FACULTY OF ENGINEERING AND TECHNOLOGY

UNDER GRADUATE PROGRAMMES

REGULATIONS -2023

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from the Academic Year 2023-2024

ST. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

(Deemed to be university U/S 3 of UGC Act 1956)

Accredited with Grade "A+" by NAAC | ISO 9001:2015 Certified| Approved by AICTE

AVADI, Chennai - 600054

TABLES OF CONTENTS

I. PREAMBLE

As per the recommendations of UGC, St.Peter's Institute of Higher Education and Research (SPIHER) has introduced Choice Based Credit System (CBCS) from the academic year 2015-16. Along with Choice Based Credit System the institution also adopted Outcome based Education (OBE) from 2015-16 academic year, with more emphasis on modified academic curriculum to meet corporate needs. Open electives, credits for internship, and semester abroad program are the measures taken to induce prolific quality component into the system. Continuous evaluation system is further strengthened with 40-60 percentage weightage that is in place for internal and external examinations respectively.

SPIHER has always strived to be a pioneer in delivering quality education. SPIHER has taken incremental steps in the right direction to provide holistic development to students through its academic curriculum. The four verticals namely knowledge, skill, self-development and learning to learn are considered while designing the curriculum. The curriculum is designed to facilitate multi-disciplinary learning, experiential learning through Project Based Learning as part of the learning process.

II. DEFINITIONS AND NOMENCLATURE

PRELIMINARY DEFINITIONS & NOMENCLATURE

i. **"Degree"** Refers the academic award conferred up a student after the successful completion of the programme in the stipulated period with required credits and set procedures. The Degree is a Under graduate program which is "Bachelor of Engineering" or Bachelor of Technology", also referred "B.E." or "B.Tech" respectively.

ii. **"Programme"** means B.E./B.Tech. Degree Programme.

iii. **"Branch"** means specialization or discipline of B.E./B.Tech. Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iv. **"Course"** means theory / practical / laboratory integrated theory / seminar / internship / project and any other subject that is normally studied in a semester like English, Mathematics, Environmental Science, Engineering Graphics, Electronic Devices etc.,

v. **"Institution"** means St.Peter's Institute of Higher Education and Research, Avadi, Chennai.

vi. **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vii. **"Director (Academic Affairs)"** means the Director (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

viii. **"Controller of Examinations (CoE)"** means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.

ix. **"Head of the Department (HoD)"** means the Head of the Department concerned.

x. "**Minor "The** discipline other than the major stream of study selected by the student, for secondary specialization

xi. "**UGC"** means, University Grants Commission

xii. **"AICTE"** All India Council of Technical Education

xiii. **"SWAYAM" means** Study Webs of Active-Learning for Young Aspiring Minds is an Indian Massive Open Online Course (MOOC) platform

ACADEMIC REGULATIONS 2023

Under Choice Based Credit System (CBCS)

1.0 VISION AND MISSION OF THE INSTITUTION

1.1 Vision:

To be a globally renowned institution in academic excellence, research and innovation by providing inspirational learning to produce socially conscious leaders capable of addressing future challenges with ethical values.

1.2 Mission:

- To provide a vibrant learning environment, fostering innovation and creativity inspired by cutting edge research.
- To instill ethical values, imbibe a sense of social responsibility and strive for societal wellbeing.
- To promote National and International alliances and collaborative initiatives to achieve global excellence.

2.0 ADMISSION

2.1 Candidates for admission to the first semester of the eight semester B.E / B. Tech. degree programme shall be required to have passed the Higher Secondary Examination of the 10+2 curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any University or authority accepted by the Institution as equivalent thereto.

2.2 Candidate shall also write an entrance examination prescribed by the Institution for admission. The entrance examination shall test the proficiency of the candidate in the courses considered eligible for admission on the standards prescribed for 10+2 academic stream.

2.3 Candidates for admission to the third semester of the eight semester B.E / B.Tech. programme under lateral entry category shall be required to have passed minimum Three years / Two years (Lateral Entry) Diploma examination in any branch of Engineering / Technology or passed B.Sc. Degree from a recognized University as defined by UGC and passed 10+2 examination with Mathematics as a subject or

Passed three year Diploma of Vocation Stream (D.Voc) in the same or allied sector or any other examination of any other authority accepted by the Institution as equivalent thereto.

2.4 Multiple Entry options (Credit transfer through ABC), credit exemptions as per the direction of duly appointed expert committee in the respective department

2.5 The Institution shall offer suitable bridge courses in Mathematics, Physics, Engineering drawing, etc., for the students of diverse backgrounds.

2.6 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution in adherence to the guidelines of regulatory authorities from time to time.

2.7 The duration of the programme for the Degree of Bachelor of Engineering and Bachelor of Technology will be four academic years, with two semesters in each year. The duration of each semester will normally be 90 working days. However, a student may complete the programme at a slower pace by taking more time, but not more than seven years.

3.0 PROGRAMMES OF STUDY

Regulations are applicable to the following B.E./B.Tech. programmes in various branches of Engineering and Technology, each distributed over eight semesters, with two semesters per academic year.

1 BioMedical Engineering

2 Civil Engineering

3 Computer Science and Engineering

4 Electrical and Electronics Engineering

5 Electronics and Communication Engineering

6 Information Technology

7 Mechanical Engineering

4.0 STRUCTURE OF THE PROGRAMME

The detailed courses of study for a programme will be decided by the respective department's Board of Studies. As per NEP 2020, the structure and lengths of degree programmes are adjustable. The undergraduate degree will be of 4-year duration, with multiple entries/exit options as per AICTE/UGC guidelines.

The 4-year multidisciplinary Bachelor's programme, however, shall be the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition with the focus on the chosen major and minors as per the choices of the student. Every programme will have a curriculum with a syllabus consisting of theory, practical, Theory based practical, Project based theory, internship, project work, etc. for 161 credits.

4.1 Categorization of Courses

i. **Humanities, Social Sciences and Management Courses (HSC)** include English for communication, Employability Skills, Engineering Ethics and Human Values and Management courses.

ii. **Basic Science Courses (BSC)** include Mathematics, Physics, Chemistry, Biology, Environmental Science and Sustainability, etc.

iii. **Engineering Science Courses (ESC)** include Engineering Practices, Engineering Drawing, Basics of Civil / Electrical / Electronics / Mechanical / Computer Engineering, Instrumentation etc.

iv. **Professional Core Courses (PCC)** include the core courses relevant to the chosen specialisation/branch.

v. **Professional Elective Courses (PEC)** include the verticals with elective courses and elective courses relevant to the chosen specialisation/ branch.

vi. **Open Elective Courses (OEC)** are Multidisciplinary courses that include the courses from Humanities and other disciplines of Engineering and Technology. Students can choose these courses from the list of Open Elective courses specified in the respective curriculum. Students may also choose courses from other disciplines from Swayam/NPTEL platform, including non-engineering courses.

vii. **Employability Enhancement Courses (EEC)** Includes Project Work and/or Internship, Career Development Skills, Creative and Innovative Project, Seminar, Professional Practices, Case Study and Industrial/Practical Training

viii. **Mandatory Courses (MC)** Mandatory Audit Courses like Environmental Science, Constitution of India, Behavioral Science, etc. are noncredit courses offered to all engineering programs of the Institution.

4.1.1 Mandatory Induction Programme for First year Students

The first-year students upon admission shall undergo a mandatory three week induction programme consisting of physical activity, creative arts, universal human values, literary, proficiency modules, lectures by eminent people, visits to local areas, familiarization with departments / schools and centres, etc.,

4.1.2 Personality and Character Development

All students shall enroll, on admission, in any of the following personality and character development programmes:

- National Service Scheme (NSS)
- Youth Red Cross (YRC)

The training activities / events / camp shall normally be organized during the weekends / vacation period.

4.1.3 Online Courses for Credit Transfer

Students are permitted to undergo department approved online courses under SWAYAM and others from 3rd to 8th Semester with the recommendation of the Head of the Department and with the prior approval of Director (Academic) during his / her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

4.1.4 Value Added Courses

The students are permitted to pursue department approved online courses (excluding courses registered for credit transfer) or courses offered / approved by the department as value added courses. The details of the value-added course viz., syllabus, schedule of classes and the course faculty shall be sent to the Director (Academic) for approval. The students may also undergo the valued added courses offered by other departments with the consent of the Head of the Department offering the course. These value-added courses shall be specified in the consolidated mark sheet as additional courses pursued by the student over and above the curriculum during the period of study.

4.1.5 Industry Internship

The students shall undergo training for a period as specified in the curriculum during the summer vacation in any industry relevant to the field study. The students are also permitted to undergo internship at research organizations / eminent academic institutions for the period prescribed in the curriculum during the summer vacation, in lieu of Industrial training. In any case, the student shall obtain necessary approval from the Head of the Department / Director Academic and the training has to be taken up at a stretch.

4.1.6 Industrial Visit

The student shall undergo at least one industrial visit every year from the second year of the programme. The Heads of Departments / Director Academic shall ensure the same.

4.2 CREDIT ASSIGNMENT FOR SEMESTER PROGRAM OF 15 WEEKS

Each course is normally assigned certain number of credits:

Lecture Hours (Theory)	1 Credit Per Lecture hour per week
Practical Hours	1 Credit for 2 Practical hours, 2 Credits for 4 hours of practical per week
Tutorial	1 Credit for 2 hours per week. 1 hour per week will not have credits
Courses with Project Based Learning Approach (PBLA)	1 Credit Per Lecture Hour Per week
Project Work Phase I	3Credits for 6 hours of project work (Phase - I) per week
Project Work Phase II	9 Credits for 18 hours of project work (Phase - II) per week
Internship/Entrepreneurship/ Consultancy/In plant training/	1 Credit for minimum 2 weeks during vacation
External Learning	1 credit for 3 credits hours per week which includes blended learning. 1 or 2 hours per week will not have credits.

4.3 Each semester curriculum shall normally have a blend of lecture courses, laboratory courses, laboratory integrated theory courses, etc.

4.4 The medium of instruction, examinations and project report shall be in English, except for courses in languages other than English.

4.5 ENROLLMENT FOR B.E. / B. Tech. (Honours) and B.E. / B. Tech. minor with specialisation in another discipline. (OPTIONAL)

4.5.1 B.E / B.Tech. (Hons.)

a) The students should have taken additional courses from a specified group of Professional Electives (vertical) or from any of the verticals of the same programme and earned a minimum of 18 credits.

b) Should have passed all the courses prescribed in the curriculum and additional courses in the first attempt.

c) Should have earned a minimum of 7.50 CGPA taking into account of all the courses prescribed in the curriculum and additional courses.

d) Lateral Entry students shall be permitted to register for the courses from Semester V onwards provided the students have earned a minimum CGPA of 7.50 until Semester III and have cleared all the courses in the first attempt.

e) If a student decides not to opt for Honor's, after completing certain number of additional courses, such additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum.

If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the grade sheet, however, they will not be considered for calculation of CGPA and the same shall be indicated in a foot note appropriately.

If the student has failed in the additional courses or faced shortage of attendance, they will not be printed in the grade sheet and will not be considered for CPGA calculation and classification of degree.

4.5.2 B.E./B.Tech. Minor with specialisation in another discipline:

The student should have earned additionally a minimum of 18 credits in any one of the verticals offered from other Engineering Disciplines / Science and Humanities / Management.

a) For these 18 credits students can optionally enroll and study a maximum of 6 credits in online mode from SWAYAM-NPTEL platform (in addition to the three online courses permitted for courses of curriculum), as approved by Head of the Department / Director Academic

b) B.E / B.Tech. (Hons.) and B.E./B.Tech. minor with specialisation in another discipline will be optional for students and the students shall be permitted to select any one of them only.

c) For the category 4.5.2, the students, including Lateral Entry, will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.

d) B.E/B.Tech. (Hons.) or B.E./ B.Tech. Minor shall be offered by the Department irrespective of the number of students enrolled.

e) If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum.

If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the grade sheet, however, they will not be considered for calculation of CGPA and the same shall be indicated in a foot note appropriately.

If the student has failed in the additional courses or faced shortage of attendance, they will not be printed in the grade sheet and will not be considered for CGPA calculation and classification of degree.

The student has to enroll for these additional courses separately and pay a tuition fee for studying these six additional courses and pay additional exam fee.

5.0 REGISTRATION AND ENROLLMENT

5.1 Each student, on admission, shall be assigned to a Faculty Advisor, who shall advise and counsel the student about the details of the academic programme and the choice of courses, considering the student's academic background and career objectives.

5.2 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn continuous assessment marks and appear for the end semester examinations.

5.3 Each student on admission shall register for all the courses prescribed in the curriculum in the student's first Semester of study.

The enrollment for all the courses of curriculum from the Semesters II to VIII and additional courses for Honours and Minor from the semesters V and VIII will commence 5 working days prior to the commencement of the succeeding semester. The courses for Honours and Minor shall be registered separately under additional courses. The student shall enroll for the courses with the guidance of the student's Faculty Advisor. If the student wishes, the student may drop or add courses within 10 working days after the commencement of the concerned semester and complete the registration process duly authorized by the faculty incharge within 30 days from the commencement of concerned semester. The list of students approved by the respective faculty incharge shall be final and would be considered for attendance, grades and calculation of CGPA and no changes shall be made thereafter.

5.4 For enrollment, a student MUST have

I. Cleared all the Institute and Hostel dues of the previous semesters and the current semester fees.

II. Not been debarred from registering for a specified period on disciplinary or any other ground.

5.5 Flexibility to Add or Drop courses:

5.5.1 A student has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. From the II to VII semesters, the student has the option of registering for additional

courses or dropping existing courses in a semester. The total number of credits that a student can add or drop in a semester is limited to 8, subject to a maximum of 2 courses. Maximum number of credits enrolled in a semester (including Shortage of Attendance (SA), Honours and Minor) shall not exceed 30. The online courses registered shall be over and above this 30 credits.

5.5.2 If the student wishes to earn more than the total number of credits prescribed in the curriculum of the student's programme within the minimum duration of the programme, then he/she can enroll for such additional courses in any programme with the permission of Head of the Department to which student belongs and Head of the Department in which the course is offered by paying the examination fee. The credits earned will be neither considered for the computation of CGPA nor for the classification of the degree. The courses successfully completed will be printed in the grade sheet, however if there is shortage of attendance or failure, it shall neither be reflected in the grade sheet nor be considered for classification. Maximum number of credits enrolled in a semester (including SA, Honours and Minor) shall not exceed 30 (except online courses).

5.6 Choice of Professional Elective Courses

The professional Elective Courses are listed in the Curriculum in Table format as verticals (Specialisation groups). A student can choose all the Professional Elective Courses either from one of the verticals or a combination of courses from all verticals in a semester. However, students irrespective of enrolling for additional courses for B.E. / B. Tech. (Hons.) are not permitted to choose more than one course from a row. Students are permitted to enroll more than one elective course from the same vertical in a semester. In the subsequent semesters students are permitted to enroll one more course in a row, provided if he/she has cleared the earlier course of the same row. For a professional elective course and open elective course, minimum number of students enrolment permitted shall be 10. However, the minimum number is not applicable for students enrolling B.E. / B. Tech. (Hons) and B.E./B.Tech. Minor. For each professional elective course at least two choices shall be offered.

