, Frequency measurement, scattering coefficient measurements.

Text Books :
1. Microwave and Radar Engineering by M.Kulkarni, Umesh Publications, New Delhi,2009.
2. Microwave and Radar Engineering by Gottapu Sasi Bhushana Rao, Pearson Publications,2014.

References :
1. SamuelYLiao, Microwave Devices and Circuits, 3rd Edition, Pearson Education, 2003.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MOBILE & CELLULAR COMMUNICATIONS

III B.Tech. VI Semester (Code:20EC606/PE2-B)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the examples and fundamental concepts of wireless cellular communication systems.
➢	Learn the basic signal propagation mechanisms and practical link budget design using path loss models.
➢	Know the role of equalization in mobile communication and to study different types of equalizers and diversity techniques.
➢	Study the different wireless communication systems and their standards (1G to 4G).

Course Outcomes: After studying this course, the students will be able to	
CO1	Illustrate the fundamental concepts of mobile and cellular communication systems
CO2	Analyze the basic signal propagation mechanisms and compare various fading techniques.
CO3	Analyze the different equalization and diversity techniques.
CO4	Compare various cellular communication standards (1G to 4G)

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													3
CO2	3	2													3
CO3	2	3													3
CO4	2	3													3
AVG	2.5	2.5													3

Syllabus

UNIT-1 (12 Hours)

CELLULAR MOBILE COMMUNICATION CONCEPTS

Examples of wireless communication systems, Frequency reuse, Channel assignment strategies, Handoff strategies: types, prioritizing handoff, practical handoff considerations; Interference and system capacity: co-channel and adjacent channel interference, power control for reducing interference; Grade of service: definition, standards; Improving coverage and capacity in cellular systems: cell splitting, sectoring, repeaters for range extension, a microcell zone concept.

UNIT-2 (12 Hours)

MOBILE RADIO PROPAGATION: LARGE-SCALE PATH LOSS (FADING)

Free space propagation model, The Three basic propagation mechanisms: Reflection, ground reflection (Two-Ray) model, diffraction, scattering; Practical link budget design using path loss models.

SMALL SCALE FADING AND MULTIPATH

Small-scale multipath propagation, Parameters of mobile multipath channels, Types of small-scale fading: Fading effects due to multipath time delay spread, Fading effects due to Doppler spread.

UNIT-3 (12 Hours)

EQUALIZATION

Fundamentals of equalization, Training a generic adaptive equalizer, Equalizers in a communication receiver, survey of equalization techniques, Linear equalizers, Nonlinear equalization: Decision feedback equalization (DFE), Maximum likelihood sequence estimation (MLSE) equalizer.

DIVERSITY TECHNIQUES

Practical space diversity considerations: Selection diversity, feedback or scanning diversity, maximum ratio combining (MRC), equal gain combining (EGC), Polarization diversity, Frequency diversity, Time diversity, Rake receiver.

UNIT-4 (12 Hours)

EVOLUTION OF CELLULAR TECHNOLOGIES

First generation cellular systems, 2G Digital cellular systems, 3G Broadband wireless systems, Beyond 3G: HSPA+, WiMAX, and LTE.

LTE

Demand drivers for LTE, Key requirements of LTE design, LTE Network architecture, Future of mobile broadband-Beyond LTE.

Text Books :

1. Theodore S.Rappaport, Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003. (UNIT I, II, III).
2. Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Fundamentals of LTE, Pearson Education, 2011. (UNIT IV).

References :

1. Yi-BingLin, Imrich Chlamtac, Wireless and Mobile Network architectures, Wiley, 2001
2. W.C.Y. Lee, Mobile Cellular Communications, 2nd Edition, Mc-Graw Hill, 1995.
3. G Sasibhusan Rao, Mobile Cellular Communications, Pearson Education, 2013.
4. Wireless Communications" 1st Edition, Kindle Edition, Goldsmith.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

GLOBAL POSITIONING SYSTEMS

III B.Tech. VI Semester (Code:20EC606/PE2-C)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn fundamental concepts of GPS and various GNSS systems.
➢	Gain the importance of Augmentation in Navigation systems and GPS signal components.
➢	Learn GPS coordinate frames and Error sources.
➢	Know the GPS Measurements and data format.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand the basic concepts of GPS and GNSS Systems.
CO2	Acquire the knowledge for Augmentation in Navigation systems
CO3	Demonstrate different GPS Coordinate Systems and GPS Error Sources.
CO4	Compare various Measurement techniques and data formats in GPS systems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3														3
CO2	3	2													3
CO3	3	2													3
CO4	3	2													3
AVG	3	2													3

Syllabus

UNIT-1 (12 Hours)

Overview of GPS: GPS Architecture, The space segment, The user segment, The control segment, GPS orbits, GPS signals, Navigation signal.

Other Global Navigation Systems: Brief introduction about GLONASS, GALILEO and BEIDOU systems.

UNIT-2 (12 Hours)

GPS Augmentation Systems: Need for Augmentation, Types of Augmentation Systems, Space Based Augmentation System (SBAS), GPS Aided Geo Augmented Navigation (GAGAN), GPS signal components, Two levels of GPS positioning and timing services - Standard Positioning Service (SPS) and Precise Positioning Service (PPS), GPS receivers.

UNIT-3 (12 Hours)

Coordinate Systems: The earth Centered Inertial (ECI) frame, Earth-Centered, Earth-Fixed (ECEF) Coordinate system, World Geodetic System 84 (WGS 84), Indian Geodetic System.

GPS Error Sources: Onboard clock errors, Receiver clock errors, Ephemeris data errors, The multipath error, Ionospheric propagation errors, Tropospheric propagation errors, Error budget.

UNIT-4 (12 Hours)

GPS Measurements: Pseudo Range Measurements, Carrier-phase measurements, Cycle slips, Signal acquisition and Tracking, GPS Observables,

GPS Data Format: RINEX (Receiver Independent Exchange) format, Observation file, Navigation file.

Text Books :
1. G. Sasibhushana Rao, "Global Navigation Satellite System with essentials of Satellite Communications", Mc Graw Hill Education, Chennai.
2. Bradford W.Parkinson, James J. Spilker, "The Global Positioning System Theory and Applications" American Institute of Aeronautics and Astronautics, Volume 1, 1996.

References :
1. B.Hoffman – Wellenhof, H.Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PATTERN RECOGNITION AND APPLICATION

III B.Tech. VI Semester (Code:20EC606/PE2-D)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn about importance pattern recognition and its applications
➢	Study of various linear classification algorithms and Support vector machines
➢	Understand different nonlinear classification algorithms and networks
➢	Study various feature selection and feature generation methods.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze probability density function between the patterns using bayes classifier for supervised learning.
CO2	Estimate cost function and minimum mean square error between the pattern classes using linear classifier algorithms such as LMS, Support Vector Machines.
CO3	Estimate the cost choice function and minimum mean square error between the pattern classes using Non-Linear classifier algorithms such as back propagation algorithms, Multi-Layer perceptron Algorithms
CO4	Apply feature selection and generation techniques to identify features and separate objects in an image.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3													3
CO2	2	3													3
CO3	2	3													3
CO4	3	2													3
AVG	2.25	2.75													3

Syllabus

UNIT-1 (12 Hours)

Introduction to Pattern Recognition: Importance of pattern recognition, Features, Feature Vectors and Classifiers, Supervised, Unsupervised and Semi Supervised Learning.

Classifiers based on Baye's Decision Theory: Baye's decision theory, Discriminant Functions and decision surfaces, Bayesian classification for Normal Distributions, Estimation of Unknown probability density functions, The Nearest Neighbor Rule.

UNIT-2 (12 Hours)

Linear Classifiers: Linear Discriminant functions and Decision Hyperplanes, The perceptron Algorithm, Least Squares Method, Mean Square Error Estimation, LMS Algorithm.

Support Vector Machine: Separable classes, Nonseparable classes, Support Vector Machines-A geometric Viewpoint.

UNIT-3 (12 Hours)

Non Linear Classifiers: The XOR problem, The two layer perceptron, Three layer perceptrons, The Back propagation Algorithm, The cost function choice, choice of the network size, A simulation example, Networks with weight sharing, generalized linear classifiers, polynomial classifiers, Radial basis Function Networks.

UNIT-4 (12 Hours)

Feature Selection: Preprocessing, The peaking phenomenon, Feature selection based on statistical hypothesis testing, ROC curve, class separability measures and feature subset selection.

Feature Generation: Basis Vectors and Images, The KL Transform, The Singular Value Decomposition, Independent Component Analysis, Non-negative Matrix Factorization, Regional features, Features for shape and size characterization.