5.7 Redoing a Course

Redoing a course means reregistering for a course, attending all classes, fulfilling the attendance requirements as per clause 6, earning fresh Continuous Assessment marks and appearing for the End Semester Examinations. A student has to redo a course as per the following conditions.

5.7.1 If a student is prevented from writing end semester examination of any core course due to lack of attendance, the student has to register for that course again when offered next and redo the course.

5.7.2 If a student is prevented from writing the end semester examination of any professional/open elective course due to lack of attendance, the student can opt to register for the same course again when offered next and redo the course, or he/she can opt to register for a different professional/open elective course when it is offered, attend the classes, fulfill the attendance requirements as per clause 6, secure Continuous Assessment marks and appear for the End Semester Examinations.

5.7.3 If the course in which a student fails to secure a pass is a professional/open elective course, then the student can opt for a different professional/ open elective course, register for the same when it is offered, attend classes, fulfill the attendance requirements as per clause 6, secure Continuous Assessment marks and appear for End Semester Examinations.

5.7.4 A student who fails in Project work shall register for the course again, when offered next, and redo the course. In this case, the student shall attend the reviews and fulfill the attendance requirements as per clause 6.

5.7.5 A student who fails in Seminar / Case Study and Creative and Innovative project, where such other courses are evaluated through 100% continuous assessment, shall register for the same in the subsequent semester and redo the course. In this case, the student shall attend the classes and fulfill the attendance requirements as per clause 7 and earn continuous assessment marks.

The student who fails in summer industrial training / internship shall attend the training / internship again and redo the course with the same organization or different organization with the approval of the HOD.

6.0 REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

A student who has fulfilled the following conditions (vide clause 6.1 and 6.2) shall be deemed to have satisfied the attendance requirements for appearing for the end semester examination of a particular course.

6.1 Ideally every student is expected to attend all periods and earn 100% attendance. However, the student shall secure not less than 75% attendance, course wise, taking into account the number of periods required for that course, as specified in the curriculum.

6.2 If a student secures attendance between 65% and less than 75% in any course in the current semester, due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level Sports events, with prior permission from the Chairman of Sports Board and Head of the Department concerned, the student shall be given exemption from the prescribed attendance requirement (75%) and the student shall be permitted to appear for the end semester examination of that course. In all such cases, the students should submit the required documents on joining after the absence to the Head of the Department through the Faculty Advisor. The HOD shall inform the course instructor to provide necessary attendance at the end of semester before finalizing attendance. Producing such documents while finalizing attendance at the end of semester shall not be accepted.

6.3 A student shall normally be permitted to appear for the end semester examination of the course if the student has satisfied the attendance requirements (vide Clause 6.1 – 6.2) and has registered for the examination in those courses of that semester by paying the prescribed fee.

6.4 Students who do not satisfy clause 6.1 and 6.2 and who secure **less than 65%** attendance in a course will not be permitted to write the end semester examination of that course. The student has to register and redo the course when it is offered next as per Clause 5.4. If the course in which the student has been prevented is a professional/ open elective, the student can opt to redo the same course or opt for different professional/ open elective course as per Clause 5.7.2.

6.5 If a student has shortage of attendance in all the registered courses of the current semester as per curriculum, he/she would not be permitted to move to the higher semester and has to repeat the current semester in the subsequent year.

6.6 In the case of reappearance (Arrear) registration for a course (the courses for which redo is not required), the attendance requirement as mentioned in Clauses 6.1 - 6.3 is not applicable. However, the student has to register for the examination in that course by paying the prescribed fee.

6.7 A student who has already appeared for a course in a semester and passed the examination is not entitled to reappear for the same course for improvement of letter grades / marks.

7.0 MENTOR

To help the students in planning their courses of study and to render general advice regarding either the academic programme or any other activity, the Head of the Department concerned, will assign every year, a certain number of students from the first semester to a faculty member who will be called as Mentor. The set of students thus assigned will continue to be under the guidance of the Mentor till they complete the programme. Mentors will help the students on multiple exits, and also assess the proficiency of the student. Each student should have one-one interaction with the mentor at least once in a month.

8.0 FACULTY COORDINATOR

There is a Faculty Coordinator who will be the in-charge for a particular batch. He will coordinate with the mentors for assessing the proficiency of the batch and report to the Head of the Department. He will also collect the course registration forms from the students. He also ensures whether the student submitted feedback at the end of the semester for the courses he/she has taken.

9.0 EXAMINATIONS AND ASSESSMENT

9.1 ASSESSMENTS

Continuous Assessment Examinations

Continuous evaluation system is strengthened with 40-60 percentage weightage system in place for internal and external examinations. Three Continuous internal assessment Examinations will be conducted as per the academic calendar posted

in our institution website. Internal mark for every course is assigned based, on the performance in Continuous Assessment Examinations and assignments submitted on the performance in Continuous Assessment Examinations and assignments submitted.

9.1.1 Theory Courses

- There will be a minimum of Three continuous internal assessment tests (Assessment Test 1,2 and a Model Exam), for each theory course.

DISTRIBUTION OF CONTINUOUS INTERNAL ASSESSMENT (CIA) MARKS FOR A THEORY COURSE			
Evaluation Component	**Syllabus coverage**	**Duration of the Exam**	**Max. Weightage (40 Marks)**
CIA-1	First 1.5 Units of the syllabus	2.0 Hours	30 Marks (25% weightage for each CIA 1 & CIA 2 and 50% for Model Exam)
CIA-2	Second 1.5 Units of the syllabus	2.0 Hours	
Model Exam	Full syllabus	3 Hours	
Assignment/ Mini Project (or) Group Presentation	Two written assignments for each course / Written quiz (or) Presentation of a written Report (or) Case study / Multiple choice Objective Type Test or Technical Project involving not more than 3 students (or) any other Group Presentation related to the course.		10 Marks

- The continuous assessment marks obtained by the candidate in the first appearance shall be retained, considered and valid for all subsequent attempts, till the candidate secures a pass.

9.1.2 Practical Courses

S. No.	Category	Maximum Marks
1.	Record	15
2.	Observation work	10
3.	Model Examination	15
Total		40

- For practical courses, the student will be evaluated on a continuous basis for 25 Marks (which will include performing all experiments, submitting observation and record note book in scheduled format and time), 15 marks for model exam at the end of the semester.
- For practical courses, if a student has been absent for some practical classes or has performed poorly, then the student will have to get permission from the lab in-charge and year coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for model and end semester practical exams
- If a student has not done all the experiments assigned for that lab, before the scheduled date will not be allowed to appear for the model and end semester practical exam. Such students will have to register the course again by doing all the experiments in the next semester when the course is offered.

9.1.3 End Semester Examinations (ESE)

- The End Semester examinations shall normally be conducted after academic schedule for both theory and practical courses of all programmes.
- End semester Theory and Practical examinations will be conducted for a maximum of 60 marks.
- **Pattern of Question Paper (Theory) for Model and ESE**

Particulars	Remarks
Maximum Marks	60 Marks
Duration	3 Hours
Part – A	Short Answers (10x2=20)
Part – B	Medium Answers (Either or type) (5x8=40)

9.1.4 Project Work/ Semester long Internship

The student shall register for Project Work-I in pre-final semester and Project Work-II in final semester. Project work may be allotted to a single student or to a group of students not exceeding 4 per group. Project Work-II may/may not be a continuation of Project Work-I. If Project Work II is not a continuation of Project Work I, then the topic and constitution of the project team members need not be the same.

- The project review would be conducted by a review committee where the student/

team shall make a presentation on the progress made, before the committee. The Head of the department shall constitute the review committee for each branch in consultation with Director Academic, approved by CoE. The members of the review committee will evaluate the progress of the project and award marks.

- The guides would evaluate the students based on their performance and follow up.

- For Project work out of 100 marks, the maximum marks for Continuous Assessment are fixed as 40 and the End Semester Examination (project report evaluation and viva-voce examination) carries 60 marks.

  There shall be **Three Continuous assessments** (each 100 marks) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee. The committee shall consist of the supervisor, expert member from the department and a project co-ordinator from another department. The total marks obtained in the three Reviews shall be reduced to 40 marks.

Continuous Assessment (40 Marks)			**End Semester Examinations (60 Marks)**			
Review I	**Review II**	**Review III**	**Project Report**		**Viva-Voce Examination**	
10	10	20	Supervisor	External	Internal	External
			20	20	10	10

- A student is expected to attend all the project reviews conducted by the institution on the scheduled dates. It is mandatory for every student to attend the reviews, even if they are working on a project in an industry, which is outside Chennai city. If a student does not attend any of the project reviews, he / she shall not be allowed for the successive reviews and thereby not allowed to appear for the final viva voce.
- The candidate is expected to submit the project report as per the guidelines of the institution on or before the last day of submission. If a candidate fails to submit the project report on or before the specified deadline, he/she can be granted an

extension of time up to a maximum limit of 5 days for the submission of project work, by the Head of the Department.

- If he/she fails to submit the project report, even beyond the extended time, then he/she is deemed to have failed in the project work and shall register for the same in the subsequent semester and re-do the project after obtaining permission from the HoD and Director Academic.

9.1.5 Assessment for Summer internship:

The summer Industrial / Practical Training/ summer internship/ summer project shall carry 100 marks and shall be evaluated through continuous assessment only. At the end of the summer Industrial / Practical Training/ summer internship/ summer project, the student shall submit a certificate from the organization where the student has undergone training and a brief report about the training. The evaluation will be made based on this report, presentation and a Viva-Voce Examination conducted by a three-member Departmental Committee constituted by the Head of the Department consisting of one co-ordinator and two faculty members. Certificates (issued by the Organization) submitted by the student shall be attached to the mark list and sent to the Controller of Examinations by the Head of the Department. The evaluation shall be carried out as per the procedure shown below.

Internship / Industrial Training		
Evaluation Marks (100)		
Report	Presentation	Viva Voce
50	30	20

9.1.6 Assessment For Online Courses

Students may be permitted to credit two online courses (which are provided with certificate), subject to a maximum of six credits. The online course of 3 credits can be considered instead of one elective course. These online courses shall be chosen from the SWAYAM platform, provided the offering organization conducts regular examination and provides marks. The credits earned shall be transferred and the marks earned shall be converted into grades and transferred, provided the student has passed in the examination as per the norms of the offering organization. The details regarding online courses taken up by the student and marks/credits earned

and the approval for the course from Concerned Head of the Department shall be sent to the Controller of Examinations, in the subsequent semester(s) along with the details of the elective(s) to be dropped.

9.2 ASSESSMENT WEIGHTAGES:

There will be Continuous Assessment Examination and End Semester Examination for courses of all programmes.

(i) Theory courses

Continuous Internal Assessment	: 40 Marks
End Semester Exams	: 60 Marks

(ii) Practical courses

Continuous Internal Assessment	: 40 Marks
End Semester Exams	: 60 Marks

(iii)Theory + Practical courses

Continuous Internal Assessment (Theory)	: 40 Marks
End Semester Exams (Practical)	: 60 Marks

(iv) Theory with Project

Continuous Assessment (Theory)	: 40 Marks
End Semester Exams (Project Report Submission)	: 60 Marks

10.0 EXAMINATIONS

10.1 RE-EXAMINATION

Re-examination requests shall be considered only for the Continuous Assessment Examinations in the last instructional week of the semester based on medical reasons.

10.2 REVALUATION

A candidate can apply for revaluation of his/her End semester examination answer paper in a theory course, immediately after the declaration of results, on payment of a prescribed fee through the ERP. The Controller of Examinations will arrange for the revaluation and the result will be intimated to the candidate through website. Revaluation is not permitted for practical courses and for project work.

10.3 SCRIBE FOR EXAMINATION

Divyangjan students or students with temporary physical disability or injury due to

accident or illness can apply for a scribe (writer) with proof of disability as a medical certificate obtained from a Registered Medical Officer. The student shall be assigned a scribe by CoE to such student. The application for the scribe should be submitted in the CoE office well in advance or at least 2 days before the examination, to make necessary arrangements (Scriber, Separate Examination Hall etc.). The scribe assigned shall neither be a student nor a degree holder of any technical programme having similar competency.

Divyangjan students/ students with reading or writing disability, who can write at a slower speed as compared to a normal student would be allowed an extra time of 30 minutes to write the examination for each course. The proof of disability and application of extra time has to be submitted to the CoE office well in advance or 3 days before the start of the examination.

10.4 ACADEMIC MALPRACTICE

Academic malpractice would be strictly prohibited and any student who is found indulging in such activity would be penalized as per the recommendations of the Malpractice Committee constituted by the CoE with the approval of the Director Academic. The Committee would inquire and decide on the action based on the norms and policy listed in the Examination Manual.

10.5 SUPPLEMENTARY EXAMINATION

Supplementary examination will be conducted only for the final semester students within 10 days from the date of publication of revaluation results for students who have backlogs to complete the programme. Only such students shall apply with the prescribed fee to the Controller of Examinations within the stipulated time.

11.0 REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A student shall normally be permitted to appear for the University Examinations for all the courses registered in the current semester if he/she has satisfied the semester completion requirements. Further, examination registration by a student is mandatory for all the courses in the current semester and all arrear(s) course(s) for the University examinations failing which, the student will not be permitted to move to the higher semester. A student who has already appeared for any course in a semester and passed the examination is not entitled to reappear in the same

subject for improvement of grades.

12.0 PASSING REQUIREMENTS FOR COMPLETION OF A COURSE

- A candidate who secures not less than 50% of total marks prescribed for the courses (Continuous Assessment + End semester examination) with a minimum of 40% of the marks prescribed for the end-semester Examination in theory, theory with practical components (40% individually in theory and laboratory) and practical courses (including Project work), shall be declared to have passed in the Examination.
- If a student fails to secure a pass in a theory course / theory with laboratory/laboratory course (except electives), the student shall register and appear only for the end semester examination in the subsequent semester. In such case, the continuous assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass. However, from the third attempt (current semester's end semester examination is considered as the first attempt) onwards if a candidate fails to obtain pass marks (IA + End Semester Examination), then the candidate shall be declared to have passed the examination if he/she secure a minimum of 50% marks prescribed for the university end semester examinations alone.
- If a student has submitted the project report but absent in the end semester examination of project work, the student is deemed to be failed. In this case and also if a student attends and fails in the End semester examination of Project work of B.E. / B.Tech, he/she shall attend end semester examination again within 60 days from the date of declaration of the results. The subsequent viva-voce examination will be considered as reappearance with payment of exam fee. In case, the student fails in the subsequent viva-voce examination also, the student shall redo the course again, when offered next.
- If a student is absent during the viva - voce examination, it would be considered as fail. If a student fails to secure a pass in Project Work-I, the student shall register for the course again in the subsequent semester and can-do Project Work-I and II together.
- The passing requirement for the courses which are assessed only through

continuous assessment, shall be fixed as minimum 50%.

13.0 WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examination during the entire duration of the degree programme.
- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the Director Academic through HoD.
- Notwithstanding the requirement of mandatory FIVE days' notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for the purpose of Classification of Degree.
- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

14.0 AUTHORIZED BREAK OF STUDY

- This shall be granted by the Institution, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.
- A candidate is normally not permitted to temporarily break the period of study. However, if a candidate would like to discontinue the programme temporarily in the middle of duration of study for valid reasons (such as accident or hospitalization due to prolonged ill health), he / she shall apply through the Director Academic in advance (Not later than the Reopening Day of that semester) through the Head of the Department stating the reasons. He /She should also mention clearly, the Joining date and Semester for Continuation of Studies after completion of break of Study. In such cases, he/she will attend classes along with the Junior Batches. A student who availed break of study has to rejoin only in the same semester from where he/she left.

- The total period for completion of the programme shall not exceed more than 10 consecutive semesters from the time of commencement of the course irrespective of the period of break of study in order that he / she may be eligible for the award of the degree.
- If any student is not allowed to appear for End Semester Examinations for not satisfying Academic requirements and Disciplinary reasons, (Except due to Lack of Attendance), the period spent in that semester shall NOT be considered as permitted 'Break of Study' and is NOT applicable for Authorized Break of Study.
- In extraordinary situations, a candidate may apply for additional break of study not exceeding another one Semester by paying prescribed fee for break of study. Such extended break of study shall be counted for the purpose of classification of First Class Degree.
- If the candidate has not reported back to the department, even after the extended Break of Study, the name of the candidate shall be deleted permanently from the institution enrolment. Such candidates are not entitled to seek readmission under any circumstances.
- This shall be granted by the Institution, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.

15.0 PURSUING COURSES IN OTHER INDIAN INSTITUTIONS AND ABROAD

- A student can be selected, to get Professional Exposure in his/her area of Expertise in any Reputed Research Organization or Educational Institution of repute or any Universities in India andabroad.
- This is possible only with the List of Research Organizations, Educational Institutions in India and abroad approved by the Academic Council.
- The student can have the option of spending not more than three to Six months in the Final year or Pre - final year of his/her Degree. During this period, the student can do his/her Project work or register for courses which will be approved by the Class Committee and Director Academic, under the Guidance of a Project Supervisor who is employed in the Organization and Co-guided by a staff member from our Institution.

- Credit Transfer can be done by the CoE on submission of certificate through the HoD and Director Academic within 15 days of completion.
- The students who undergo training outside the Institution (either in India or Abroad) is expected to abide by all Rules and Regulations to be followed as per Indian and the respective Country Laws, and also should take care of Financial, Travel and Accommodation expenses.

16.0 AWARD OF LETTER GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

RANGE OF MARKS FOR GRADES

Range of Marks	Letter Grade	Grade Point
90 -100	**O**	**10**
80 – 89	**A+**	**9**
70 – 79	**A**	**8**
60 – 69	**B+**	**7**
50 – 59	**B**	**6**
00-49 (Reappear)	**F**	**0**
ABSENT	**AAA**	**0**
Withdrawal	**W**	**0**
Authorised Break of Study	**ABS**	**0**

16.1 CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 Point scale is used to describe the overall performance of a student in all courses from first semester to the last semester. RA, AAA and W grades will be excluded for calculating GPA and CGPA.

$$\text{GPA} = \frac{\sum_{i=1}^{N} Ci\ GPi}{\sum_{i} Ci} \qquad \text{CGPA} = \frac{\sum_{i=1}^{N} Ci\ GPi}{\sum_{i} Ci}$$

Where

Ci – Credits for the course

GPi – Grade Point for the course

i – Sum of all courses successfully cleared during all the semesters

n - Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

16.2 GRADE SHEET

After revaluation results are declared in each semester, Grade Sheets will be issued to each student. At the end of programme a consolidated grade sheet also will be issued to each student. The grade sheet and consolidated grade sheet will contain the following details:

- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester and the grade secured
- The Grade Point Average (GPA) for the semester.

16.3 CLASSIFICATION OF DEGREE AWARDED

Final Degree is awarded based on the following

Range of CGPA	Classification of Degree
≥ 7.50	**First Class with Distinction**
≥ 6.00 <7.50	**First Class**
≥ 5.00 < 6.0	**Second Class**

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

- A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters in his/her first appearance within a maximum of 10 consecutive semesters securing a overall CGPA of not less than 7.5 (Calculated from 1st semester) shall be declared to have passed the examination in **First Class with Distinction**. Authorized Break of Study vide Clause 14, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction

- A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 10 consecutive semesters after his/her commencement of study securing a overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in **First Class.** Authorized break of study vides Clause 14 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided (in addition to four years for Normal UG programme) will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.
- All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 10 consecutive semesters after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in **Second Class**.
- A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.

17.0 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the Certificate / Diploma / UG Degree / UG Honours degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the I/II/III/IV year respectively within the maximum period specified in clause 2.7.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 5 years reckoned from the commencement of the first semester to which the candidate was admitted.

iii) Successfully completed any additional courses prescribed by the Institution.

iv) has earned a CGPA of not less than 5

v) has no dues to the Institution, Library, Hostels, etc.,

vi) has no disciplinary action pending against him / her.

18.0 RANKING

- A candidate who qualifies for the UG degree programme passing all the examinations in the first attempt, within the minimum period prescribed for the programme of study from semester I through semester VIII to the programme shall be eligible for ranking. Such ranking will be confirmed to 10 percent of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

19.0 DICIPLINE

- Every student is required to observe disciplined and decorous behavior both inside and outside the Institution and not to indulge in any activity which will tend to bring down the prestige of the Institution. If a student indulges in malpractice in any of the end semester theory / practical examination, continuous assessment examinations he/she shall will be liable for disciplinary action as prescribed by the Institution from time to time.

20.0 ST UDE NT APRAISAL

- It is mandatory for every student to submit the feedback on each and every course, he/she has undergone, at the end of every semester.

21.0 DECLARATION OF RESULTS

- The End Semester Examination results will be declared in institution website and the same is shared with the Head of the Department. In general, the results will be declared within 15 days from the date of last examination.

22.0 ACADEMIC BANK OF CREDITS (ABC)

- All the students who admitted in any one of the above programmes are mandatory to register in the Academic Bank of Credits (ABC) portal provided by the Ministry of Education (MoE), Government of India.

23.0 REVISION OF REGULATIONS / POWER TO MODIFY

- St. Peter's Institute of Higher Education and Research (Deemed to be University)

may, time to time revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

Notwithstanding all that has been stated above, the Academic Council is vested with powers to modify any or all of the above regulations from time to time, if required, subject to the approval by the Board of Management.

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Director Academic Registrar

Curriculum 2023

Semester I								
S.no	**Course Code**	**Course type**	**Category**	**Course Name**	**L**	**T**	**P**	**C**
1	BMA121	Theory	BSC	Algebra and Calculus	3	1	0	4
2	BPH121	Theory + Lab	BSC	Engineering Physics	3	0	2	4
3	BCY121	Theory+ Lab	BSC	Engineering Chemistry	3	0	2	4
4	BEN121	Theory+ Lab	HSC	English for Engineers	3	0	2	4
5	BME121	Theory	ESC	Engineering Graphics	2	1	0	3
6	BCS121	Theory	ESC	Fundamentals of Computing and Python Programming	3	0	0	3
7	BCS107	Practical	ESC	Python Programming Laboratory	0	0	4	2
Total Credits					**17**	**2**	**10**	**24**
Semester 2								
S.no	**Course Code**	**Course type**	**Category**	**Course Name**	**L**	**T**	**P**	**C**
1	BMA131	Theory	BSC	Partial Differential Equations and Transforms	3	1	0	4
2	BEE131	Theory	ESC	Basic Electrical and Instrumentation Engineering	3	0	0	3
3	BBO131	Theory	BSC	Environmental Science	2	0	0	2
4	BEC111	Theory+Lab	PCC	Electronics Devices	3	0	2	4
5	BEC112	Theory+Lab	PCC	Circuit and Network Analysis	3	0	2	4
6	BCS131	Theory+Lab	ESC	C Programming and Data Structures	2	0	2	3
7	BME117	Practical	ESC	Engineering Practices	0	0	4	2
8	BEO131	Theory	MAC	Indian Constitution and Human Rights	0	0	0	0
9		Theory	VAC	Value added Course-1	0	0	0	0
Total Credits					16	1	10	**22**
Semester 3								
S.no	**Course Code**	**Course type**	**Category**	**Course Name**	**L**	**T**	**P**	**C**
1		Theory + Project	HSC	Humanities Elective I	2	0	2	3
2	BMA243	Theory	BSC	Probability and Random Process	3	1	0	4
3	BEC201	Theory+Lab	PCC	Digital Electronics	3	0	2	4
4	BEC202	Theory	PCC	Analog Electronic Circuits	3	0	0	3
5	BEC203	Theory	PCC	Signals and Systems	3	0	0	3
6	BEE221	Theory	PCC	Control Systems	3	0	0	3
7	BEN221	Skill	EEC	Essential skills and Aptitude for Engineers	0	0	2	1
8	BEC207	Practical	PCC	Electronic Circuits Laboratory	0	0	4	2
Total Credits					**17**	**1**	**10**	**23**
Semester 4								
S.no	**Course Code**	**Course type**	**Category**	**Course Name**	**L**	**T**	**P**	**C**

1	BEC211	Theory	PCC	Analog and Digital Communication	3	0	0	3
2	BEC212	Theory	PCC	Linear Integrated Circuits and Applications	3	0	0	3
3	BEC213	Theory + Lab	PCC	Digital Signal Processing	3	0	2	4
4	BEC231	Theory	PCC	Electromagnetic Field Theory	3	0	0	3
5	BEC215	Theory	PCC	Network and Security	3	0	0	3
6	BEC217	Practical	PCC	Analog and Digital Communication Laboratory	0	0	4	2
7	BEC218	Practical	PCC	Analog Integrated Circuits Laboratory	0	0	4	2
8	BEN231	Skill	EEC	Communication skills for career success	0	0	2	1
9	BEO231	Theory	MAC	Indian Knowledge System	2	0	0	2
10		Theory	VAC	Value added Course-2	0	0	0	0
Total Credits					**17**	**0**	**12**	**23**
	Summer Internships (2-4 weeks) is mandatory during the summer vacation in between semester IV and V for each student to continue the programme and the corresponding valuation will take place in the semester V							

Semester 5

S.no	Course Code	Course type	Category	Course Name	L	T	P	C
1	BEC301	Theory	PCC	VLSI and Chip Design	3	0	0	3
2	BEC302	Theory + Lab	PCC	Wireless Communication	3	0	2	4
3	BEC303	Theory	PCC	Transmission Lines and RF systems	3	0	0	3
4	BEC304	Theory	PCC	Optical Communication and Networks	3	0	0	3
5		Theory	PEC	Professional Elective 1	3	0	0	3
6		Theory	OEC	Open Elective 1	3	0	0	3
7	BEC307	Practical		VLSI Laboratory	0	0	4	2
8	BEC309	Skill	EEC	Internship	0	0	2	1
9	BEN321	Skill	EEC	Leadership skills and Personality Development	0	0	2	1
Total Credits					**18**	**0**	**8**	**23**

Semester 6

S.no	Course Code	Course type	Category	Course Name	L	T	P	C
1	BEC312	Theory +Project	PCC	Embedded Systems and IOT Design	3	0	2	4
2	BEC313	Theory	PCC	Antenna Design	3	0	0	3
3	BEC314	Theory+Lab	PCC	Microwave Engineering	3	0	2	4
4		Theory	PEC	Professional Elective 2	3	0	0	3
5		Theory	PEC	Professional Elective 3	3	0	0	3
6		Theory	OEC	Open Elective 2	3	0	0	3
7	BEC310	Project	EEC	Design Thinking and Innovations	0	0	4	2
8		Theory	VAC	Value added Course-3	0	0	0	0
Total Credits					**18**	**0**	**8**	**22**

	Summer Internships (2-4 weeks) is mandatory during the summer vacation in between semester VI and VII for each student to continue the programme and the corresponding valuation will take place in the next semester (semester VII)

Semester 7

S.no	Course Code	Course type	Category	Course Name	L	T	P	C
1	BEC401	Theory	PCC	Multi-core architecture and programming	3	0	0	3
2		Theory	PEC	Professional Elective 4	3	0	0	3
3		Theory	HSC	Humanities Elective -II	2	0	0	2
4	BEC409	Skill	EEC	Internship	0	0	0	1
5	BEC410	Project	EEC	Project Work (Phase-I)	0	0	12	6
6		Theory	VAC	Value Added Course-4	0	0	0	0
7	BMCX01	Skill	EEC	NCC/YRC/NSS/Rotary Club	0	0	2	1
Total Credits					**8**	**0**	**12**	**16**

Semester 8

S.no	Course Code	Course type	Category	Course Name	L	T	P	C
1	BEC420	Project	EEC	Project Work (Phase-II)	0	0	24	12
2		Theory	OEC	Mooc courses*	3	0	0	3
Total Credits					3	0	24	**15**
					Total credits			**168**

Professional Elective Verticals

Vertical 1: semiconductor chip design and testing

Sl.no	Category	Course Code	Course Title	Periods per week			Credits
				L	T	P	
1.	PE	BEC341	Wide Bandgap Devices	3	0	0	3
2.	PE	BEC342	Validation and Testing Technology	3	0	0	3
3.	PE	BEC343	Low Power IC Design	3	0	0	3
4.	PE	BEC344	VLSI Testing and Design For Testability	3	0	0	3
5.	PE	BEC441	Mixed Signal IC Design Testing	3	0	0	3
6.	PE	BEC442	Analog IC Design	3	0	0	3

Vertical 2: Signal processing

Sl.no	Category	Course Code	Course Title	Periods per week			Credits
				L	T	P	
1.	PE	BEC351	Advanced Digital Signal Processing	3	0	0	3
2.	PE	BEC352	Image Processing	3	0	0	3
3.	PE	BEC353	Speech Processing	3	0	0	3
4.	PE	BEC354	Software Defined Radio	3	0	0	3
5.	PE	BEC451	DSP Architecture and Programming	3	0	0	3
6.	PE	BEC452	Computer Vision	3	0	0	3

Vertical 3: High Speed Communications

Sl.no	Category	Course Code	Course Title	Periods per week			Credits
				L	T	P	
1.	PE	BEC361	Wireless Broad Band Networks	3	0	0	3
2.	PE	BEC362	4G/5G Communication Networks	3	0	0	3
3.	PE	BEC363	Software Defined Networks	3	0	0	3
4.	PE	BEC461	Green Radio Communication Techniques	3	0	0	3
5.	PE	BEC462	Massive MIMO Networks	3	0	0	3
6.	PE	BEC463	Advanced Wireless Communication Techniques	3	0	0	3

Vertical 4: Sensor technologies and IOT

Sl.no	Category	Course Code	Course Title	Periods per week			Credits
				L	T	P	
1.	PE	BEC371	IoT Processors	3	0	0	3
2.	PE	BEC372	IoT Based System Design	3	0	0	3

3.	PE	BEC373	Wireless Sensor Network Design	3	0	0	3
4.	PE	BEC374	Industrial IoT and Industry 4.0	3	0	0	3
5.	PE	BEC471	MEMS Design	3	0	0	3
6.	PE	BEC472	Fundamentals of Nanoelectronics	3	0	0	3

Vertical 5: Emerging Technologies

Sl.no	Category	Course Code	Course Title	Periods per week			Credits
				L	T	P	
1.	PE	BEC346	Introduction to HDL Programming	3	0	0	3
2	PE	BEC347	Industry 5.0 for Electronics Engineers	3	0	0	3
3	PE	BEC348	Electro-Magnetic Interference and Compatibility	3	0	0	3
4	PE	BEC349	Digital Image Processing	3	0	0	3
5	PE	BEC350	Introduction to ASIC Design	3	0	0	3
6	PE	BEC445	PCB Design	3	0	0	3
7	PE	BEC446	Embedded C Programming	3	0	0	3
8	PE	BEC447	Multimedia Compression and Communication Techniques	3	0	0	3
9	PE	BEC448	Body Area Networks	3	0	0	3
10	PE	BEC355	Real Time Operating System	2	0	2	3

Open Electives		
S.No	**Course Code**	**Course Name**
1	BEC391	PCB Design
2	BEC392	Automotive Embedded Software Engineering
3	BEC393	Digital Design using EDA tools
4	BEC394	Consumer Electronics

SEMESTER I

BMA121	ALGEBRA AND CALCULUS	L	T	P	C	TOTAL MARKS
		3	2	0	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To develop the uses of matrix algebra techniques that is needed by engineers for practical applications.
2	To familiarize the students with theory of equations.
3	To familiarize the students with differential calculus.
4	To familiarize the student with functions of several variables. This is required in many branches of engineering.
5	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT 1: MATRICES **9+3**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors – Cayley - Hamilton theorem– Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.