Text Books :
1. Sergios Theodoridis, Konstantinos Koutroumbas, Pattern Recognition, Academic Press, Fourth Edition, 2009.
2. Pattern Classification (2 edition) – Richard Duda, Peter E Hart, David G Stork, John Wiley &Sons, 2001.

References :
1. Pattern Recognition and Machine Learning ,Christopher M.Bishop, Springer Publications 2006.

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL SIGNAL PROCESSING LAB
III B.Tech. VI Semester (Code: 20ECL601)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits :	1.5

Pre-Requisite: Signals and Systems.

Course Objectives: Students will	
➢	Implement various modulation techniques using MATLAB.
➢	Realize LPF and HPF for DSP Applications.
➢	Evaluate DFT and IDFT using DIT and DIF algorithms.
➢	Design and implement IIR and FIR Filters.

Course Outcomes: At the end of the course, student will be able to	
CO1	Analyze various modulation techniques and schemes using software to enhance proficiency.
CO2	Simulate DFT, IDFT, LPF, and HPF for understanding digital signal processing principles in communication systems.
CO3	Evaluate DFT and IDFT of a 16-sample sequence using both DIT and DIF algorithms, refining proficiency in digital signal processing techniques.
CO4	Design and implement IIR Butterworth and FIR Filters with windowing, convolution, and correlation for practical signal processing skills.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3			3				2				2		3
CO2	3	3			3				2				2		3
CO3	3	3			3				2				2		3
CO4	3	3	3		3				2				2		3
AVG	3	3	3		3				2				2		3

LIST OF EXPERIMENTS 36 Hours

1. Simulation of AM.
2. Simulation of FM.
3. Simulation of DFT and IDFT.
4. Simulation of LPF&HPF.
5. Generate the basic pulse shapes, NRZ, RZ.
6. Simulation of Digital Modulation and Demodulation Schemes(ASK, PSK, FSK).
7. Simulation of DPCM.

8. Evaluation of DFT and IDFT of 16 sample sequence using DIT Algorithm.
9. Evaluation of DFT and IDFT of 16 sample sequence using DIF Algorithm.
10. Design of IIR Butterworth Filter using Impulse Invariant Method.
11. Design of FIR Filter using Windowing Technique.
12. Convolution of Two signals.
13. Correlation of Two signals.
14. Direct for mII realization of Given Second ordered Digital Filter using Simulink.
15. Serial / Parallel form realization of Given Second ordered Digital Filter using Simulink.

NOTE: *A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Lab Examination.*

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INTERNET OF THINGS LAB

III B.Tech. VI Semester (Code: 20ECL602)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to	
➢	Demonstrate skills in programming edge devices using Arduino board and Node MCU.
➢	Master skills in programming edge devices using Raspberry Pi.
➢	Interface different Sensors with Arduino, Raspberry Pi and Node MCU.
➢	Design & Interface Edge Devices and actuators using various protocols for IoT applications.

Course Outcomes: At the end of the course, student will be able to	
CO1	Experiment with edge devices like Arduino.
CO2	Select appropriate sensors for designing an IoT Application.
CO3	Choose appropriate components with feasible communication interfaces to realize an application.
CO4	Design & develop IoT applications and solutions using latest controllers

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2		3	3				3				2	3	2
CO2	3	2		3	3				3				2	3	2
CO3	3	2		3	3				3				2	3	2
CO4	3	2	3	3	3				3				2	3	2
AVG	3	2	3	3	3				3				2	3	2

LIST OF EXPERIMENTS

36 Hours

Design, Develop and implement Embedded and IOT applications using the following. Software: Arduino IDE; Tinker CAD; Raspbian OS and other Open Source Software. Hardware: Arduino, RaspberryPi, Node MCU andother Latest Controller boards.

Note: *Minimum of 10 experiments to be completed Arduino / RaspberryPi Basic (Optional – Study Experiments)*

a) *Interface Digital I/O–Switch- LED–Turn ON LEDfor1Secafter 2Sec.*
b) *Interface Analog I/O–Potentiometer.*

Using Arduino/ Raspberry Pi

1. Display entered keypad message in Serial Monitor.
2. Acquired Analog Sensor signal data (Ex:LDR/LM35) and display on LCD.
3. Data logic quired signal, display; entered data into an Micro SD Card.
4. Automatic Identification using (Ex:IR, Ultrasonic, RFID tags etc).
5. Automation of actuators based on sensor signals for specific application.

Using Node MCU

6. Interface Node MCU with display device (Ex: RGBLED)to convey signal information (ON/OFF, Different colors)etc for specific durations (Ex: 2, 3sec.)
7. Android Application Development –Android Studio or MITApp Inventor

Wireless/Internet/CloudConnectivityusingArduino/RaspberryPi/NodeMCU

8. Program to send or receive SMS using any MC.
9. Web Server: Control Motor using Relay, ON/OFF switch button over server web page.
10. Measure/Retrieve Sensor data and upload to Things peak.
11. Monitor or Control IOT application for Sending & Receiving data using a Mobile App.
12. Machine-to-Machine(M2M)Protocol; Publish/subscribe sensor data using MQTT
13. Broker.
14. Demonstration of any of the protocols (Ex: Zigbee, Bluetooth, RF, LoRa, or CAN).

IOT Design &UI Development using Latest Controller Boards &Software:

15. TIVAC/MSP430/MSP432withCC3100/CC3200;
16. PIC-IOTWA,WG/AVR-IOTWA,STM32,Beaglebone,
17. Matlab, Lab VIEW & my RIO
18. GPIO Programming, Sensor/ActuatorInterfacing–1
19. GPIO Programming, Sensor/ActuatorInterfacing-2
20. Upload/Read data to or from Cloud–1(Google, AWS,I BM, Microsoft Azure)
21. Upload/Read data to or from Cloud –2(Google, AWS, IBM, Microsoft Azure)
22. Setup my RIO as a standalone device and data logging to Pen Drive.
23. Connect my RIO over a network and Upload/Read data to or from the cloud.
24. Demonstration of IOT using Matlab

NOTE: *A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Lab Examination.*

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VLSI DESIGN LAB

III B.Tech. VI Semester (Code: 20ECL603)

Lectures :	0 Hours/Week	Tutorial :	0 Hours/Week	Practical :	3 Hours/Week
CIE Marks :	30	SEE Marks :	70	Credits :	1.5

Pre-Requisite: None.

Course Objectives: Students will be able to	
➢	Discuss basic language features of verilog HDL and the role of HDL in digital logic design.
➢	Describe the steps involved in synthesis and simulation of verilog HDL code.
➢	Design combinational circuits using HDL Programming Language.
➢	Design sequential circuits using HDL Programming Language

Course Outcomes: At the end of the course, student will be able to	
CO1	Demonstrate the basics of Hardware Description Languages, Program structure and basic language elements of Verilog.
CO2	Simulate various Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
CO3	Design sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
CO4	Synthesize Combinational and Sequential circuits using verilog HDL.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3			3				3	3				3	
CO2	3	3			3				3	3				3	
CO3	3	3	3		3				3	3				3	
CO4	3	3			3				3	3				3	
AVG	3	3	3		3				3	3				3	

LIST OF EXPERIMENTS 36 Hours

Write the Code using VERILOG, Simulate and synthesize the following:

1. Logic Gates.
2. Multiplexers/De-Multiplexers.
3. Encoders/Decoders.
4. Comparators.
5. Adders/Subtractors.
6. Multipliers.
7. Parity Generators.

8. Design of ALU.
9. Latches.
10. Flip-Flops.
11. Synchronous Counters.
12. Asynchronous Counters.
13. Shift Registers.
14. Memories.
15. CMOS Circuits.

NOTE: *A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Lab Examination.*

BAPATLA ENGINEERING COLLEGE:: BAPATLA

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROFESSIONAL ETHICS AND HUMAN VALUES

III B.Tech. VI Semester (Code:20EC607/MC02)

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	--	Credits	: 0

Pre-Requisite: None

Course Objectives: Students will	
➢	Explain the importance of Values and Ethics in Personal lives and professional careers.
➢	Compare about various social issues, code of ethics and uses of ethical theories
➢	Extend the concept of safety & risk assessment, responsibilities and engineering rights
➢	Classify different global issues and ethical principles of professional societies

Course Outcomes: After studying this course, the students will be able to	
CO1	Identify different human values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values
CO2	Illustrate professional roles played by an engineer in the society& apply the concepts of engineering ethics to various theories
CO3	Distinguish the concepts of safety and risk and understand the responsibilities of engineers towards the same
CO4	Apply ethical principles to resolve situations that arise in their professional lives and global issues.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						2		3				2			
CO2						2		3				2			
CO3						2		3				2			
CO4						2		3				2			
AVG						2		3				2			

Syllabus

UNIT-1 (12 Hours)

HUMAN VALUES: Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic Virtue, Respect for Others, Living Peacefully, caring, Sharing, honesty, Courage, Valuing Time, Cooperation,Commitment,Empathy,SelfConfidence,Character,Spirituality

UNIT-2 (12 Hours)

ENGINEERING ETHICS: Senses of 'Engineering Ethics', Variety of model issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Professions and Professionalism, Professional Ideals and Virtues, Theories about right action, Self- interest, customs and Religion, Uses of Ethical Theories.