UNIT 2: THEORY OF EQUATIONS **9+3**

Polynomial equations with real coefficients, irrational roots, complex roots, symmetric functions of roots, transformation of equation by increasing or decreasing roots by a constant, reciprocal equation. Newton's method to find a root approximately – simple problems.

UNIT 3: DIFFERENTIAL CALCULUS **9+3**

Representation of functions-Limit of a function-Continuity-Derivatives-Differentiation rules (sum, product, quotient, chain rules)- Implicit differentiation -Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.

UNIT 4: FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partial differentiation–Homogeneous functions and Euler's theorem–Total derivative–Change of variables–Jacobians–Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT 5: MULTIPLE INTEGRALS **9+3**

Double integrals–Change of order of integration–Double integrals in polar co-ordinates - Area enclosed by plane curves – Triple integrals – Volume of solids –Change of variables in double and triple integrals – Applications: Moments and centres of mass, moment of inertia.

60 PERIODS

COURSE OUTCOMES

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

CO1:	Use the matrix algebra methods for solving practical problems.
CO2:	Apply the concept of theory of equations in solving various application problems.
CO3:	Able to use differential calculus ideas on several variable functions.
CO4:	Apply the concept of several variable functions in calculus.
CO5:	Apply multiple integral ideas in solving areas, volumes and other practical problems.

TOTAL:60 PERIODS

TEXT BOOKS & REFERENCES

1.	Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.

3.	Bali.N.,Goyal.M.and Watkins.C., "Advanced Engineering Mathematics", Firewall Media(An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi,7th Edition, 2009.
4.	Jain.R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
5.	Narayanan. S. and Manicavachagom Pillai. T.K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	2	2	1	2	1	3	2	1	2	3	2	1	2
CO2:	2	2	2	2	2	3	3	2	3	2	2	2	2	2
CO3:	2	2	3	2	2	2	2	1	3	3	2	3	1	2
CO4:	3	2	2	2	2	3	3	2	2	3	2	2	3	3
CO5:	3	2	2	3	3	1	1	2	2	1	3	1	3	3

1 - low, 2 - medium, 3 - high

BPH121	ENGINEERING PHYSICS	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: NONE

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To gain knowledge on the basics of mechanics and properties of matter and its applications
2	To acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics
3	To understand the basics of electrical properties of materials and the classification of materials based on band theory.
4	To have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion of joints and heat exchangers
5	To get an insight on advanced physics concepts of quantum theory and its applications in tunnelling microscopes

UNIT 1: MECHANICS & PROPERTIES OF MATTER **9**

Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Equation of motion in central force, Planetary motion and Kepler's Law, Elasticity – Stress-strain diagram and its uses – twisting couple - torsion pendulum: theory and experiment

UNIT 2: WAVES AND FIBER OPTICS **9**

Oscillatory motion – forced and damped oscillations Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly-damped oscillators; Forced oscillations and resonance. Lasers : population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Solid state ,Gas laser, Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – Application in Communication

UNIT 3: ELECTRICAL PROPERTIES OF MATERIALS **9**

Classical free electron theory-Expression for Electrical conductivity-thermal conductivity- expression-Wiedmann Franz law- success and failure-electrons in metals-Particle in three dimensional box- degenerate state- Fermi Dirac Statistics-Density of Energy states-Electron in
periodic potential-Bloch Theorem- Metals and Insulators-Energy bands in solids-Effective mass of electron-Concept of holes

UNIT 4: THERMAL PHYSICS **9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment – conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

UNIT 5: QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunnelling (qualitative) - scanningtunneling microscope.

45 PERIODS

PRACTICAL EXERCISES: **15 PERIODS**

1.	Torsional Pendulum-Determination of Moment of Inertia and Rigidity Modulus with equal masses

2.	(a) Determination of wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber
3.	Determination of Young's modulus by non-uniform bending method
4.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
5.	Ultrasonic Interferometer-Determination of Velocity of Ultrasonic waves andCompressibility of the given liquid
6.	Determination of band gap of a semiconductor
7.	LC circuit and LCR circuit

COURSE OUTCOMES:

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

CO1:	The students will gain knowledge on the basics of mechanics and propertiesof matter and its applications,
CO2:	The students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics
CO3:	The students will understand the basics of electrical properties of materials and the classification of materials based on band theory
CO4:	The students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion of jointsand heat exchangers
CO5:	The students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes

TOTAL: 60 PERIODS

TEXT BOOKS

1.	Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press,2015.
2.	Gaur, R.K. & Gupta, S.L. "Engineering Physics". DhanpatRai Publishers, 12.
3.	Pandey, B.K. &Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.
4.	Properties of Matter by BrijLal and N.Subramaniam, S. Chand & Co., NewDelhi (1994).

REFERENCES

1.	Halliday, D., Resnick, R. & Walker, J. "Principles of Physics". Wiley, 2015.
2.	Serway, R.A. & Jewett, J.W. "Physics for Scientists and Engineers". Cengage Learning, 2010.
3.	Tipler, P.A. &Mosca, G. "Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	2	2	1	2	2	1	2	1	2	1	3	1	1
CO2:	3	2	2	1	2	2	1	2	1	2	1	3	3	3
CO3:	3	2	2	1	2	2	1	2	1	2	1	3	3	2
CO4:	3	2	2	1	2	2	1	2	1	2	1	3	1	1
CO5:	3	2	2	1	2	2	1	2	1	2	1	3	3	3
CO	3	2	2	1	2	2	1	2	1	2	1	3	2.2	2

1 - low, 2 - medium, 3 - high,

BCY121	ENGINEERING CHEMISTRY	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES:NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To inculcate sound understanding of water quality parameters and water treatment techniques.
2	To impart knowledge on the basic principles and preparatory methods of nano-materials.
3	To introduce the basic concepts and applications of phase rule and composites.
4	To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5	To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT 1: WATER AND ITS TREATMENT **9**

Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Domestic water treatment: Steps involved -primary treatment and disinfection (UV, Ozonation, break- point chlorination). Desalination of brackish water: Electro dialysis- Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming and foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralization process and zeolite process.

UNIT 2: NANOCHEMISTRY **9**

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube-Single walled and Multiwalled Nanotubes- Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT 3: PHASE RULE AND COMPOSITES **9**

Phase rule: Introduction, definition of terms with examples. One component system – water system; Reduced phase rule; Construction of a simple eutectic phase diagram – Thermal analysis; Two component system: lead-silver system – Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites (CMC) and Polymer matrix composites (PMC). Hybrid composites –definition and examples.

UNIT 4: FUELS AND COMBUSTION **9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate andultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Fractional distillation of Petroleum- Manufacture of synthetic petrol(Fischer – Tropsch and Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value higher and lower calorific values, Theoretical calculation of calorific value; ignition temperature: spontaneous ignition temperature, Explosive range;
Flue gas analysis –ORSAT Method. CO2 emission and carbon foot print.

UNIT 5: ENERGY SOURCES AND STORAGE DEVICES **9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery – dry cell, Secondary battery – NICAD battery, lead acid battery and lithium-ion battery; Electric vehicles – working principles; Fuel cells: H2-O2 fuel cell, microbial fuel cell; Super capacitors:
Storage principle, types and examples.

45 PERIODS

PRACTICAL EXERCISES:	15 PERIODS
1.	Determination of hardness of water by EDTA method.
2.	Determination of chloride content of water sample by argento metric method.
3.	Determination of alkali content of water sample.
4.	Determination of strength of given hydrochloric acid using pH meter.
5.	Determination of strength of acids in a mixture using conductivity meter.
6.	Conductometric titration of strong acid Vs strong base.
7.	Estimation of copper by EDTA method.
8.	Estimation of iron content by Potentiometry.
9.	Determination of molecular weight of polymer using Ostwald viscometer.
10.	Adsorption of acetic acid by charcoal.
	TOTAL PERIODS :60
COURSE OUTCOMES: Upon successful completion of the course, students will be able to:	
CO1:	Understand the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2:	Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3:	Apply the knowledge of phase rule and composites for material selection requirements
CO4:	Understand the suitable fuels for engineering processes and applications
CO5:	Acquire knowledge on different forms of energy resources and apply them for suitable applications in energy sectors.
REFERENCE BOOKS	
1.	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing CompanyLtd, New Delhi, 2008.
3.	S.S. Dara, "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
4.	Dr. Sayeeda Sultana," Engineering Chemistry'', R.K.Publishers, Coimbatore, 2016.
5.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, " Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
6.	Dr. Sayeeda Sultana, "Practical Engineering Chemistry laboratory manual", R.K.Publishers, Coimbatore, 2016.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	-	-	-	2	3	3
CO2	2	2	1	-	-	-	-	-	-	-	-	2	3	3
CO3	2	2	1	-	-	-	-	-	-	-	-	2	2	3
CO4	2	2	1	-	-	-	-	-	-	-	-	2	3	3
CO5	2	2	1	-	-	-	-	-	-	-	-	2	3	3
CO	2	2	1	-	-	-	-	-	-	-	-	2	2.8	3

1 - low, 2 - medium, 3 - high

BEN121	ENGLISH FOR ENGINEERS	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To improve the communicative competence of learners.
2	To help learners use language effectively in academic/work contexts.
3	To build on students 'English language skills by engaging them in listening, speaking andgrammar learning activities that are relevant to authentic contexts.
4	To develop analytical thinking skills for problem solving in communicative contexts.
5	To equip them with writing skills needed for academic as well as work place contexts.

UNIT 1: **9**

Listening–for general information-specific details-conversation: Introduction to classmates.
Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation.
Reading - Reading brochures (technical context).
Writing-Writing emails/letters introducing oneself, Paragraph Writing.
Grammar – Parts of Speech, Sentence kinds. Wh-Questions forms and Tags.
Vocabulary-Synonyms; One word substitution; Abbreviations &Acronyms (as used in technicalContexts).

UNIT 2: **9**

Listening- Listening to podcast, anecdotes/stories/event narration; documentaries and Interviews.
Speaking- Narrating personal experiences/events; Interviewing a celebrity; Reporting andsummarizing of documentaries/podcasts/interviews.
Reading- Reading biographies, travelogues, news paper reports, Excerpts from literature, travel and technical blogs.
Writing – Report Writing - Short Report on an event.
Grammar- Transformation of Sentences - Active & Passive Voice, The Impersonal Passive,
Subject-Verb Agreement; Infinitive and Gerunds
Vocabulary– Antonyms, Word Formation (prefixes & suffixes).

UNIT 3: **9**

Listening- Listen to a classroom lecture.
Speaking–Picture description; Giving instruction to use the product; Presenting a product andSummarizing a lecture.
Reading – Reading advertisements, gadget reviews; user manuals.
Writing - Writing definitions; Instructions and Product/ Process description.
Grammar- Sentence Structures, Tenses.
Vocabulary -Compound Words, Homonyms; and Homophones.

UNIT 4: **9**

Listening – Listening to TED Talks; Scientific lectures and educational videos.
Speaking – Small Talk; Mini presentations and making recommendations.
Reading–News paper articles; Journal reports–and Non Verbal Communication (tables, pie chartsetc,)
Writing–Writing recommendations; Transferring information from non verbal (chart, graph etc, to verbal mode), Checklists
Grammar–Error correction; If conditional sentences.
Vocabulary- Discourse markers, Connectives and Sequence words.

UNIT 5: **9**

Listening–Listening to debates/discussions; different view points on an issue; and paneldiscussions.
Speaking–Group discussions, Debates, and Expressing opinions through Simulations &Role play.
Reading – Reading Editorials and Opinion Blogs.
Writing– Note-making/ Note-taking; Job/Internship application–Cover letter& Resume.
Grammar–Numerical adjectives, Punctuation.
Vocabulary- Cause & Effect Expressions

	45 PERIODS
PRACTICAL EXERCISES:	**15 PERIODS**
1.	Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2.	Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3.	Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics / Kinesics. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
4.	Official/Public Speaking based on suitable Rhythmic Patterns.
5.	Argumentative Skills/Role Play Presentation with Stress and Intonation.
6.	Comprehension Skills based on Reading and Listening Practicals on a model AudioVisual Usage
COURSE OUTCOMES: Upon successful completion of the course, students will be able to:	
CO1:	Listen and comprehend complex academic texts.
CO2:	Read and infer the denotative and connotative meanings of technical texts.
CO3:	Write definitions, descriptions narrations and essays on various topics.
CO4:	Speak fluently and accurately and informal communicative contexts.
CO5:	Express their opinions effectively in both oral and written medium of communication.
TEXT BOOKS	
1.	English for Engineers &Technologists Orient Blackswan Private Ltd. Department of English, Anna University,(2020 edition).
2.	English for Science &Technology Cambridge University Press, 2021.Authored by Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr.K N.Shoba, and Dr.LourdesJoe vani, Department of English, Anna University.
REFERENCES	
1.	Technical Communication–Principles And Practices by Meenakshi Raman &Sangeeta Sharma, Oxford Univ.Press,2016,NewDelhi.
2.	Dr.S.Uma Maheswari. "English Workbook for Engineers and Technologists", Eleventh Edition, Uma Publications, July 2014.
3.	A Course Book on Technical English by Lakshmi narayanan, Scitech Publications (India) Pvt. Ltd.
4.	English for Technical Communication (With CD) by Aysha Viswamohan, Mcgraw Hill Education, ISBN: 0070264244.
5.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
6.	Learning to Communicate– Dr.V.Chellammal, Allied Publishing House, New Delhi, 2003.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	2	0	2	0	0	0	0	3	3	3	3
CO 2	0	0	0	0	0	0	0	0	0	0	2	1	2	3
CO 3	0	3	3	2	0	2	0	0	0	0	2	2	3	3
CO 4	0	0	1	0	0	0	0	0	0	0	3	2	3	3
CO 5	0	3	3	3	0	0	0	0	0	0	2	2	2	3
CO	3	2.6	2.6	2.3	0	2	0	0	0	0	2	2	3	3

1 - low, 2 - medium, 3 - high

BME121	ENGINEERING GRAPHICS	L	T	P	C	TOTAL MARKS
		2	2	0	3	100

PREREQUISITES: School Mathematics

COURSE OBJECTIVES:

The main objectives of this course are to:

1	Communicate the concepts, ideas and design of Engineering products through graphic skills.
2	Acquaint the national standards related to technical drawings.
3	Comprehend Orthographic, Isometric and perspective projection to represent the objects in two and three-dimensions.

UNIT 1:	PLANE CURVES AND FREE HAND SKETCHING	6+3

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales. Visualization concepts and Free Hand sketching:
Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects.

UNIT 2:	PROJECTION OF POINTS, LINES AND PLANE SURFACES	6+3

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT 3:	PROJECTION OF SOLIDS	6+3

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT 4:	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	6+3

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT 5:	ISOMETRIC AND PERSPECTIVE PROJECTIONS	6+3

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to drafting packages and demonstration of their use.

45 PERIODS

COURSE OUTCOMES:

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

CO1:	Understand the specifications and standards of technical drawing and draw free hand sketching of basic geometrical shapes and objects.
CO2:	Apprehend and draw the Orthographic Projection of Points, Lines and Planes.
CO3:	Develop the Orthographic views of Simple Solids.
CO4:	Draw and interpret the Sections of Solids and Development of Solid surfaces.
CO5:	Perceive and draw the Isometric and Perspective projection of simple solids and components.

TEXT BOOKS

1.	Parthasarathy,N.S.and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.
2.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition,2014.
3.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,(2017).

REFERENCES	
1.	Venugopal K. and Prabhu Raja V., "Engineering graphics", New Age International (P) Limited,(2008).
2.	Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai,(2012).

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	2	3	1	2	1	1	1	1	2	2	2	2	2
CO2:	3	2	2	1	2	1	1	1	1	2	2	2	2	2
CO3:	3	2	2	1	2	1	1	1	1	2	2	2	2	2
CO4:	3	2	2	1	2	1	1	1	1	2	2	2	2	2
CO5:	3	2	2	1	2	1	1	1	1	2	2	2	2	2
CO	3.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0

1 - low, 2 - medium, 3 - high,

BCS121	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES:NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To introduce the fundamentals of computing devices, peripheral devices, fundamentals ofOS and computer networks
2	To provide hands-on use of databases, Microsoft Office applications: Word, Excel andPower Point
3	To gain familiarity with the basics of computer programming in Python
4	To write Arithmetic Expressions and understand array data structures and strings
5	To understand files, modules and packages

UNIT 1:	**BASICS OF COMPUTER**	**9**

Components of a Computer, Types of software, types of memory and memory devices, peripheral devices, fundamentals of Operating System and basics of Computer Networks

UNIT 2:	**WORD PROCESSING AND DESKTOP PUBLISHING**	**9**

Overview of Database Management System, Word Processing: Editing and Reviewing, Drawing, Tables, Graphs, Templates, Worksheet Management: Formulas, Functions, Charts, designing powerful power-point presentations.

UNIT 3:	**INTRODUCTION TO PYTHON PROGRAMMING**	**9**

The idea of Algorithm, Representation of Algorithm: Flowchart/Pseudo code with examples, Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments

UNIT 4:	**ARITHMETIC EXPRESSIONS, ARRAYS AND STRINGS**	**9**

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching Iteration and Recursion - Arrays (1-D, 2-D), Character arrays and Strings, List, Tuple, Dictionary

UNIT 5:	**FILES, MODULES AND PACKAGES**	**9**

Files and exception: text files, reading and writing files, format operator; Command line arguments, errors and exceptions, handling exceptions, modules, packages.

45 PERIODS

COURSE OUTCOMES:

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

CO1:	Bridge the fundamental concepts of computers with the present level of knowledge of thestudents, Familiarize the basic concepts of operating systems and computer networks
CO2:	Understand the fundamentals of word processing, excel and power point presentationapplications
CO3:	Formulate simple algorithms, and write and debug programs in Python for arithmeticand logical problems.
CO4:	Implement conditional branching, iteration, and recursion in Python
CO5:	Gain knowledge of files, modules and packages in Python

TEXT BOOKS

1.	August E Grant, Jennifer H.Meadows, "Communication Technology Update and Fundamentals", Apress, 2018.
2.	Reema Thareja, "Fundamentals of Computers", Oxford University Press, 2015.
3.	Florian Dedov, "Python Bible for Beginners", Kindle Edition, 2019.
4.	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python"- Revisedand updated for Python 3.2", Network Theory Ltd., 2011.

REFERENCES

1.	Anita Goel, "Computer Fundamentals", Pearson Education, 2010.
2.	Joiner Associates Staff, "Flowcharts: Plain & Simple: Learning & ApplicationGuide", Oriel Inc, 2002.

3.	Robert Sedgewick, Kevin Wayne, Robert Dondero, ”Introduction to Programmingin Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd.,2016.
4.	Timothy A. Budd, ”Exploring Python”, Mc-Graw Hill Education (India) PrivateLtd.,2015.
5.	John V Guttag, “Introduction to Computation and Programming Using Python”, MITPress, 2013

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3	1	1	2	1	1	0	1	3	2
CO2	3	2	2	3	3	2	2	2	3	3	2	3	3	2
CO3	3	3	3	3	3	3	3	2	3	1	3	3	3	3
CO4	3	3	3	3	3	3	3	2	3	1	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	1	3	3	3	3
AVERAGE	3	2.6	2.4	2.6	3	2.4	2.4	2	2.6	1.4	2.2	2.2	3	2.6

1 - low, 2 - medium, 3 - high,

SEMESTER II

BMA131	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C	TOTAL MARKS
		3	2	0	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To introduce the Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.
2	To acquaint the student with Fourier transform techniques used in wide variety of situations.
3	To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes.
4	To develop Z-transform techniques for discrete time systems.
5	To familiarize the student with functions of several variables. These are required in many branches of engineering.

UNIT 1:	PARTIALDIFFERENTIALEQUATIONS	9+3

Formation of partial differential equations Solutions of standard types of first order partial differential equations–Lagrange's linear equation-Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT 2:	FOURIER-SERIES	9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series–Root mean square value–Parseval's identity– Harmonic analysis.

UNIT 3:	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	9+3

Classification of PDE – Method of separation of variables –Fourier Series-Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction(excluding insulated edges)

UNIT 4:	FOURIERTRANSFORMS	9+3

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT 5:	Z-TRANSFORMSANDLAPLACE TRANSFORMS	9+3

Z-transforms- Elementary properties–Convergence of Z transform-Initial and final value theorem-Inverse Z -transform using partial fraction and residues.

Laplace transforms of standard functions-Transforms properties-Transforms of derivatives and Integrals-Periodic Functions-Inverse Laplace Transforms-Convolution theorem-Applications of Laplace transforms for solving Linear ordinary Differential Equations up to second order with constant coefficients.

60 PERIODS

COURSE OUTCOMES

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

CO1:	Understand the methods of solving Partial differential equations.
CO2:	Understand and apply the concepts in Fourier series.
CO3:	Apply the Partial derivative one-two dimensional concept in solving the Heat flow

	equations.
CO4:	Understand the concepts of Fourier transforms.
CO5:	Identify, understand and to apply Z-transform and Laplace-transform concepts in Problem solving.
	TOTAL:60 PERIODS
TEXT BOOKS & REFERENCES	
1.	Kreyszig. E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3.	Bali .N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition,. 2009

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	3	3	2	2	2	3	2	2	3	3	2	2	2
CO2:	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CO3:	1	2	3	2	3	2	3	2	3	2	2	3	2	2
CO4:	2	3	2	3	3	2	2	2	2	3	2	2	3	3
CO5:	3	2	1	2	3	2	2	2	2	1	3	1	3	3

1 - low, 2 - medium, 3 - high

BEE131	BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: NIL

COURSE OBJECTIVES

The main objectives of this course are to:

1	To make the students understand the basic calculations and measurements in DC circuits.
2	To provide the basic knowledge on AC circuit calculations and measurements.
3	To familiarize with working and characteristics of different DC and AC machines.
4	To impart knowledge on the fundamentals of measuring electrical quantities
5	To expose the students to various sensors and transducers to measure non-electrical quantities.

UNIT 1:	DC CIRCUITS AND MEASUREMENTS	9

The concept of voltage and current-Electric circuit elements: R, L, C – Independent and dependent sources – Ohm's law- Kirchhoff's law- series and parallel resistive circuits – Voltage and current division – Star-delta transformation - Mesh and nodal analysis of resistive circuits – simple problems - Measurement of voltage, current and power in DC circuits.

UNIT 2:	AC CIRCUITS AND MEASUREMENTS	9

Sinusoidal voltage - RMS, average, peak value, peak factor and form factor - single phase RL, RC and RLC circuits –phasor representation - complex power – power factor – simple problems - Resonance in RLC circuits – 3 phase balanced circuit calculations– star and delta connections - Principles of measurement of AC voltage, current, power and energy - Measurement of three phase power - Protection of AC circuits: Fuse and Miniature Circuit Breakers (MCB).

UNIT 3:	ELECTRICAL MACHINES	9

Construction, principle of operation, basic equations, characteristics and applications of DC generators, DC motors, single phase transformers and three phase induction motors. Working principle of BLDC Motor and its applications in home appliances.

UNIT 4:	ELECTRICAL MEASUREMENTS	9

Functional blocks of a measurement system - types of measurements - Direct and indirect measurements – Classification of instruments – Induction type – dynamometer type wattmeters - Types of indicating Instruments Principles of Electrical Instruments – Multimeters, Oscilloscopes - Static and Dynamic characteristics of an instrumentation system – Errors in Measurement – Calibration and Standards..

UNIT 5:	TRANSDUCERS AND SENSORS	9

Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect – electromagnetic flow transducers - Level transducers – Ultrasonic and fiber optic transducers – Smart transducers - Types of sensors – elastic sensors – viscosity – moisture and pH sensors – sensors based on semiconductor junctions – charge coupled and CMOS image sensors – Biosensors.

45 PERIODS

COURSE OUTCOMES

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

CO1:	Perform the basic calculations in DC circuits and measure the various quantities associated with DC circuits.
CO2:	Measure and compute the RMS current and voltage, power, power factor and energy in AC circuits.
CO3:	Choose appropriate motor for specific applications based on the motor characteristics.
CO4:	Use the CRO and other measuring devices for measuring electrical quantities.

CO5:	Select appropriate transducer or sensor for applications involving non electrical quantities.
	TOTAL:45 PERIODS

TEXT BOOKS & REFERENCES	
1.	D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
2.	Giorgio Rizzoni, "Principles and Applications of Electrical Engineering", McGraw Hill Education (India) Private Limited, 2010.
3.	S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson India, 2011.
4.	Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2015.
5.	Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013.
6.	Rajendra Prasad, "Fundamentals of Electrical engineering", Prentice Hall of India, 2006.
7.	Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, 24th reprint 2016.
8.	Sawhney, A. K., and Puneet Sawhney "A Course in Electrical and Electronic Measurements and Instrumentation" Dhanpat Rai & Company, 2016.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	2	3	1	1	1	2	1	1	1	2	1	2	2
CO2:	3	1	3	1	1	1	2	1	1	1	2	1	2	3
CO3:	3	2	3	1	1	1	2	1	1	1	2	1	3	2
CO4:	3	2	3	1	1	1	2	1	1	1	2	1	2	3
CO5:	3	2	3	1	1	1	2	1	1	1	2	1	3	2

1 - low, 2 - medium, 3 - high

BB0131	ENVIRONMENTAL SCIENCE	L	T	P	C	TOTAL MARKS
		2	0	0	2	100

PREREQUISITES: NIL

COURSE OBJECTIVES

The main objectives of this course are to:

1	To create awareness among students about the basic concepts of environment and ecosystems
2	To understand about the biodiversity and emphasize on the biodiversity of India and its conservation
3	To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters
4	To facilitate the understanding of global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them
5	To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability

UNIT 1: ENVIRONMENT AND ECOSYSTEM **6**

Environment – Definition, scope and significance - Public awareness: Risk and hazards - Chemical hazards, Physical hazards, Biological hazards in the environment. Ecosystem - concept -structure and function - producers, consumers and decomposers - Food chain - Food web - Ecological pyramids - Energy flow - Forest, Grassland, desert and aquatic ecosystem

UNIT 2: BIODIVERSITY AND ITS CONSERVATION **6**

Introduction to Biodiversity - Definition - genetic, species and ecosystem diversity - Values and uses of biodiversity - biodiversity at global, national (India) and local levels - Hotspots, threats to biodiversity - Endangered and endemic species of India - conservation of biodiversity - Insitu & Exsitu.

UNIT 3: ENVIRONMENTAL POLLUTION AND MANAGEMENT **6**

Definition, Causes - Effects and control measures of Air, Water, Marine, soil, Noise, thermal and nuclear hazards, Solid waste Management : Causes, effects and control measures of urban and industrial wastes- Role of an individual in prevention of pollution- Pollution case studies- Disaster management : floods, earthquake, cyclone and landslides

UNIT 4: RENEWABLE SOURCES OF ENERGY **6**

Role and potential of new and renewable source- Energy management and conservation, New Energy Sources: Need of new sources. Different types of new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT 5: SUSTAINABILITY AND MANAGEMENT: PRACTICES **6**

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability -millennium development goals, and protocols- Climate change- Global, Regional and local environmental issues. Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable urbanization- Socio economical and technological change.

30 PERIODS

COURSE OUTCOMES

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

CO1:	Understand the functions of environment, eco systems and biodiversity and their conservation.
CO2:	Understand the causes, effects of environmental pollution and natural disasters and

	contribute to the preventive measures in the society.
CO3:	Acquire the knowledge of renewable resources and contribute to the sustainable measures to preserve them for future generations
CO4:	Get the knowledge of the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5:	Demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.
	TOTAL:30 PERIODS
TEXT BOOKS & REFERENCES	
1.	Gilbert M.Masters "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education (2004).
2.	Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi (2006).
3.	Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publication (2010).
4.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
5.	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
6.	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
7.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
8.	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.
9.	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
10.	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005
11.	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	1	3	1	2	2	2	1	1	1	1	1	3	2
CO2:	3	2	3	1	2	2	2	1	1	1	1	1	2	3
CO3:	2	2	3	1	2	1	2	1	1	1	1	1	3	2
CO4:	3	1	2	1	2	2	2	1	1	1	1	1	2	3
CO5:	3	2	3	1	1	1	2	1	1	1	1	1	3	2

1 - low, 2 - medium, 3 - high

BEC111	ELECTRONIC DEVICES	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: PHYSICS

COURSE OBJECTIVES

The main objectives of this course are to:

1	To describe fundamental concepts of semiconductors and electronic components.
2	To discuss about various semiconductor devices and its applications.
3	To explain the process of PCB design.
4	To use different types of power control devices in an appropriate applications.
5	To analyze the characteristics of optoelectronic and nano electronic devices

UNIT 1:	INTRODUCTION TO DIODES AND PCB DESIGN	9

Overview of Electronic components- Semiconductors – Construction, Characteristics and applications of PN junction diode: Rectifiers - Construction, Characteristics and applications of Special purpose diodes: Zener Diode, Varactor Diode, Tunnel Diode, Schottky Diode -Process of PCB design: Schematic and Layout.