UNIT-3 (12 Hours)

ENGINEERING AS SOCIAL EXPERIMENTATION: Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, A Balanced Outlook on Law, Safety, Responsibility and Rights: Safety and Risk-Assessment of Safety and Risk, risk Benefit

analysis and reducing risk. Collegiality and Loyalty, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, employee Rights, Intellectual Property Rights(IIPR), Discrimination.

UNIT-4 (12 Hours)

GLOBAL ISSUES: Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, consulting Engineering, Engineers as Expert Witnesses and Advisors, Moral Leadership, Sample Code of Ethics like ASME, ASCE, IEEE, Institution of engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

Text Books :
1. R.Subramanian, Professional ethics, Oxford higher Education, 2013.
2. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGrawHill, NewYork, 1996

References :
1. Govindarajan. M, Natarajan. S, Senthilkumar. V.S, Engineering Ethics, PHI, 2004.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RADAR ENGINEERING

IV B.Tech. VII Semester (Code:20EC701/PE3-A)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	: 0
CIE Marks	:	30	SEE Marks	:	70	Credits	: 3

Pre-Requisite: Antenna and Wave Propagation, Analog Communications

Course Objectives: Students will	
➢	Know the fundamentals of basic Radio Detection and Ranging (RADAR)
➢	Understand the working of various types of RADARS
➢	Learn RADAR Receivers and their applications
➢	Have an idea of Electronic Warfare in Military applications

Course Outcomes: After studying this course, the students will be able to	
CO1	Familiarize with the Range equation, Radar Cross Section and Losses of RADAR Systems.
CO2	Analyze the working of different types of Radars
CO3	Explain about the performance of Tracking radars and working of Radar Receiver
CO4	Describe various Principles of Electronic warfare used in Military

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													3
CO2	2	2													3
CO3	3	2													3
CO4	2	2				1									3
AVG	2.5	2				1									3

Syllabus

UNIT-1 (12 Hours)

Introduction to RADAR: The simple form of the Radar equation, Radar Block Diagram and operation, Applications of RADAR, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Integration of Radar pulses, Radar Cross Section of Targets, Cross Section Fluctuations, Transmitter Power, Pulse Repetition Frequency And Range Ambiguities, Antenna Parameters, System Losses.

UNIT-2 (12 Hours)

CW and Frequency Modulated RADAR: The Doppler Effect, CW Radar, Frequency Modulated CW Radar, Multiple Frequency CW Radar.

MTI and Pulse Doppler radar: Introduction, Block Diagrams of MTI Radar Delay line cancellers, Multiple or Staggered Pulse Repetition Frequencies, Range Gated Doppler Filters

UNIT-3 (12 Hours)

Tracking Radar: Tracking with Radar, Sequential lobbing, conical scan, Monopulse Tracking RADARS (amplitude comparison and phase comparison).

Receivers, Displays & Duplexers: The RADAR Receiver, Noise Figure, Mixers, Low Noise front Ends, Displays, Duplexers and Receiver Protectors, Radome.

UNIT-4 (12 Hours)

Electronic Warfare: Electronic counter measures and Electronic counter-counter measures, Introduction, Electronic counter measures, RADAR jamming, Electronic counter-counter measures, Electronic Support, Stealth applications.

Other Radar Topics: HF Over-the-Horizon Radar, Air-Surveillance Radar, Height Finder and 3D Radars, Bistatic Radar.

Text Books :

1. Introduction to Radar Systems - 2nd edition by Merrill Skolnik

References :

1. Radar Engineering and Fundamentals of Navigational Aids by GSN Raju Wiley India Pvt. Ltd.
2. Radar Principles, Technology, Applications by ByronEdde, Pearson Education 2007.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SPEECH PROCESSING

IV B.Tech. VII Semester (Code:20EC701/PE3-B)

Lectures :	3 Hours/Week	Tutorial :	0 Hour/Week	Practical :	0
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: Digital Signal Processing

Course Objectives: Students will	
➢	Understand the fundamentals of speech production model
➢	Learn speech coding techniques useful for speech compression
➢	Acquire the knowledge of speech enhancement techniques
➢	Apply the quantization techniques and wave form coding techniques on speech.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand the production of speech with the help of functioning of human organs and utilize the mathematical knowledge for modeling it.
CO2	Apply Linear Predictive Coding techniques to analyze the speech signals
CO3	Develop the speech enhancement and speech recognition algorithms useful for societal applications.
CO4	Analyze different types of speech coding and quantization techniques.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3														3
CO2	3	3													3
CO3	3	3													3
CO4	3	3													3
AVG	3	3													3

Syllabus

UNIT-1 (12 Hours)

Introduction– Signal and Linear Systems, Frequency analysis, Discrete-time signals and systems, filters. Speech production and acoustic phonetics , Anatomy and physiology of speech organs, articulatory phonetics, acoustic phonetics. Short-time speech analysis– windowing, spectra of windows, signal analysis in time domain, short time energy, magnitude, zero-crossing rate and auto correlation function,

UNIT-2 (12 Hours)

Linear Predictive Coding (LPC) Analysis– Basic principles, computation of LP coefficients, spectral estimation, window considerations, emphasizing low frequencies, pole-zero LPC models. Cepstral analysis – Mathematical details, applications of the cepstrum, ,pitch estimation using time domain and short-time spectral techniques.

UNIT-3 (12 Hours)

Speech Enhancement– Nature of interfering sounds, speech enhancement techniques, spectral subtraction, enhancement by resynthesis. Automatic speech recognition- Basic pattern recognition approaches, parametric representation of speech, evaluating the similarity of speech patterns.

UNIT-4 (12 Hours)

Speech Quantization and Coding- Uniform and Non-Uniform Quantizers and Coder, Companded Quantizers, Uniform Quantization of Non-uniform Sources: Adaptive Quantizers, Waveform Coding of Speech, Comparison of Different Waveform Coding Techniques, Parametric Speech Coding Techniques.

Text Books :
1. Douglas O Shaughnessy, Speech Communications, second Edition, Oxford University Press, 2000.
2. L.R Rabiner and S.W.Schafer. Digital Processing of signals, Prentice Hall

References :
1. Owens, Signal Processing of Speech.
2. Dellar and Proakis, Digital Signal Processing, PHI.
3. Dr. Shaila D. Apte, Speech and Audio Processing, Wiley India Edition.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FPGA DESIGN

IV B.Tech. VII Semester (Code:20EC701/PE3-C)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: VLSI Design

Course Objectives: Students will	
➢	Familiarize with various programmable logic devices of different families
➢	Study various FPGA Architectures and its features
➢	Understand the different programming technologies of FPGA.
➢	Implement large scale systems on FPGA.

Course Outcomes: After studying this course, the students will be able to	
CO1	Demonstrate various architectures and device technologies of PLDs and FPGAs.
CO2	Analyze and compare the various architectures of and FPGA
CO3	Explore various FPGA programming technologies.
CO4	Design and verify large systems on FPGA.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3												3	
CO2	2	3												3	
CO3	2	3												3	
CO4	2	2	3											3	
AVG	2.25	2.75	3											3	

Syllabus

UNIT-1 (12 Hours)

Introduction to Programmable Logic Devices: Introduction, Simple Programmable Logic Devices–Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices

FPGA Based Systems: Digital Design and FPGAs, Role of FPGAs, FPGA Types, FPGA Based System Design, Registers and RAM.

UNIT-2 (12 Hours)

Field Programmable Gate Arrays: Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

FPGA FABRICS: Introduction to FPGA Fabrics - FPGA Architectures - SRAM Based FPGAs - Permanently Programmed FPGAs-Chip I/O - Circuit Design of FPGA Fabrics - Architecture of FPGA Fabrics.

UNIT-3 (12 Hours)

SRAM Programmable FPGAs: Introduction, Programming Technology, Device Architecture, The Xilinx XC2000 Architectures.

Anti-Fuse Programmed FPGAs: Introduction, Programming Technology, Device Architecture, The Actel ACT1 Architectures.

UNIT-4 (12 Hours)

FPGA ARCHITECTURE DESIGN AND LARGE-SCALE SYSTEMS

Behavioral Design: Data path controller Architectures, Scheduling and Allocation, Power, Pipelining, Design Methodologies, Examples.

Introduction to Large scale systems - Busses - Platform FPGAs - Multi FPGA systems, Novel Architectures.