UNIT 2:	BIPOLAR JUNCTION TRANSISTORS	9

Construction, Configurations and Characteristics of BJT - Current components - Hybrid Model - Biasing of BJT - Transistor switching times -Applications of BJT.

UNIT 3:	FIELD EFFECT TRANSISTORS	9

Construction, Configuration and Characteristics of JFET - JFET biasing - Applications of JFET. Construction, Configuration and Characteristics of MOSFET - MOSFET biasing –Types of FET - Applications of MOSFET.

UNIT 4:	POWER CONTROL DEVICES	9

Construction, characteristics, and applications: UJT, SCR, TRIAC and DIAC - IGBT – Power MOSFET.

UNIT 5:	OPTOELECTRONIC AND NANOELECTRONICS DEVICES	9

Optoelectronic devices- Laser diodes, Photoresistors, Photo diodes, Solar cell, Display Devices: Liquid Crystal Display, LED, OLED, AMOLED – Nano electronic Devices.

45 PERIODS

PRACTICAL EXERCISES: 15 PERIODS

1.	Study of Electronic Components, Data Sheet and Equipments.
2.	PCB Design Process - Schematic capture, Simulation, Schematic to layout transfer.
3.	PN junction diode characteristics and its application
4.	Zener Diode characteristics and its application
5.	Bipolar Junction Transistor (BJT) characteristics and its application
6.	Field Effect Transistor (FET) characteristics and its application
7.	Silicon Controlled Rectifier (SCR) characteristics and its application
8.	Light Dependent Resistor(LDR) characteristics and its application

COURSE OUTCOMES

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

CO1:	Recall the classification of electronic components and concepts of semiconductors and apply the process of PCB design.
CO2:	Identify the applications of PN junction diode and various special diodes.
CO3:	Analyze the characteristics of Bipolar junction transistor and Field Effect transistor..
CO4:	Choose various power control devices, switches and nanoelectronic devices for different applications
CO5:	Summarize the characteristics of optoelectronic and display devices.

TOTAL:60 PERIODS

TEXT BOOKS

1.	J.Millman, C.C.Halkias, and Satyabratha Jit, “Electronic Devices and Circuits” Tata McGraw Hill, 2nd Ed., 2010.
2.	Thomas L. Floyd, ”Electronic Devices”, Global Edition, Pearson Education, 2017.
3.	Pallab Bhattacharya, “Semiconductor Optoelectronic Devices”, 2017, 2nd Edition,

	Pearson Education, India.
4.	William Liu, "Fundamentals of III-V Devices: HBTs, MESFETs, and HFETs/ HEMTs", Wiley-Interscience; 1st edition, 1999.
5.	Byung-Gook Park, Sung Woo Hwang, Young June Park," Nano electronic devices", Stanford publishing, 2012
REFERENCES	
1.	Donald A.Neaman, "Semiconductor Physics and Devices" 3rd Ed., Tata McGraw Hill 2003.
2.	Nandita Das Gupta and Amitava Das Gupta, "Semiconductor Devices – Modeling and Technology", Prentice Hall of India, 2004
3.	David A Bell, "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2008.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	3	3	1	2	1	1	1	3	1	1	2	3	2
CO2:	3	3	2	1	2	1	1	1	2	1	1	2	3	2
CO3:	3	3	3	1	2	1	1	1	2	1	1	2	3	2
CO4:	3	3	3	1	2	1	1	1	3	1	1	2	2	1
CO5:	3	3	3	2	3	1	1	1	3	1	1	2	3	1

1 - low, 2 - medium, 3 - high

BEC112	CIRCUIT AND NETWORK ANALYSIS	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: LINEAR ALGEBRA AND MATRIX THEORY

COURSE OBJECTIVES

The main objectives of this course are to:

1	To apply the fundamental theorems of electrical circuit and network
2	To discuss the concepts of steady state and transient analysis in RL, RC and RLC circuits.
3	To analyze the significance of two port networks
4	To design and analyze the circuits using simulation tools

UNIT 1:	CIRCUIT THEOREMS AND KIRCHOFF'S LAWS	9

Analysis with dependent current and voltage sources. Node and Mesh Analysis, Current and Voltage Divider Rules, Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Concept of duality and dual networks.

UNIT 2:	SOLUTION OF FIRST AND SECOND ORDER NETWORKS	9

Solution of first and second order differential equations, Review of Laplace Transform, Representation of sine function as rotating phasor, phasor diagrams. Series and parallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response

UNIT 3:	SINUSOIDAL STEADY STATE ANALYSIS	9

Impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

UNIT 4:	ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS	9

Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

UNIT 5:	TWO PORT NETWORK	9

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

45 PERIODS

PRACTICAL EXERCISES: 15 PERIODS

1.	Perform KVL & KCL on simulation and kit.
2.	Perform Thevenin & Norton theorem on simulation and kit.
3.	Perform Superposition Theorem on simulation and kit.
4.	Perform maximum power transfer Theorem on simulation and kit.
5.	Determination of Resonance Frequency of Series & Parallel RLC Circuits.
6.	Transient analysis of RL and RC circuits
7.	Study the network parameters for various types of network connections using simulation

COURSE OUTCOMES

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

CO1:	Apply knowledge of various theorems to electrical circuits and simplify the network
CO2:	Understand mathematical background for circuit analysis and utilize it for solution of First and second order circuits
CO3:	Understand phasor representation and utilize it for carrying out AC circuit analysis
CO4:	Understand Laplace operation and utilize if for solving complex time domain circuits
CO5:	Evaluate two-port network parameters.

CO6:	Use simulation tools for the analysis of circuits
	TOTAL:60 PERIODS
TEXT BOOKS	
1.	William H.Hayt, Jr, J.E.Kemmerly& Steven M.Durban, "Engineering Circuit Analysis" 9th Edition, Mc Graw Hill, 2020
2.	K.S.Suresh Kumar, “Electric Circuit Analysis”, Pearson Publications, 2013
3.	M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
4.	A. A. Nimje and D. P. Kothari, “Electrical Circuit Analysis and synthesis”, New Age International Publications, 2017
5.	C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004
REFERENCES	
1.	C. Davis, “DC Circuits”, University of Oklahoma Libraries, 2016
2.	C. Davis, “AC Circuits”, University of Oklahoma Libraries, 2017
3.	James M. Fiore, “AC Electrical Circuit Analysis: A Practical Approach”, dissidents, 2020
4.	James M. Fiore, “DC Electrical Circuit Analysis: A Practical Approach”, dissidents, 2020
OPEN SOURCE SOFTWARE/LEARNING WEBSITE	
	Falstad Circuit Simulator Applet : https://www.falstad.com/circuit/
	CircuitLab: Online circuit simulator & schematic editor: https://www.circuitlab.com/
	https://openlibrary.org/search?q=circuit+analysis&mode=everything

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	3	3	2	2	1	1	2	2	2	2	2	3	3
CO2:	3	2	2	2	2	1	1	2	2	2	2	2	3	3
CO3:	3	2	3	2	3	1	1	2	2	2	2	2	3	3
CO4:	2	2	3	2	3	1	1	2	2	2	2	2	3	3
CO5:	2	3	3	2	2	1	1	2	2	2	2	2	3	3
CO6:	2	2	3	2	3	1	1	2	3	2	2	2	3	3

1 - low, 2 - medium, 3 - high

BCS131	C PROGRAMMING AND DATA STRUCTURES	L	T	P	C	TOTAL MARKS
		2	0	2	3	100

PREREQUISITES:

COURSE OBJECTIVES

The main objectives of this course are to:

1.	To introduce the basics of C programming language.
2.	To learn the concepts of advanced features of C
3.	To understand the concepts of ADTs and linear data structures
4.	To know the concepts of non-linear data structure and hashing.
5.	To familiarize the concepts of sorting and searching techniques

UNIT 1:	**C PROGRAMMING FUNDAMENTALS**	**6**

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays

UNIT 2:	**C PROGRAMMING - ADVANCED FEATURES**	**6**

Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives

UNIT 3:	**LINEAR DATA STRUCTURES**	**6**

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications..

UNIT 4:	**NON-LINEAR DATA STRUCTURES**	**6**

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing

UNIT 5:	**SORTING AND SEARCHING TECHNIQUES**	**6**

Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.

30 PERIODS

PRACTICAL EXERCISES: **15 PERIODS**

1.	Practice of C programming using statements, expressions, decision making and iterative statements
2.	Practice of C programming using Functions and Arrays
3.	Implement C programs using Files, Pointers and Structures
4.	Development of real time C applications
5.	Array implementation of List ADT
6.	Array implementation of Stack and Queue ADTs
7.	Linked list implementation of List, Stack and Queue ADTs
8.	Applications of List, Stack and Queue ADTs
9.	Implementation of Binary Trees and operations of Binary Trees
10.	Implementation of Binary Search Trees
11.	Implementation of searching techniques
12.	Implementation of Sorting algorithms : Insertion Sort, Quick Sort, Merge Sort
13.	Implementation of Hashing – any two collision techniques

COURSE OUTCOMES

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

CO1:	Develop C programs for any real world/technical application.
CO2:	Apply advanced features of C in solving problems.
CO3:	Write functions to implement linear and non–linear data structure operations and use

	appropriate linear/non–linear data structure operations for solving a given problem
CO4:	Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval
CO5:	Appropriately use sort and search algorithms for a given application
	TOTAL:45 PERIODS
TEXT BOOKS	
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
2.	ReemaThareja, "Programming in C", Second Edition, Oxford University Press, 2016.
REFERENCES	
1.	Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 1999
2.	Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013
3.	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education,1983
LIST OF OPEN SOURCE SOFTWARE/ LEARNING WEBSITE	
1.	https://www.coursera.org/specializations/data-structures-algorithms
2.	https://nptel.ac.in/courses/112107243
3.	https://nptel.ac.in/courses/112105598

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	3	1	2	2	1	1	-	1	2	1	3	2	1
CO2:	1	2	1	2	2	-	-	-	1	1	1	2	2	2
CO3:	2	3	1	2	3	-	-	-	1	1	1	2	2	1
CO4:	2	1	-	1	1	-	-	-	2	1	1	2	2	3
CO5:	1	2	1	2	2	1	1	-	1	2	1	3	2	2

1 - low, 2 - medium, 3 - high

BME121	ENGINEERING PRACTICES LABORATORY	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES:

COURSE OBJECTIVES

The main objectives of this course are to:

1	To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.
2	To provide exposure to the students with hands on experience on various basic engineering practices in Electrical and Electronics Engineering.

PRACTICAL EXERCISES: 30 PERIODS

1.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

Buildings: (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:

(a) Preparation of arc welding of butt joints, lap joints and teejoints.
(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example –Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

2.	**GROUP B (ELECTRICAL & ELECTRONICS)** **III ELECTRICAL ENGINEERING PRACTICE** 1. Residential house wiring using switches, fuse, indicator, lamp and energy meter. 2. Fluorescent lamp wiring. 3. Stair case wiring 4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit. 5. Measurement of energy using single phase energy meter. 6. Measurement of resistance to earth of electrical equipment. **IV ELECTRONICS ENGINEERING PRACTICE** 1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR. 2. Study of logic gates AND, OR, EOR and NOT. 3. Generation of Clock Signal. 4. Soldering practice – Components Devices and Circuits – Using general purpose PCB. 5. Measurement of ripple factor of HWR and FWR.
COURSE OUTCOMES	
At the end of this course, the students will be able to:	
CO1:	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
CO2:	Wire various electrical joints in common household electrical wire work.
CO3:	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipment.
CO4:	Make simple products like tray shaped structures out of sheet metal.
CO5:	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
REFERENCES	
1.	Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2.	Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt. Ltd, (2006)
3.	Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4.	Rajendra Prasad A. & Sharma P.M.M.S., "Workshop Practice", Sree Sai Publication, (2002).

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	1	1	1	3	2	2	2	3	1	1	2	2	2
CO2:	2	1	1	1	3	2	2	2	3	1	1	2	2	2
CO3:	2	1	1	1	3	2	2	2	3	1	1	2	2	2
CO4:	2	1	1	1	3	2	2	2	3	1	1	2	2	2
CO5:	2	1	1	1	3	2	2	2	3	1	1	2	2	2
CO	2.0	1.0	1.0	1.0	3.0	2.0	2.0	2.0	3.0	1.0	1.0	2.0	2.0	2.0

1 - low, 2 - medium, 3 - high,

BEC201	DIGITAL ELECTRONICS	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES

The main objectives of this course are to:

1	To impart knowledge on various types of Binary logics.
2	To design a binary logic circuit for an arithmetic expression.
3	To understand the usage of registers and counters used in various digital circuits.
4	To understand the design of memory devices used.
5	To get an exposure about the electronics behind design of Basic digital logical elements.

UNIT 1: NUMBER SYSTEMS, LOGIC FUNCTIONS AND BOOLEAN ALGEBRA — **9**

Number systems – Number systems conversions - Binary arithmetic – Binary codes – Logic functions Universal gate functions - Boolean algebra – Functionally complete operation sets, Reduction of switching equations using Boolean algebra, Realization of switching function.

UNIT 2: DESIGN OF COMBINATIONAL LOGIC — **9**

Design procedure of Combinational Logic – Design of two level gate networks - Sum of Products (SOP) - Product of Sums(POS) - Canonical SOP - Canonical POS - Karnaugh Map - Simplifications of Boolean functions using Karnaugh Map and implementation using Logic function – Advantages and limitations of K-Map –Tabulation method.

UNIT 3: COMBINATIONAL CIRCUITS — **9**

Introduction to Combinational circuits – Half Adder, Full Adder - Half Subtractor, Full Subtractor - Parallel binary Adder, Parallel binary Subtractor - Carry look ahead Adder- BCD Adder- Decoders, Encoders - Multiplexers- Demultiplexers- Code convertors- Magnitude Comparator.

UNIT 4: SEQUENTIAL CIRCUITS — **9**

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master-Slave flip flop, Characteristic and excitation table –Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters –State diagram, State table, State minimization – Hazards.

UNIT 5: DIGITAL LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES — **9**

Classification and characteristics of logic family – Bipolar logic family – Saturated logic family – Non saturated family – Unipolar family – TTL, MOS and CMOS logic families. Programmable Logic Devices– Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA)

45 PERIODS

PRACTICAL EXERCISES: 15 PERIODS

1.	Experimental Verification of Logic Gates
2.	Design and Experimental verification of Boolean function
3.	Design of adders and subtractors & code converters.
4.	Design of Multiplexers & Demultiplexers.
5.	Design of Encoders and Decoders.
6.	Design of Magnitude Comparators
7.	Design and implementation of counters using flip-flops
8.	Design and implementation of shift registers.

COURSE OUTCOMES

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

CO1:	Minimize Boolean functions for computationally less complex implementations.
CO2:	Apply K map and tabulation method for minimization of Boolean functions.
CO3:	Implement combinational logic circuits for Real World Problems.
CO4:	Implement sequential logic circuits for Real World Problems.
CO5:	Analyze the performance of various logic families and Implement memory units with Programmable logic devices

TOTAL:60 PERIODS

TEXT BOOKS

1.	Morris Mano, "Digital design", 5 th Edition, Prentice Hall of India, 2016.
2.	Milos Ercegovac, Tomas Lang, "Introduction to Digital Systems", Wiley publications, 2013.
3.	John M. Yarbrough, "Digital logic: Applications and Design", Thomas – Vikas Publishing House, 2002

REFERENCES	
1.	R.P.Jain, "Modern digital Electronics", 3rd Edition, TMH, 2003
2.	William H. Gothmann, "Digital Electronics", Prentice Hall, 2001
3.	David A Bell, "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2008.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	3	3	1	2	1	1	1	2	1	1	2	3	2
CO2:	3	3	2	1	2	1	1	1	2	1	1	2	3	2
CO3:	3	3	3	1	2	1	1	1	2	1	1	2	3	2
CO4:	3	3	3	1	2	1	1	1	3	1	1	2	2	3
CO5:	3	3	3	2	3	1	1	1	3	1	1	2	3	3

1 - low, 2 - medium, 3 - high

BEC202	ANALOG ELECTRONIC CIRCUITS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: Fundamentals of Semiconductor physics, Electron Devices.

COURSE OBJECTIVES

The main objectives of this course are to:

1	To design and analyze the performance of BJT and FET amplifiers
2	To test and design the feedback amplifiers and oscillators
3	To estimate and design tuned amplifiers and power amplifiers.
4	To apply and analyze the concepts of Multivibrator circuits.
5	To design and analyze the blocking oscillator & Time base generating circuits

UNIT 1:	SMALL SIGNAL ANALYSIS AND FREQUENCY RESPONSE OF AMPLIFIERS	9

Small signal models of BJT and MOSFET, Small signal Analysis of Common Emitter, Common Collector and common Base amplifiers. Small signal analysis of FET amplifiers, Differential amplifiers. Low frequency response of BJT and FET amplifiers-high frequency response of BJT and FET amplifiers.

UNIT 2:	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Basic feedback concepts - Properties of Negative feedback -Four feedback topologies with amplifier circuit - Analysis of series - shunt feedback amplifiers. Oscillators: Barkhausen criteria for oscillator - Analysis of RC oscillators - LC oscillators - Crystal Oscillator

UNIT 3:	POWER AMPLIFIERS AND TUNED AMPLIFIERS	9

Classification of large signal amplifiers – Class A amplifier– Class B amplifier – Class AB amplifier– Class C amplifier and Efficiency – Analysis of Single tuned amplifier - Double tuned amplifier - Synchronously tuned amplifiers.

UNIT 4:	MULTIVIBRATOR CIRCUITS	9

Collector coupled and Emitter coupled Astable multivibrator – Monostable multivibrator- Bistable multivibrators. Triggering methods: Storage delay and calculation of switching times - Speed up capacitors - Schmitt trigger circuit.

UNIT 5:	BLOCKING OSCILLATORS AND TIME BASE GENERATORS	9

Pulse transformers - Monostable Blocking Oscillators using Emitter and base timing - Astable blocking oscillator - Voltage sweep generators - Current sweep generators.

45 PERIODS

COURSE OUTCOMES

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

CO1:	Design and analyze the BJT and FET amplifiers
CO2:	Classify and construct the feedback amplifiers and oscillators.
CO3:	Design and analysis of tuned amplifiers and power amplifiers
CO4:	Design and develop circuits to generate non-sinusoidal waveforms
CO5:	Design the circuits to generate Time base waveforms.

TOTAL:45 PERIODS

TEXT BOOKS

1.	Boylested and Nashlesky, Electronic Devices and Circuit theory, 11 th edition, Prentice Hall of India, 2015
2.	Donald .A.Neamen, Electronic Circuit Analysis and Design, 2 nd edition, Tata McGraw Hill, 2009
3.	Millman .J. and Halkias C.C, Integrated Electronics, McGraw Hill, 2 nd Edition, 2017
4.	Robert Boylestad , Introductory Circuit Analysis, Pearson; 13th edition, 2015.

REFERENCES

1.	Adel.S.Sedra, Kenneth C. Smith, Micro Electronic circuits, 8th Edition, Oxford University Press, 2020.
2.	David A. Bell,Electronic Devices and Circuits, Oxford Higher Education press, 5th Edition, 2010
3.	David A. Bell, "Solid State Pulse Circuits", 4th edition, Eastern economic edition, Prentice

	Hall of India, 2010
4.	Millman J. and Taub H., "Pulse Digital, Switching waveform", 3rd Edition, McGraw-Hill International, 2017

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	3	3	1	2	1	1	2	2	2	2	2	1	2
CO2:	3	3	3	2	2	1	1	2	2	2	2	2	1	2
CO3:	3	3	3	3	2	1	1	2	2	2	2	2	1	2
CO4:	3	3	3	3	2	1	1	2	2	2	2	2	1	1
CO5:	3	3	3	3	2	1	1	2	2	2	2	2	1	1

1 - low, 2 - medium, 3 - high

BEC203	SIGNALS AND SYSTEMS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: NONE

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To categorize the various types of CT and DT signals.
2	To analyze the spectral characteristics of CT periodic and a periodic signals
3	To determine the response of CT LTI system.
4	To analyze system properties based on impulse response, Fourier analysis and Z transform.
5	To apply mathematical tools for analysis of various real time signals and systems.

UNIT 1: INTRODUCTION TO SIGNALS **9**

Signals- Continuous time signals (CT signals) and Discrete time signals (DT signals) -Step, Ramp, Pulse, Impulse, Exponential and Sinusoidal Signal – Basic Operations on signals -Amplitude Scaling, Time Scaling, Time Reversal, Time Shifting, Signal Addition, Subtraction-classification of CT and DT signals- Deterministic and Non- deterministic Signals, Even and Odd Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Real and Imaginary Signals.

UNIT 2: ANALYSIS OF CONTINUOUS TIME SIGNALS **9**

Continuous Time Fourier Transform -Properties of CTFT- Inverse Fourier transform- unilateral and bilateral Laplace Transform analysis with examples - Basic properties -Correlation-Auto correlation, Cross Correlation, Inverse Laplace transform using partial fraction expansion method - Relation between Fourier transform and Laplace transform.

UNIT 3: LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS AND DISCRETE TIME SYSTEMS **9**

Classification of CT and DT systems - Static and dynamic, Linear and non-linear, Time-variant and time-invariant, Causal and non-causal, Stable and unstable -Linear time Invariant System- Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - Differential equation- Computation of impulse response, step response, natural response - forced response and transfer function using Laplace transform - Convolution integral.

UNIT 4: ANALYSIS OF DISCRETE TIME SIGNALS AND LTI DISCRETE TIME SYSTEMS **9**

Discrete Time Fourier Transform (DTFT)- z-transform -Basic properties of Z transform Properties of ROC - Inverse z- transform, Long division and Partial fraction expansion- Difference equation - Computation of Impulse response, Frequency response, step response, natural response, forced response and Transfer function using Z Transform, Convolution Sum using matrix, graphical and tabulation method.

UNIT 5: REAL TIME APPLICATIONS OF SIGALS AND SYSTEMS **9**

Mathematical tools for the analysis of deterministic and random signals –Sampling theorem- Speech and audio processing- Underwater acoustic- Biological signal analysis- Multimedia processing-image and Video- Analysis and modeling of Systems- Systems that manipulate signals-analysis and synthesis of signals and their interaction with systems.

45 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply various signal operations on different types of CT and DT signals.
CO2:	Analyze the characteristics of continuous-time periodic and aperiodic signal using suitable transforms.
CO3:	Evaluate the input and output relationships of LTI system.
CO4:	Analyze the response of DT systems using various transforms.
CO5:	Analyze the characteristics of various real time signals.

TEXT BOOKS	
1.	Alan v Oppenheim Alan s Willsky with S Hamid Nawab, “Signals and systems”, 2nd edition, Pearson Education, March 2016
2.	P.Ramesh Babu, R. Anandanataragan, “Signals and Systems”, 5th Edition, Scitech Publishers, 2018.
3.	Rodger E. Ziemer , William H Tranter, D. R. Fannin,”Signals and Systems: Continuous and Discrete”, 4th Edition, Pearson Education India, 2014.
REFERENCES	
1.	Rodger E. Ziemer , William H Tranter, D. R. Fannin,”Signals and Systems: Continuous and Discrete”, 4th Edition, Pearson Education India, 2014.
2.	H.P. Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill, 2017.

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	**3**	**1**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2:	**3**	**1**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**
CO3:	**3**	**3**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**
CO4:	**3**	**3**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**
CO5:	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**

1- low, 2 - medium, 3 - high,

BEE221	CONTROL SYSTEM	L	T	P	C	TOTALMARKS
		2	2	0	3	100

PREREQUISITES:NONE

COURSEOBJECTIVES:

Themainobjectivesofthiscourseareto:

1	To introduce the components and their representation of control systems
2	To learn various methods for analyzing the time response, frequency response and stability of the systems.
3	To learn the various approach for the state variable analysis.
4	To learn the concepts of stability analysis.
5	To learn the concepts of state variable methods.

UNIT1:	SYSTEMS COMPONENTS AND THEIR REPRESENTATION	9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory - Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

UNIT2:	TIME RESPONSE ANALYSIS	9

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems

UNIT3:	FREQUENCY RESPONSE AND SYSTEM ANALYSIS	9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT4:	CONCEPTS OF STABILITY ANALYSIS	9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT5:	CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS	9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

45 PERIODS

COURSEOUTCOMES:

Uponsuccessfulcompletion ofthecourse,students willbeableto:

CO1:	Develop the mathematical model of the physical systems.
CO2:	Analyze the response of the closed and open loop systems.
CO3:	Illustrate the frequency response characteristics of open loop and closed loop system response.
CO4:	Analyse the stability using Routh and root locus techniques.
CO5:	Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.

TEXTBOOKS

1.	M.Gopal,"Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

REFERENCES

1.	J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2.	K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2012.
3.	S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013.
4.	Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition,1995.

CO's-PO's&PSO'sMAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	3	3	2	2	2	0	0	0	0	2	3	3	3
CO2:	3	3	3	3	2	3	0	0	0	0	2	2	3	3
CO3:	3	2	3	3	2	2	0	0	0	0	2	3	3	2
CO4:	3	3	3	2	2	2	0	0	0	0	2	2	3	3
CO5:	2	2	3	3	2	3	0	0	0	0	2	3	2	2
CO	3	3	3	3	2	2	0	0	0	0	2	3	3	3

1-low,2-medium, 3-high,

BEC207	ELECTRONIC CIRCUITS LABORATORY	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES: NIL

COURSE OBJECTIVES

The main objectives of this course are to:

1	To gain hands on experience in designing electronic circuits
2	To learn simulation software used in circuit design
3	To learn the fundamental principles of amplifier circuits
4	To differentiate feedback amplifiers and oscillators
5	To differentiate the operation of various multivibrator

PRACTICAL EXERCISES: 30 PERIODS

1.	Series and Shunt feedback amplifiers-Frequency response, Input and output impedance
2.	Class A & B Transformer Coupled Power Amplifier
3.	RC Phase shift oscillator and Wien Bridge Oscillator
4.	Hartley Oscillator and Colpitts Oscillator
5.	RC Integrator and Differentiator circuits
6.	Clippers and Clampers
7.	Multivibrator (Astable, Monostable, Bistable)
	SIMULATION USING SPICE (Using Transistor):
8.	Tuned Collector Oscillator
9.	Double and Stagger tuned Amplifiers
10.	Twin -T Oscillator / Wein Bridge Oscillator

COURSE OUTCOMES

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

CO1:	Analyze various types of feedback amplifiers.
CO2:	Design oscillators and tuned amplifiers
CO3:	Design wave-shaping circuits and Multivibrators
CO4:	Design amplifiers and oscillators, using transistor
CO5:	Design and simulate feedback amplifiers and wave- shaping circuits and Multivibrators, filters using SPICE Tool

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	2	3	3	2	2	1	1	1	2	1	1	2	3	2
CO2:	3	3	2	2	2	1	1	1	2	1	1	2	3	2
CO3:	3	3	3	2	2	1	1	1	2	1	1	2	3	2
CO4:	3	3	3	1	1	1	1	1	3	1	1	2	2	3
CO5:	3	3	3	2	3	1	1	1	3	1	1	2	3	3

1 - low, 2 - medium, 3 – high

BEC211	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: COMMUNICATION

COURSE OBJECTIVES

The main objectives of this course are :

1	To provide understanding on the needs of analog and digital communication systems
2	To teach various analog and digital modulation and demodulation techniques.
3	To impart basic knowledge of AM, FM transmitters and receivers.
4	To familiarize the concepts of sampling, quantization & the various band pass signaling schemes.
5	To know the fundamentals of spread spectrum modeling and speech coding.

UNIT 1: AMPLITUDE MODULATION AND DEMODULATION **9**

Model of communication systems – Communication system classification - Need for modulation – Representation of AM – Modulation index and power calculation – Types of AM and its Generation - Comparison of various AM schemes – AM Demodulation, Envelope detector and Square law detector.

UNIT 2: FREQUENCY AND PHASE MODULATION AND DEMODULATION **9**

FM Generation: Direct method using Varactor diode and indirect method - FM Detector: Balanced slope detector, Foster seeley frequency discriminator and Ratio detector. PM Generation and Detections - FM to PM and PM to FM – Comparison of AM, FM and PM – Pre-emphasis and Deemphasis - characteristics. Design and Experimental Verification AM Modulation, frequency modulation and Phase modulation.

UNIT 3: ANALOG TO DIGITAL CONVERSION **9**

Sampling theorem - Sampling and signal reconstruction – Aliasing - Types of sampling - Concepts of PAM, PWM, PPM – Quantization – Companding - PCM - DPCM – ADPCM - Delta modulation - Adaptive delta modulation – Non theoretical comparison of Pulse modulation Techniques.

UNIT 4: DIGITAL MODULATION TECHNIQUES **9**

ASK - Modulator, Coherent and Non-Coherent Detector, FSK - Modulator, Coherent and Non-Coherent FSK Detector, BPSK - Modulator, Coherent BPSK Detection - Principles of QPSK - Differential PSK and QAM. A Baseband Signal Optimum Receiver - Probability of Error – ISI - Eye Diagrams - Observe the performance of Digital carrier system ASK, PSK, FSK.

UNIT 5: SPREAD SPECTRUM TECHNIQUES **9**

Pseudo-noise sequence - DS Spread Spectrum with coherent binary PSK - Processing gain - FH Spread Spectrum -Multiple access techniques: TDMA, FDMA, CDMA - Speech encoding for wireless communication.