Text Books :

1. Stephen M. Trimberger, "Field Programmable Gate Array Technology", Springer International Edition.
2. Charles H. Roth Jr, Lizy Kurian John, "Digital Systems Design", Cengage Learning

References :

1. John V. Oldfield, Richard C. Dorf, "Field Programmable Gate Arrays", Wiley India.
2. Pak K. han/Samiha Mourad, "Digital Design Using Field Programmable Gate Arrays" - Pearson Low Price Edition.
3. Ian Grout, "Digital Systems Design with FPGAs and CPLDs", Elsevier.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MICRO ELECTRO MECHANICAL SYSTEM

IV B.Tech. VII Semester (Code:20EC701/PE3-D)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Electronic Devices and Circuits, Digital Logic Design

Course Objectives: Students will	
➢	Understand principles and applications of MEMS and NEMS in diverse fields.
➢	Gain knowledge of materials used in MEMS/NEMS fabrication and their suitability for applications.
➢	Acquire proficiency in fabrication technologies: photolithography, ion implantation, diffusion, oxidation, CVD, sputtering, etching, Bulk Micromachining, Surface Micromachining, and LIGA.
➢	Develop understanding of MEMS sensors and actuators, including design principles and operation, through case studies and practical applications.

Course Outcomes: After studying this course, the students will be able to	
CO1	Apply knowledge of MEMS and NEMS design principles to real-world applications.
CO2	Analyze and select appropriate fabrication techniques for MEMS production.
CO3	Evaluate the performance and characteristics of MEMS sensors in various scenarios.
CO4	Apply design principles to develop efficient MEMS actuators using different actuation mechanisms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3		3										2	3	
CO2	2	3	3										2	3	
CO3	3	2											2	3	
CO4	3	2	3										2	3	
AVG	2.67	2.33	3										2	3	

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION: Introduction to Design of MEMS and NEMS, Overview of Nano and Micro Electro Mechanical Systems, Applications of Micro & Nano Electro Mechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT-2 (12 Hours)

FABRICATION TECHNOLOGIES: Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, and LIGA.

UNIT-3 (12 Hours)

MICRO SENSORS: MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester.

UNIT-4 (12 Hours)

MICRO ACTUATORS: Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

Text Books :
1. Nadim, Maluf & Kirt Williams, "An Introduction to Micro Electro Mechanical System engineering, Artech house, Inc Boston 2003.
2. Stephen Beeby, Graham Ensell, Michael Kraft, Neil White "MEMS Mechanical Sensors", Artech house, Inc Boston 2003.

References :
1. Tai Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata McrawHill, 2002.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SATELLITE COMMUNICATIONS

IV B.Tech. VII Semester (Code:20EC702/PE4-A)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn Fundamental concepts of satellite communications and orbital mechanics.
➢	Understand the various space craft sub systems and satellite link design.
➢	Compare various multiple access techniques.
➢	Have fundamental knowledge on GPS

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze fundamental concepts of Satellite Communication and Orbital mechanism.
CO2	Examine the Satellite subsystems and satellite link design.
CO3	Classify the multiple access techniques (FDMA, TDMA, CDMA) used for Satellite Communication and also Describes the VSAT systems along with its applications
CO4	Illustrate the principles of Global Positioning System (GPS) and working

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													3
CO2	3	2													3
CO3	2	3													3
CO4	3	2													3
AVG	2.67	2.33													3

Syllabus

UNIT-1 (12 Hours)

Introduction:

A brief history of Satellite communications, Orbital Mechanics and Launchers: Orbital mechanics, Look angle determination, Orbital perturbations, Orbit determination, Launch and Launch vehicles, Orbital effects in Communication System performance

UNIT-2 (12 Hours)

Satellites:

Satellite sub systems, Attitude and Orbit Control system (AOCS), Telemetry, Tracking, Command & Monitoring, Power Systems, Communication subsystems, satellite antennas.

Satellite Link Design:

Introduction, Basic transmission theory, System noise temperature and G/T ratio. Satellite Downlink and Uplink Design.

UNIT-3 (12 Hours)

Multiple Access:
Introduction, FDMA, TDMA, CDMA.

VSAT systems:
Introduction, Overview of VSAT systems, Network Architectures, Access control Protocols, Basic techniques, VSAT Earth Station Engineering.

UNIT-4 (12 Hours)

Satellite Navigation and Global positioning System:
Introduction, Radio and satellite Navigation, GPS position location Principles, GPS Navigation Message, GPS Signal Levels, Timing Accuracy, GPS Receiver Operation, Differential GPS.

Text Books :
1. Satellite Communications, Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2nd Edition John Wiley India, 2006

References :
1. Satellite Communications, Dennis Roddy, McGraw-Hill International Edition, Third edition, 2001.
2. Advanced Electronic Communication Systems, W Tomasi, 4th Edition, Pearson Education, 2002.
3. Satellite Communications Systems : systems, techniques and technology, 5th edition, by G. Maral, M. Bousquet, Z. Sun, Publisher: John Willy and sons

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

WIRELESS NETWORKS

IV B.Tech. VII Semester (Code:20EC702/PE4-B)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Computer Organization and Architecture

Course Objectives: Students will	
➢	Understand the fundamentals of Ad-hoc and Mobile Ad-hoc Networks
➢	Gain the knowledge about broadcasting and geo casting in wireless networks.
➢	Learn the sensors and their role in wireless networks
➢	Acquire knowledge about various attacks that are prevalent in wireless networks

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe and distinguish various Mobile Adhoc Networks and its characteristic features
CO2	Understand and compare broad casting, multi casting and geo casting
CO3	Familiarize technology standards related to wireless sensor networks
CO4	Compare various attacks and understand the security issues that are prevalent in Ad-hoc and wireless sensor networks

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													3
CO2	2	2													3
CO3	2	3													3
CO4	2	3													3
AVG	2.25	2.5													3

Syllabus

UNIT-1 (12 Hours)

Introduction to Ad Hoc Networks: Characteristics of MANETs, Applications of MANETs and Challenges of MANETs. Routing in MANETs- Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms-Proactive: DSDV; Reactive: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-Location Services-DREAM,

UNIT-2 (12 Hours)

Broadcasting, Multicasting and Geocasting: Introduction, Broadcast Storm- Broadcasting in a MANET Flooding-Generated Broadcast Storm, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge based methods, Multicasting-Issues in Providing Multicast in a MANET, Introduction to Geocasting.

UNIT-3 (12 Hours)

Wireless Sensor Networks: Introduction, The Mica Mote,, Sensing and Communication Range, Design Issues- Challenges, Energy Consumption, Clustering of Sensors- Regularly placed sensors, Heterogeneous WSNs, Mobile Sensors, WSN Applications

UNIT-4 (12 Hours)

Attacks in Ad-hoc and Sensor Networks: Active and passive attacks- Black hole, Gray hole, Wormhole Rushing attacks, Sybil attack. DDoS attack.

Security: Introduction, Distributed Systems Security, Security in Ad-hoc Networks-Requirement Security Solutions Constraints, Challenges, Secure Routing- Problems Affecting Secure Ad-ho Routing, WSN Security

Text Books :
1. Schiller J., Mobile Communications, Addison Wesley, 2000.
2. Vijay Garg, "Wireless Communications and Networking", 1st Edition, Elsevier 2007.

References :
1. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc, 2002.
2. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc, 2000.
3. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI, 2000.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ADVANCED DSP

IV B.Tech. VII Semester (Code:20EC702/PE4-C)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Digital Signal Processing

Course Objectives: Students will	
➢	Develop practical proficiency in solving diverse filter bank models for signal processing applications.
➢	Analyze the efficiency of Continuous Wavelet and Short Time Fourier Transform techniques in representing signals in the time-frequency domain.
➢	Realize the suitability of Wavelet and Short Time Fourier Transform techniques for specific signal representation requirements, considering their strengths and limitations.
➢	Learn Discrete Wavelet Transform techniques at multiple scales to achieve optimal time-frequency signal representation based on signal characteristics and application needs.

Course Outcomes: After studying this course, the students will be able to	
CO1	Demonstrate proficiency in solving diverse filter bank models in practical problem-solving scenarios.
CO2	Analyze Continuous Wavelet and Short Time Fourier Transform techniques for efficient time-frequency signal representation.
CO3	Evaluate Wavelet and Short Time Fourier Transform techniques for time-frequency signal representation.
CO4	Apply various Discrete Wavelet Transform techniques at multiple scales.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													3
CO2	2	3													3
CO3	2	3													3
CO4	3	2													3
AVG	2.5	2.5													3

Syllabus

UNIT-1 (12 Hours)

Introduction: Basic sample rate alteration devices, Filters in sampling rate alteration systems, Multistage design of decimator and interpolator, Polyphase decomposition, Arbitrary-Rate sampling rate converters, Digital filter banks, Nyquist filters.

UNIT-2 (12 Hours)

Two-Channel Quadrature –Mirror Filter banks, Perfect reconstruction Two-Channel FIR Filter banks, L-Channel QMF banks, Cosine-Modulated L-Channel Filter banks, Multilevel Filter banks, Problems on each model.

UNIT-3 (12 Hours)

Continuous wavelet and Short Time Fourier Transform: Introduction, Wavelet Transform, Mathematical Preliminaries, Continuous Time-frequency representation of signals, Windowed Fourier Transform (STFT), Uncertainty principle and Time-Frequency tiling, Properties of Wavelets used in Continuous Wavelets Transforms, Continuous versus Discrete Wavelet Transform

UNIT-4 (12 Hours)

Discrete Wavelet Transform: Introduction, HAAR Scaling functions and Function spaces, Nested Spaces, HAAR Wavelet Function, Orthogonality, Normalization of HAAR bases at different scales, standardizing the Notations, Refinement relation with respect to Normalized bases, Support of a wavelet system, Daubechies Wavelets.

Text Books :

1. Digital Signal Processing, A computer Based Approach by Sanjit K Mitra, Tata Mc Graw Hill Publishing.
2. Insight into Wavelets from Theory to Practice by K.P. Soman, K.I. Ramachandran, N.G. Reshmi, PHI Publications, Third Edition, 2010.

References :

1. Multirate Systems and Filter Banks, P.P.Vaidyanathan, Pearson Education, Low Priced Edition, 2006.
2. Wavelet Transforms - Introduction to Theory and Applications, Raghuveer M. Rao, Ajit opardikar, Pearson Education, Asia.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CLOUD COMPUTING

IV B.Tech. VII Semester (Code:20EC702/PE4-D)

Lectures :	3 Hours/Week	Tutorial :	0 Hour/Week	Practical :	0
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the importance of cloud, migration to cloud and integration as a service
➢	Differentiate Cloud Deploy Models & Service Models in enterprise cloud environment
➢	Learn about Cloud Virtual Machines Migration and cloud enhancing service.
➢	Have knowledge on Cloud Data security issues, work flow engines and Service Level Agreement (SLA) management.

Course Outcomes: After studying this course, the students will be able to	
CO1	Analyze the Integrate Enterprise cloud Environments, Cloud Deployment & Service Models.
CO2	Understand the use of Cloud Virtual Machines and cloud enhancing service
CO3	Evaluate the Secure Distributed Data Storage and work flow engines for clouds.
CO4	Explain the Data security and SLA Management.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3			2	2						1			3
CO2	3	2			2	2						1			3
CO3	3	2			2	2						1			3
CO4	2	2			2	2						1			3
AVG	2.5	2.25			2	2						1			3

Syllabus

UNIT-1 (12 Hours)

Introduction to cloud computing: Cloud Computing in a Nutshell, roots of Cloud Computing, Layers and Types of Clouds, Desired Features of Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers.

Migration into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud

Enriching the 'Integration as a Service' Paradigm for the Cloud Era: An Introduction, The Onset of Knowledge Era, The Evolution of SaaS, The challenges of SaaS paradigm, New integration scenarios, The integration methodologies, Saas integration products and platforms, SaaS Integration Services, Business to Business Integration(B2Bi) Services, A Framework of Sensor Cloud Integration

UNIT-2 (12 Hours)

The Enterprise Cloud Computing Paradigm: Relevant deployment models for enterprise cloud computing, Issues for Enterprise Applications on the Cloud, Transition Challenges, Business Drivers toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain.

Virtual Machines Provisioning &Migration Services: Virtualization Technology overview, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT-3 (12 Hours)

Secure Distributed Data Storage in Cloud Computing: Introduction, Cloud Storage: from LANs TO WANs, Technologies for Data Security in Cloud Computing.

Workflow Engine for Clouds: Introduction, Workflow Management Systems and Clouds, Architecture of Workflow Management Systems, Utilizing Clouds for Workflow Execution.

UNIT-4 (12 Hours)

SLA Management in Cloud Computing: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.

Data Security in the Cloud: An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, Homo Sapiens and Digital Information, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security-Pros and Cons.

Text Books :
1. Rajkumar Buyya, James Broberg and Andrzej Goscinski, ' Cloud Computing Principles and Paradigms', Wiley Publications.

References :
1. Michael Miller, Cloud Computing – Web-Based Application That Change the Way You Work and Collaborate Online, Pearson Publications.
2. Thomas Erl, ZaighamMahmood, & Ricardo Puttini, Cloud Computing-Concepts, Technology& Architecture Pearson Publications.
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.

LOW POWER VLSI

IV B.Tech. VII Semester (Code:20EC703/PE5-A)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: VLSI Design.

Course Objectives: Students will	
➢	Understand various techniques of MOS fabrication process and basic electrical properties of MOS and BiCMOS circuits.
➢	Analyze basic MOS circuits by using stick diagram and MOS layout with the help technology-based design rules.
➢	Design combinational and sequential circuits using MOS technology.
➢	Gain knowledge on various types of design flows like ASIC design Flow, FPGA, CPLD.

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe different low power design methodologies and Modes of MOS transistor.
CO2	Analyze low power design approaches for system level and circuit level MOS Inverters and Combinational Circuits.
CO3	Illustrate different Sources of Power Dissipation.
CO4	Discuss different techniques for Minimizing Leakage Power.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3											2	3	
CO2	2	2											2	3	
CO3	3	2											2	3	
CO4	2	3	2		2								2	3	
AVG	2.25	2.5	2		2								2	3	

Syllabus

UNIT-1 (12 Hours)

Introduction: Historical background, why low power, sources of power dissipations, low power design methodologies. MOS Transistors: Introduction, the structure of MOS Transistor, the fluid model, modes of operation of MOS transistor, Electrical Characteristics of MOS Transistors, MOS Transistors as Switch

UNIT-2 (12 Hours)

MOS Inverters: Introduction, inverters and its characteristics, configurations, inverter ratio in different situations, switching characteristics, delay parameters, driving parameters, driving large capacitive loads.

MOS Combinational Circuits: Introductions, Pass-transistor logic, Gate logics, MOS Dynamic Circuits**.**

UNIT-3 (12 Hours)

Source of Power Dissipation: Introduction, short-circuit power dissipation, Switching power dissipation, glitching power dissipation, leakage power dissipation.

UNIT-4 (12 Hours)

Minimizing Leakage Power: Introduction, fabrication of multiple threshold voltages, approaches for minimizing leakage power, Adiabatic logic Circuits, Battery-Driven System, CAD Tools for Low Power VLSI Circuits.

Text Books :
1. Ajit. Pal, Low power VSLI Circuits and systems, springer.
2. Sung Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata Mcgrag Hill.

References :
1. Neil H.E Weste and K. Eshraghain, Principles of COMS VLSI Design, 2nd Edition, Addison Wesley (Indian reprint).
2. A.Bellamour, and M.I.Elmasri, Low power VLSI CMOS Circuit Design, Kluwer Academic Press, 1995.
3. Anantha P.Chandrakasan and Robert W.Brodersen, Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ADVANCED WIRELESS COMMUNICATIONS

IV B.Tech. VII Semester (Code:20EC703/PE5-B)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Study the concepts of wireless communications and multi-antenna systems.
➢	Evaluate the capacity of multi-antenna systems.
➢	Learn the concepts of Massive MIMO and mm-Wave technologies.
➢	Have knowledge on concepts of MIMO Beam forming and NOMA.

Course Outcomes: After studying this course, the students will be able to	
CO1	Illustrate the concepts of wireless communications and multi-antenna systems.
CO2	Analyze the capacity of multi-antenna systems.
CO3	Develop the concepts of Massive MIMO and mm-Wave technologies.
CO4	Summarize the concepts of MIMO Beam forming and NOMA.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3													3
CO2	3	3													3
CO3	3	3	2												3
CO4	3	2													3
AVG	3	2.75	2												3

Syllabus

UNIT-1 (12 Hours)

Advanced Wireless Communication: Introduction to Wireless Communication, Physical Modeling for Wireless Channels, Baseband and Passband Representation, Rayleigh Fading Channels, Bit Error Rate of Wired / Wireless Channel, Deep Fade, and Probability of Error Analysis, Introduction to Li-Fi.

Multi-Antenna System: Introduction to Multi-Antenna Diversity, Receive Diversity: Single-Input Multiple-Output (SIMO), BER of SIMO with Maximal-Ratio-Combining, Receive Combining Techniques, MISO and MIMO Wireless System.

UNIT-2 (12 Hours)

Capacity of Multi-Antenna Systems: Capacity of SISO Additive White Gaussian Noise (AWGN) Channel, Capacity of Multi-Antenna AWGN and Wireless Channels, Capacity of Slow-Fading Channels, Fast-Fading Channels, Capacity of Fixed MIMO Channel with Transmit Channel State Information (CSI), Capacity of Fixed MIMO Channel Without Transmit CSI, Optimal and Suboptimal MIMO Receivers.

UNIT-3 (12 Hours)

Massive Multiple-Input Multiple-Output (MIMO): Massive MIMO Fundamentals, Basics of Channel Estimation, Channel Estimation of Multi-cell Multiuser System, Element Wise-MMSE, LS, and Other Channel Estimation Techniques, Spectral Efficiency Analysis.

Millimeter-Wave (mm-Wave) Systems: mm-Wave System and Challenges, mm-Wave Channels, mm- Wave Design Considerations.

UNIT-4 (12 Hours)

MIMO Beamforming: Architecture, System Model, Objectives and Algorithms.
Non-Orthogonal Multiple Access (NOMA): Motivation of NOMA, Two-User NOMA, Achievable Throughput, Multi-User NOMA, MIMO NOMA.

Text Books :
1. EzioBiglieri, "MIMO Wireless Communications" Cambridge University Press.
2. Aditya K. Jagannatham, "Principles of Modern Wireless Communication Systems"

References :
1. Theodore S. Rappaport, Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Wireless Communications" 1st Edition, Kindle Edition, Goldsmith.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SEMICONDUCTOR DEVICE MODELING

IV B.Tech. VII Semester (Code:20EC703/PE5-C)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the concept and components of Metal Oxide Semiconductor (MOS) capacitor.
➢	Learn the concepts of MOSFET physics.
➢	Acquire the knowledge on characteristics of Silicon on Insulator (SOI) MOSFET.
➢	Familiriaze with the of Nano Scale Transistors and advanced MOSFETs.

Course Outcomes: After studying this course, the students will be able to	
CO1	Acquire the knowledge on MOS capacitor, modes of operations and the effect of non-uniform substrate doping.
CO2	Explain the channel and body effects and MOSFET reliability issues
CO3	Compare the characteristics of Fully Depleted Silicon on Insulator (FDSOI) and Partially Depleted on Insulator (PDSOI) MOSFETs.
CO4	Describe the working of Nano Scale Transistors and advanced MOSFETs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											2	3	
CO2	3	2											2	3	
CO3	3	2											2	3	
CO4	3	2											2	3	
AVG	3	2											2	3	

Syllabus

UNIT-1 (12 Hours)

MOS Capacitor: Energy band diagram of Metal-Oxide-Semiconductor contacts, Mode of Operations: Accumulation, Depletion, Midgap, and Inversion, 1D Electrostatics of MOS, Depletion Approximation, Accurate Solution of Poisson's Equation, CV characteristics of MOS, LFCV and HFCV, Non-idealities in MOS, oxide fixed charges, interfacial charges, Midgap gate Electrode, Poly- Silicon contact, Electrostatics of non-uniform substrate doping, ultrathin gate-oxide and inversion layer quantization, quantum capacitance, MOS parameter extraction.

UNIT-2 (12 Hours)

Physics of MOSFET: Drift-Diffusion Approach for IV, Gradual Channel Approximation, Sub-threshold current and slope, Body effect, Pao & Sah Model, Detail 2D effects in MOSFET, High field and doping dependent mobility models, High field effects and MOSFET reliability issues (SILC, TDDB, & NBTI), Leakage mechanisms in thin gate oxide, High-KMetal Gate MOSFET devices and technology issues, Intrinsic MOSFET capacitances and resistances, Meyer model.

UNIT-3 (12 Hours)

SOI MOSFET: FDSOI and PDSOI, 1D Electrostatics of FDSOI MOS, VT definitions, Back gate coupling and body effect parameter, IV characteristics of FDSOI-FET, FDSOI-sub-threshold slope, Floating body effect, single transistor latch, ZRAM device, Bulk and SOI FET: discussions referring to the ITRS.

UNIT-4 (12 Hours)

Nanoscale Transistors: Diffusive, Quasi Ballistic & Ballistic Transports, Ballistic planer and nano wire -FET modeling: semi-classical and quantum treatments. Advanced MOSFETs: Strain Engineered Channel materials, Mobility in strained materials, Electrostatics of double gate, and Fin-FET devices.

Text Books :

1. S.M. Sze& Kwok K. Ng, Physics of Semiconductor Devices, Wiley.
2. B. G. Streetman, S. K. Banerjee, Solid State Electronic Devices, Pearson, (2016).

References :

1. N. Arora, MOSFET modeling for VLSI Simulation: Theory and Practice, World.
2. Yannis T sividis, Operation and Modeling of the MOS Transistor, Oxford University Press.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ADVANCED SENSORS

IV B.Tech. VII Semester (Code:20EC703/PE5-D)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Learn working principles of various semiconductor sensors and their applications.
➢	Explain the working principles of chemical and Biomedical sensors and their applications
➢	Identify various micro sensors for measuring different physical quantities.
➢	Classify various smart sensors and their applications.

Course Outcomes: After studying this course, the students will be able to	
CO1	Illustrate the working principle of semiconductor sensors and their applications.
CO2	Explore the working principle and applications of chemical and Biomedical sensors.
CO3	Apply micro sensors for measurement of different physical quantities.
CO4	Design signal processing circuit for various measurement applications.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											3	2	
CO2	3	2											3	2	
CO3	3	3	2										3	2	
CO4	3	3	2										2	3	
AVG	3	2.5	2										2.75	2.25	

Syllabus

UNIT-1 (12 Hours)

Semiconductor Sensors: Metal Oxide Semiconductors, Hall Elements, Silicon Sensors, Silicon planner technology, Micro machine technology, mechanical, magnetic, chemical and other signals, IC sensors

UNIT-2 (12 Hours)

Chemical and Biomedical Sensors: Polymers, chemically modified electrodes, Membrane electrodes, Thick Film Devices, catalytic devices, Gas sensors.

Optical Sensors: Lasers, photo-detectors and optical fiber as sensors, integrated optics.

UNIT-3 (12 Hours)

Micro Sensors: Thin film sensors, Applications of Micro sensors, Mechanical, Magnetic and Chemical signals, Acoustic steam leak detector.

UNIT-4 (12 Hours)

Interfacing and Signal Processing: Intelligent and smart sensors, concepts of redundant and multi - sensory systems, operation in coded mode and mapping mode.

Text Books :
1. Middle Hock S and Andel SA – Silicon Sensors, Academic Press, London, 1989.
2. Edmonds TE - Chemical Sensors , Blackie London 1988.

References :
1. Patranabis D – Sensors and Transducers, Wheeler Publishing.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYSTEM ON CHIP ARCHITECTURE

IV B.Tech. VII Semester (Code:20EC703/PE5-E)

Lectures :	3 Hours/Week	Tutorial :	0 Hour/Week	Practical :	0
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the architectural features of System On Chip (SOC).
➢	Gain knowledge on different types of processors.
➢	Learn the various Memory Design for SOC.
➢	Imbibe the knowledge of customization using case studies.

Course Outcomes: After studying this course, the students will be able to	
CO1	Demonstrate the knowledge of SOC Architectural features.
CO2	Analyze various processor selection criteria and their limitations.
CO3	Design of Memory architectures on SOC.
CO4	Analyze the interconnection strategies and their customization on SOC.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3											2	3	
CO2	2	3											2	3	
CO3	3	3	3										2	3	
CO4	2	3											2	3	
AVG	2.5	3	3										2	3	

Syllabus

UNIT-1 (12 Hours)

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT-2 (12 Hours)

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling.

Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT-3 (12 Hours)

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

UNIT-4 (12 Hours)

Interconnect Customization: Interconnect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization.

Text Books :
1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiely India Pvt. Ltd.
2. ARM System on Chip Architecture – Steve Furber –2nd Eed., 2000, Addison Wesley Professional.

References :
1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM
3. System on Chip Verification– Methodologies and Techniques– Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DIGITAL IMAGE PROCESSING

IV B.Tech. VII Semester (Code:20EC705/JO3-A)

Lectures :	3 Hours/Week	Tutorial :	0 Hour/Week	Practical :	0
CIE Marks :	30	SEE Marks :	70	Credits :	3

Pre-Requisite: Digital Signal Processing

Course Objectives: Students will	
➢	Learn and summarize the digital image fundamentals and to be exposed to basic image processing techniques.
➢	Illustrate various filtering techniques for images in terms of spatial and frequency domain.
➢	Be familiar with different image restoration techniques and fundamentals of color images.
➢	Compare different image compression techniques and understand the morphological image processing operations.

Course Outcomes: After studying this course, the students will be able to	
CO1	Review the fundamental concepts of a digital image processing system.
CO2	Describe the spatial and frequency domain methods for image enhancement in gray scale images.
CO3	Examine various filtering techniques for Image restoration and understand the fundamentals of color image processing.
CO4	Analyze different lossy and lossless coding techniques for Image compression and understand the different morphological operations.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3													3
CO2	2	3													3
CO3	2	3													3
CO4	2	3													3
AVG	2	3													3

Syllabus

UNIT-1 (12 Hours)

INTRODUCTION: What Is Digital Image Processing? The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

DIGITAL IMAGE FUNDAMENTALS: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels.

UNIT-2 (12 Hours)

INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING: Background. Some Basic Intensity Transformation functions, Histogram Processing, Fundamentals of Spatial Filters, Smoothing Spatial Filters, and Sharpening Spatial Filters.

FILTERING IN THE FREQUENCY DOMAIN: Background, Extension to Functions of two variables, Some properties of 2D Discrete Fourier Transform, The basics of filtering in the Frequency Domain, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters.

UNIT-3 (12 Hours)

IMAGE RESTORATION: A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

COLOR IMAGE PROCESSING: Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening

UNIT-4 (12 Hours)

IMAGE COMPRESSION: Fundamentals, Some basic compression Methods, Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run length coding, Symbol based coding, Bit plane coding, Block transform coding, Predictive coding.

MORPHOLOGICAL IMAGE PROCESSING: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit & Miss Transformation.

Text Books :

1. R. C. Gonzalez, R.E.Woods, Digital Image Processing 4th Edition, Pearson Education Publishers,2019.

References :

1. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, Mc-Grah Hill Publications, 2010.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Thomson learning, Second Edition, 2001.
3. S.Sridhar, Digital Image Processing, Oxford University Press, 2016

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BIO-MEDICAL SIGNAL PROCESSING

IV B.Tech. VII Semester (Code:20EC705/JO3-B)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Illustrate the use of wavelets in medical applications
➢	Interpret the essential bio medical signals such as ECG and EEG
➢	Apply signal and data processing techniques to bio medical signals and applications in bio-medicine.

Course Outcomes: After studying this course, the students will be able to	
CO1	Examine biological systems from signals and systems viewpoint and apply suitable signal processing techniques.
CO2	Apply advanced data compressing, modeling, and signal processing techniques to ECG and EEG signals
CO3	Design and implement digital filters for noise reduction in ECG data
CO4	Design and implement digital filters for noise reduction in EEG data

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											2		
CO2	3	2											2		
CO3	2	2	3	2				2							3
CO4	2	2	3	2				2							3
AVG	2.5	2	3	2				2					2		3

Syllabus

UNIT-1 (12 Hours)

Mathematics for Bio-Medical Signal Processing: STFT - Introduction to wavelets - CWT and DWT with Haar wavelet, Random Processes: Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth and noise figure of systems.

UNIT-2 (12 Hours)

Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantization, DICOM Standards

UNIT-3 (12 Hours)

Cardiological Signal Processing: Pre-processing, QRS Detection Methods, Rhythm analysis, Arrhythmia Detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition. Adaptive Noise Cancelling: Principles of Adaptive Noise Cancelling, Adaptive Noise Cancelling with the LMS Adaptation Algorithm, Noise Cancelling Method to Enhance ECG Monitoring, Fetal ECG Monitoring

UNIT-4 (12 Hours)

Neurological Signal Processing: Modeling of EEG Signals, Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modeling of seizure EEG. Sleep Stage analysis, Inverse Filtering, Least squares and polynomial modeling.

Text Books :
1. D.C.Reddy, "Biomedical Signal Processing, Principles and Techniques", Tata McGraw Hill Publishing Company Limited, First Edition, 2005
2. Willis.J.Tompkins, "Biomedical Digital Signal Processing", Prentice Hall India Private Limited, First Edition, 2006.
3. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4th Edition, 2009, TMH.

References :
1. Rangaraj M.Rangayyan "Biomedical Signal Analysis– A case study approach" IEEE press series in biomedical engineering, First Edition, 2002.
2. Weitkunat R, "Digital Bio Signal Processing", 1991, Elsevier.
3. Akay M, "Biomedical Signal Processing", IEEE Press.
4. Cohen.A, "Biomedical Signal Processing-Time & Frequency Analysis", 1986, CRC Press.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ROBOTICS

IV B.Tech. VII Semester (Code:20EC705/JO3-C)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the basic concepts associated with the design and functioning and applications of Robots.
➢	Study about the drives and sensors used in Robots.
➢	Learn about analyzing robot kinematics and robot programming.

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe the concepts of robotics and its applications.
CO2	Design a robot with various links, mechanisms and effectors.
CO3	Choose appropriate sensors for specific applications.
CO4	Apply spatial transformations to obtain forward and inverse kinematics.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											2	3	
CO2	3	2											2	3	
CO3	3	2											2	3	
CO4	3	2	3		3								2	3	
AVG	3	2	3		3								2	3	

Syllabus

UNIT-1 (12 Hours)

FUNDAMENTALS OF ROBOT

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications

UNIT-2 (12 Hours)

ROBOT DRIVE SYSTEMS AND END EFFECTORS

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers,

Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT-3 (12 Hours)

SENSORS AND MACHINE VISION

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time

of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors. Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

UNIT-4 (12 Hours)

ROBOT KINEMATICS AND ROBOT PROGRAMMING

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom(In 3-Dimensional): Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages– VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

Text Books :
1. M.P. Groover, "Industrial Robotics– Technology, Programming and Applications", McGraw-Hill, 2001
2. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing,

References :
1. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
2. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw- Hill, 1995

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DEEP LEARNING

IV B.Tech. VII Semester (Code:20EC705/JO3-D)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: Probability and Statistics.

Course Objectives: Students will	
➢	Study the various types of Machine Learning Algorithms.
➢	Understand the basic Deep Learning architectures and study the concepts of activation functions.
➢	Explore the CNN architectures and study the transfer learning techniques.
➢	Know the functionality of RNN and Auto Encoders.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand machine learning algorithms such as MLP & back-propagation algorithms.
CO2	Explain the Deep Learning architecture and various activation functions.
CO3	Apply various CNN architectures such as ResNet, AlexNet, DenseNet, and PixelNet in Image classification.
CO4	Familiarize with sequence modeling networks such as RNN, Bi-RNN, LSTM, and Auto Encoders.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	2	2	2										3
CO2	2	3	2	2	2										3
CO3	2	3	2	2	2										3
CO4	2	3	2	2	2										3
AVG	2	3	2	2	2										3

Syllabus

UNIT-1 (12 Hours)

Machine Learning Basics: Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient descent, Curse of Dimensionality.

UNIT-2 (12 Hours)

Introduction to Deep Learning & Architectures: Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders.

UNIT-3 (12 Hours)

Convolutional Neural Networks: Architectural Overview – Motivation - Layers – Filters – Parameter sharing – Regularization, Popular CNN Architectures: ResNet, AlexNet.
Transfer Learning: Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

UNIT-4 (12 Hours)

Sequence Modelling–Recurrent and Recursive Nets: Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks.

Auto Encoders: Under complete AutoEncoders – Regularized AutoEncoders – stochastic Encoders and Decoders – Contractive Encoders.

Text Books:
1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" A press, 2018.

References:
1. Deep Learning with Python, Francois Chollet-Maning Publications, 2017.
2. Applied Machine Learning, M.Gopal, McGraw Hill Publishers, 2019

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP DEVELOPMENT

IV B.Tech. VII Semester (Code:20EC706/ME01)

Lectures	:	3 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	30	SEE Marks	:	70	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn how	
➢	To provide students an insight into the concepts of general, scientific management and various forms of business organizations along with awareness about various organization structures
➢	It aims to provide the students with an understanding of basics of human resource management, marketing management.
➢	To understand inventory control concepts, fundamentals of TQM, and supply chain management.
➢	To provide an understanding of financial management and realize the importance of entrepreneurship.

Course Outcomes: After studying this course, the students will be able to	
CO1	Describe the various functions of the management. Learn various forms and structures of business organizations.
CO2	Understand how resources to be planned and also understand various motivation theories, leadership styles and marketing management.
CO3	Develop knowledge about inventory control. Gain the knowledge on Total quality management and understand supply chain management.
CO4	Grasp complete knowledge on importance of entrepreneurship & ability to understand capital and various types of capital.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1									1		3	3			
CO2									1		3	3			
CO3									1		3	3			
CO4	2	3	2	3					1		3	3			
AVG	2	3	2	3					1		3	3			

Syllabus

UNIT-1 (12 Hours)

General Management: Management definition, Functions of Management and Principles of Management.

Scientific Management: Definition, Principles of Scientific Management.

Forms of Business Organization: Choice of form of organization, Salient features of Sole Proprietorship, Partnership, Joint Stock Company: Private Limited and Public Limited companies; Merits and demerits.

Organization: Definition, Line, line and staff, functional and matrix organization, Introduction to Strategic Management: Definition and scope

UNIT-2 (12 Hours)

Human Resource Management: Functions of HR management, human resource planning, recruitment, selection, placement, training & development and performance appraisal, Motivation theories, leadership styles.

Marketing Management: Concepts of Selling and Marketing, Functions of Marketing, Marketing mix (4 Ps); Advertising and sales promotion; Product life cycle; distribution channels.

UNIT-3 (12 Hours)

Materials Management: Inventory Control, objectives of inventory control, Inventory costs, Basic EOQ model, Model with Price breaks, ABC analysis, FSN Analysis, VED Analysis.

Total Quality Management: Definition of, Importance of quality, Phases of quality management, quality control, Difference between Inspection and Quality control, Components of total quality, Quality Function Deployment

Introduction to Supply Chain Management: Definition, scope of SCM, Drivers of SCM, Advantages, limitations

UNIT-4 (12 Hours)

Financial Management: Functions of finance, Types of Capital-Fixed and Working Capital, Break Even Analysis.

Entrepreneurship Development: Introduction, Entrepreneurial characteristics, Functions of an Entrepreneur; Factors affecting entrepreneurship; Role of communication in entrepreneurship; Entrepreneurial Development-Objectives, Need of Training for enterprises; Finance for the enterprises.

Text Books :

1. Essentials of Management /Koontz and Heinz Weihrich/ Tata-McGraw-Hill 10th Ed.
2. Manufacturing Organization and Management / Amrine / Pearson Education

References :

1. Management Science, A. R. Aryasri.
2. Industrial Engineering and production management by M Mahajan, Dhanapatrai Publications
3. Marketing Management, Philip Kotler

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ARTIFICIAL NEURAL NETWORKS

IV B.Tech. VII Semester (Code:20ECL701/SOC5)

Lectures	:	1 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	2 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits	:	2

Pre-Requisite: None

Course Objectives: Students will	
➢	Understand the basics of Artificial neural networks and various activation functions.
➢	Learn classification of patterns and patterns association.
➢	Acquire basic knowledge in competitive neural networks
➢	Gain knowledge on working of Back propagation algorithm.

Course Outcomes: After studying this course, the students will be able to	
CO1	Understand the functionality of Artificial Neural Model for different structures and activation functions.
CO2	Describe the characteristics of pattern classification.
CO3	Distinguish between competitive and feed forward neural networks.
CO4	Interpret the working of Back propagation algorithm.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	2	2	2										3
CO2	2	3	2	2	2										3
CO3	2	3	2	2	2										3
CO4	2	3	2	2	2										3
AVG	2	3	2	2	2										3

Syllabus

UNIT-1 (12 Hours)

ARTIFICIAL NEURAL NETWORKS: BASIC CONCEPTS: Introduction, Computation in terms of patterns, The McCulloch-Pitts Neural Model, The Perceptron, Neural Network Architectures, Activation Functions, Learning by Neural Nets.

UNIT-2 (12 Hours)

PATTERN CLASSIFIERS: Hebb Nets, Perceptron, Adaline, Madaline

PATTERN ASSOCIATORS: Auto-associative Nets, Hetero-Associative Nets, Hopfield Networks, Bi-directional Associative Memory.

UNIT-3 (12 Hours)

COMPETITIVE NEURAL NETS: The MAXNET, Kohonen's Self Organizing Map (SOM), Learning Vector Quantization (LVQ), Adaptive Resonance Theory (ART).

UNIT-4 (12 Hours)

BACKPROPAGATION: Multilayer Feed forward Net, The Generalized Delta Rule, The Back propagation Algorithm.

Practical Exercises

1. Write a program to generate the activation functions that are being used in Neural Networks
2. Write a program to realize the ANDNOT function using McCulloch-Pitts neural net.
3. Write a program to cluster the given samples using unsupervised learning (winner takes all algorithm).
4. Write a program to realize the logical AND with a neural net that learns the desired function through Hebb learning.
5. Write a program to realize the logical AND with a neural net that learns the desired function through Perceptron learning.
6. Write a program to realize the logical AND with a neural net that learns the desired function through LMS learning.
7. Write a program to realize a logical function with the help of ADALINE Learning.
8. Write a program to realize a logical function with the help of MADALINE Learning (XOR problem).
9. Write a program to implement an auto-associative net to store the patterns [-1 -1 -1 -1] and [-1 -1 1 1]. Test the performance of the net with the test patterns [-1 -1 -1 -1] (stored pattern), [1 1 1 1] (unknown pattern.)
10. Write a program to implement a hetero-associative net to map four patterns [1 1 0 0], [0 1 0 0], [0 0 1 1] and [0 0 1 0] to two output patterns [1 0], [0 1] so that patterns [1 1 0 0] and [0 1 0 0] are associated with [1 0] and the patterns [0 0 1 1], and [0 0 1 0] are associated with [0 1].
11. Write a program to find weight matrix in bipolar form for the bi-directional Associative memory (BAM) network based on the following binary input output pairs.

    S(1) = (1 1 0) t(1) = (1 0)
    S(2) = (1 0 1) t(2) = (0 1)
12. Write a program for clustering the vectors by using Kohonen's SOM network.
13. Write a program for clustering the following vectors into two clusters by using an LVQ net.

Vector	Class
(1 1 0 0)	1
(0 0 0 1)	2
(0 0 1 1)	2
(1 0 0 0)	1
(0 1 1 0)	2

14. Write a program for clustering the vectors by using ART-1 neural network.
15. Write a program to implement XOR function with momentum factor using Back-Propagation algorithm.

Text Books :
1. Introduction to SOFT COMPUTING by Samir Roy and Udit Chakraborty, Pearson Publishing, 2013.

References :
1. Introduction to Neural Networks using Matlab 6.0 by S N Sivanandam,S Sumathi, S N Deepa,Tata McGraw Hill Publishing,7th Reprint, 2008
2. J.M. Zurada Introduction to Artificial Neural Systems, Jaico Publications.
3. B. Yegnanarayana, Artificial Neural Networks, PHI, New Delhi.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

INDUSTRIAL/RESEARCH INTERNSHIP

IV B.Tech. VII Semester (Code: 20ECL702/INT02)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical	:	0 Hours/Week
CIE Marks	:	--	SEE Marks	:	100	Credits	:	3

Pre-Requisite: None.

Course Outcomes: At the end of the course, student will be able to	
CO1	Improve Communication skills and Soft Skills
CO2	Improve the domain knowledge.
CO3	Develop report writing skills.
CO4	Analyze the information, concepts, and ideas.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1									3	3		3	3	3	3
CO2									3	3		3	3	3	3
CO3									3	3		3	3	3	3
CO4									3	3		3	3	3	3
AVG									3	3		3	3	3	3

PROJECT WORK
IV B.Tech. VIII Semester (Code:20EC801/PW)

Lectures	:	0 Hours/Week	Tutorial	:	0 Hours/Week	Practical :	24 Hours/Week
CIE Marks	:	30	SEE Marks	:	70	Credits :	12

Pre-Requisite: None.

Course Outcomes: At the end of the course, student will be able to	
CO1	Identify the real time problem related to domain knowledge and outline a solution for the problem.
CO2	Acquire practical knowledge related to preparation of project.
CO3	Report the outcomes of the project by means of verbal and written presentation
CO4	Communicate effectively with engineering community applying knowledge through publication to know the limitations

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	2	2	3	3	3	2	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	2	2	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	2	3	3	3	3
AVG	3	3	3	3	3	2	2	3	3	3	2	3	3	3	3

The Project work shall be carried out by a batch consisting not more than four students for one semester. It should help the students to comprehend and apply different theories and technologies that they have learnt through and are learning. It should lead to a substantial result as a comparative study, a new application of the technologies available or some extension to the works carried out by some researcher and published in referred journals. Each batch must carry out the analysis, design, implementation and testing of the entire project basing on the Software Engineering principles. There shall be a total of three reviews made by the batch regarding:

1. **Project Initiation Step:** The idea/concept which forms the basis for their project shall be presented to the guide, concerned in charge and classmates and shall get the approval for Continuation.
2. **1st Review:** The analysis and design carried out.
3. **2nd Review**: The implementation and the testing done.
4. **3rd Review:** Over all Presentation of the work carried out and the results found out for the valuation under the internal Assessment.

A comprehensive report on the lines of format specified by the department is to be submitted at the end of the semester, which is certified by the concerned guide and the HOD.

There shall be an external examiner appointed by the Principal/Controller of Examiner to make an assessment and to carry out the Viva-Voce examination.