45 PERIODS

COURSE OUTCOMES

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

CO1:	Explain various continuous wave Amplitude modulation and demodulation techniques
CO2:	Describe the concept of Angle modulation and demodulation, and the effect of noise on it.
CO3:	Discuss about the different AM, FM Transmitters and Receivers
CO4:	Explain various digital modulation and demodulation techniques
CO5:	Explain Multiple access techniques and speech coding

TEXT BOOKS

1.	Simon Haykin Communication Systems, 4th / 5th Edition Wiley India
2.	B. P. Lathi & Zhi Ding Modern Digital and Analog Communication Systems, 4th Edition Oxford University Press

3.	Taub, Schilling & Saha Principles of Communication Systems, 3rd Edition Tata McGraw-Hill
4.	John G. Proakis & Masoud Salehi Communication Systems Engineering, 2nd Edition Pearson
5.	Theodore S. Rappaport Wireless Communications: Principles and Practice, 2nd Edition Pearson

REFERENCES	
1.	H. Taub & D. Schilling Digital Integrated Electronics & Communication Systems McGraw-Hill
2.	R. P. Singh & S. D. Sapre Communication Systems: Analog and Digital Tata McGraw-Hill
3.	Bernard Sklar Digital Communications: Fundamentals and Applications, 2nd Edition Pearson

CO-PO Mapping

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1										3	3
CO2	3	2	1										3	3
CO3	3	2	1										3	3
CO4	3	2	1										3	3
CO5	3	2	1										3	3

1 - low, 2 - medium, 3 – high

BEC212	LINEAR INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: ELECTRONIC CIRCUITS

COURSE OBJECTIVES

The main objectives of this course are :

1	To provide an understanding of Op-Amp Characteristics and its applications.
2	To teach the design of filters and oscillators using Op-amp.
3	To impart knowledge on different types of Analog to Digital Converter and Digital to Analog Converters.
4	To introduce the basic principles & applications of PLL and Instrumentation amplifier.
5	To teach the design of waveform generators using Timers.

UNIT 1:	OP- AMP AND ITS APPLICATIONS	9

OP-AMP- DC and AC Characteristics- Input offset voltage- Input bias current-Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger-Rail-to-Rail CMOS OP-AMP Overview.

UNIT 2:	FILTERS AND SIGNAL GENERATORS	9

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters - RC phase shift, Wein's bridge oscillator- Astable and Monostable multivibrator-Precision half wave and full wave rectifiers.

UNIT 3:	A/D AND D/A CONVERTERS	9

Sample and Hold circuit - Digital to analog converters: R-2R ladder network and Binary weighted Characteristics of D/A converters - Analog to digital converters: Flash converter – Successive approximation converter - Dual slope ADC-Weighted Capacitor DACs- Oversampling Converters.

UNIT 4:	PLL AND INSTRUMENTATION AMPLIFIER	9

Phase Locked Loop IC 565- Block schematic - Applications of PLL: FM demodulator and Frequency synthesizers Demodulator - AD623 Instrumentation Amplifier and its application as load cell weight measurement.

UNIT 5:	WAVEFORM GENERATOR	9

Square wave generators: 555Timer, Crystal controlled Oscillator Ramp Generator: Triangle generator, Saw tooth generator Sine wave generator: Requirement for sinusoidal oscillations, Wien-bridge and twin-T oscillators. Function Generators: Multi op-amp function generators

45 PERIODS

COURSE OUTCOMES

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

CO1:	Explain the performance characteristics of Op-amp and its applications.
CO2:	Design filters and oscillators using Op-amp
CO3:	Explain various types of A/D and D/A converters using Op-amp
CO4:	basic principles & applications of PLL and Instrumentation amplifier
CO5:	Design various waveform generators using timers

TEXT BOOKS

1.	D.Roy Choudary, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2022.
2.	James M . Fiore, Operational amplifier and linear Integrated circuits: Theory and applications, 2020
3.	Ramakant A.Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015
4.	S. Salivahanan, V.S. Kanchana Bhaaskaran, "Linear integrated circuits", 3rd Edition, McGrawHill, 2011.

REFERENCES	
1.	William D.Stanely, "Operational Amplifiers with Linear Integrated Circuits", 4th Edition, Pearson Education, 2004
2.	Sergio Franco "Design With Operational Amplifiers and Analog Integrated Circuits" 4 th Edition, McGraw-Hill Education, 2015

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2										3	2
CO2	3	2	2										3	2
CO3	3	2	2										3	2
CO4	3	2	2										3	2
CO5	3	2	2										3	2

1 - low, 2 - medium, 3 – high

BEC213	DIGITAL SIGNAL PROCESSING	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are :

1	To teach discrete Fourier transform, properties of DFT and its application to linear filtering
2	To impart knowledge on characteristics of digital filters and design digital IIR and FIR filters.
3	To provide an understanding on the effects of finite precision representation on digital filters.
4	To teach the fundamental concepts of multi rate signal processing and its applications
5	To introduce the concepts of adaptive filters and its application to communication engineering.

UNIT 1: DISCRETE FOURIER TRANSFORM **9**

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in- time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT 2: INFINITE IMPULSE RESPONSE FILTERS **9**

Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency 81 transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT 3: FINITE IMPULSE RESPONSE FILTERS **9**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT 4: FINITE WORD LENGTH EFFECTS **9**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT 5: DSP APPLICATIONS **9**

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization-DSP Architecture Fixed and Floating point architecture principles.

45 PERIODS

PRACTICAL EXERCISES: **15 PERIODS**

1.	Generation of elementary Discrete-Time sequences
2.	Linear and Circular convolutions.
3.	Auto correlation and Cross Correlation.
4.	Frequency Analysis using DFT and FFT.
5.	Design of FIR filters (LPF/HPF/BPF/BSF) and demonstration of the filtering operation
6.	Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstration of the filtering operations

7.	Decimation and Interpolation.
8.	Finite word length Effects
9.	Study of architecture of Digital Signal Processor.
10.	Wave form generation.

COURSE OUTCOMES: Upon successful completion of the course, students will be able to:	
CO1:	Apply DFT for the analysis of digital signals and systems.
CO2:	Design IIR and FIR filters
CO3:	Characterize the effects of finite precision representation on digital filters
CO4:	Design multirate filters
CO5:	Apply adaptive filters appropriately in communication systems
TEXT/REFERENCE BOOKS	
1.	John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2.	A. V. Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
3.	Emmanuel C. Ifeachor& Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
4.	Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
5.	Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006

CO's-PO's & PSO's MAPPING

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**3**	**2**	**2**	**2**	**2**							**1**	**3**	**3**
CO2	**3**	**2**	**2**	**2**	**2**							**1**	**3**	**3**
CO3	**3**	**2**	**2**	**2**	**2**							**1**	**3**	**3**
CO4	**3**	**2**	**2**	**2**	**2**							**1**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**2**							**1**	**3**	**3**

1 - low, 2 - medium, 3 – high

BEC231	ELECTROMAGNETIC FIELD THEORY	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: NONE

COURSE OBJECTIVES

The main objectives of this course are :

1	To be familiar with some elementary phenomena and concepts in field theory
2	To study the behavior of electric field across a boundary between a conductor and dielectric and between two different dielectrics.
3	To impart knowledge on the concepts of Magneto static fields, magnetic flux density, vector potential and its applications.
4	To acquire knowledge on different methods of emf generation and Maxwell's equations
5	To learn the Electromagnetic waves and characterizing parameters.

UNIT 1: ELECTRIC FIELDS **9**

Introduction - Concepts of Different Co-Ordinate Systems , Sources and effects of electromagnetic fields - Coulomb's Law, Electric Field Intensity, Electric Field due to Point Charge, Line Charge, Surface Charge and Volume Charge Distributions - Electric Flux Density - Gauss Law - Application of Gauss Law - Electric Potential - Potential Gradient - Divergence and Divergence Theorem - Poisson's and Laplace equation.

UNIT 2: CONDUCTORS AND DIELECTRICS **9**

Current and current density-Continuity of current- Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates.

UNIT 3: MAGNETIC FIELDS **9**

Biot - Savart's law, Ampere's circuital law- The Curl, Stokes theorem- Magnetic flux and flux density- Scalar and vector magnetic potentials-Force on a moving charge and differential current element-Force between differential current elements-Force and torque on a closed circuit.

UNIT 4: ELECTRODYNAMIC FIELDS **9**

Magnetic Circuits – Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT 5: ELECTRO MAGNETIC WAVES **9**

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

45 PERIODS

COURSE OUTCOMES

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

CO1:	Select suitable laws for specific applications in electromagnetic fields.
CO2:	Explain the behavior of electric field across a boundary conditions.
CO3:	Apply various theorems and laws in solving magnetic field circuits.
CO4:	Explain electromagnetic induction phenomena and Maxwell's equations in integral and differential forms.
CO5:	Explain the concept of electromagnetic waves and characterizing parameters

TEXT /REFERENCE BOOKS:
1. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Sixteenth Edition Eighth Reprint :2015.
2. V.V.Sarwate, 'Electromagnetic fields and waves', Second Edition, Newage Publishers,2018.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Fifth Edition (Schaum's Outline Series), McGraw Hill, 2018.
4. Karl.E.Lonngren, Sava.V.Savov, "Fundamentals of Electromagnetics with MATLAB", PHI,2005.
5. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
6. R.Meenakumari&R.Subasri, "Electromagnetic Felds", New Age International Publishers, 2ndEdition, 2007.
7. E.C.Jordan&K.G.Balmain, "Electromagnetic Waves & Radiating Systems", Prentice Hall, 2006.

CO's-PO's & PSO's MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1										3	2
CO2	3	2	1										3	2
CO3	3	2	1										3	2
CO4	3	2	1										3	2
CO5	3	2	1										3	2

1 - low, 2 - medium, 3 - high

BEC215	NETWORK AND SECURITY	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: NONE

COURSE OBJECTIVES:

The main objectives of this course are :

1	To impart knowledge on the Network Models and datalink layer functions
2	To teach the fundamental concepts of routing in the Network Layer
3	To explore methods of communication and congestion control by the Transport Layer.
4	To introduce the Network Security architectures, algorithm and Mechanisms.
5	To create awareness of various hardware security attacks and their countermeasures.

UNIT 1: NETWORK MODELS AND DATALINK LAYER **9**

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introduction to Datalink Layer – Error Detection and Correction – Ethernet(802.3)- Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols – HDLC – PPP.

UNIT 2: NETWORK LAYER PROTOCOLS **9**

Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6 Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.

UNIT 3: TRANSPORT AND APPLICATION LAYERS **9**

Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram - Congestion Control and Avoidance(DEC bit, RED)- QoS - Application Layer Paradigms – Client – Server Programming – Domain Name System – World Wide Web, HTTP, Electronic Mail.

UNIT 4: NETWORK SECURITY **9**

OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption –Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm – Digital Signature Algorithm.

UNIT 5: HARDWARE SECURITY **9**

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Countermeasures – Design for Security. Introduction to Blockchain Technology

45 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the various types of Network Models, layers and functions.
CO2:	Categorize and classify the routing protocols.
CO3:	List the functions of the transport and application layer
CO4:	Evaluate and choose the network security mechanisms
CO5:	Discuss the hardware security attacks and countermeasures

TEXT BOOKS

1.	Behrouz.A.Forouzan, Data Communication and Networking, Fifth Edition, TMH, 2017.(Unit – I,II,III)
2.	William Stallings, Cryptography and Network Security, Seventh Edition, Pearson Education, 2017(Unit- IV)
3.	Bhunia Swarup, Hardware Security –A Hands On Approach,Morgan Kaufmann, First edition, 2018.(Unit – V).

REFERENCES	
1.	James.F.Kurose and Keith.W.Ross, Computer Networking – A Top – Down Approach, Sixth Edition, Pearson, 2017
2.	Doughlas .E.Comer, Computer Networks and Internets with Internet Applications, Fourth Edition, Pearson Education, 2008.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**3**	**2**	**2**									**1**	**3**	**3**
CO2	**3**	**2**	**2**									**1**	**3**	**3**
CO3	**3**	**2**	**2**									**1**	**3**	**3**
CO4	**3**	**2**	**2**									**1**	**3**	**3**
CO5	**3**	**2**	**2**									**1**	**3**	**3**

1 - low, 2 - medium, 3 – high

BEC217	ANALOG AND DIGITAL COMMUNICATION LABORATORY	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES: COMMUNICATION

COURSE OBJECTIVES

The main objectives of this course are to:

1	The goal of this course is to introduce basic principles of Continuous wave (CW) Modulation, Pulse Modulation, as required for Electronics engineering students
2	The course aims to make the student familiar with Digital Modulation and Demodulation techniques, Digital transmission, reception etc.

LIST OF EXPERIMENTS

1.	Amplitude Modulation and Demodulation
2.	Frequency Modulation and Demodulation
3.	Pre-Emphasis/ De-Emphasis Circuits
4.	Sampling
5.	Pulse Amplitude Modulation (PAM),
6	Pulse Width Modulation (PWM), Pulse Position Modulation (PPM)
7	Pulse Code Modulation (PCM).
8.	Time Division Multiplexing.
9.	Delta Modulation
10.	Digital Modulation &Demodulation-ASK (Hardware & MATLAB)
11.	Digital Modulation & Demodulation-FSK (Hardware &MATLAB)
12.	Digital Modulation & Demodulation-PSK (Hardware &MATLAB)
13.	Digital Modulation & Demodulation-QPSK (Hardware &MATLAB)
14.	PLL and Frequency Synthesizer
15.	Error Control Coding using MATLAB

TOTAL :30 PERIODS

COURSE OUTCOMES

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

CO1:	Analyze and compare different analog modulation schemes like AM, FM for their efficiency and bandwidth.
CO2:	Compare and contrast various analog and digital modulation and demodulation techniques
CO3:	Evaluate the performance of pulsed modulation systems and their performance

LIST OF REFERENCES:

1.	B. P. Lathi, “Modern Digital and Analog Communication Systems”, Oxford Publication
2.	Taub & Schilling, “Principles of Communication Systems”, Tata McGraw Hill Publication
3.	S.Haykin, “Communication systems”, John Wiley
4.	Bhattacharya Amitabh, “Digital Communication”, Tata McGraw-Hill
5.	Prokis J.J, “Digital Communications” ,McGraw Hill

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	3	1	1	1	1	1	1	1	1	3	3
CO2	3	2	1	3	1	1	1	1	1	1	1	1	3	3
CO3	3	2	1	3	1	1	1	1	1	1	1	1	3	3

1 - low, 2 - medium, 3 – high

BEC218	ANALOG INTEGRATED CIRCUITS LABORATORY	L	T	P	C	TOTAL MARKS
		0	0	4	2	100

PREREQUISITES: Electronic Circuits

COURSE OBJECTIVES

The main objectives of this course are to:

1	To enable the students to design and test of analog circuits using op-amp and Timer ICs.
2	To expose the students to a variety of practical circuits using various analog ICs.

PRACTICAL EXERCISES: **30 PERIODS**

1.Inverting, Non Inverting amplifier
2. Integrator and Differentiator.
3. Precision Rectifiers (HW & FW)..
4. Comparators.
5. Filters (LPF & HPF).
6. Astable Multivibrator Using IC741.
7. Monostable Multivibrator Using IC 741.
8. Schmitt Trigger Using IC 741.
9. Instrumentation Amplifier
10. A/D Converters
11. D/A Converters
12. Wein's Bridge Oscillator
13. RC Phase Shift Oscillator
14. Astable Multivibrator using IC555.
15. Monostable Multivibrator using IC 555.

COURSE OUTCOMES

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

CO1:	Design and analyze the analog circuits like filters, waveform generators, etc. using Op-amps
CO2:	Design and analyze waveform generators using Timers.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	3	1	1	1	1	1	1	1	1	3	3
CO2	3	2	1	3	1	1	1	1	1	1	1	1	3	3

1 - low, 2 - medium, 3 – high

BEN231	COMMUNICATION SKILLS FOR CAREER SUCCESS	L	T	P	C	TOTAL MARKS
		0	0	2	1	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To improve the communicative competence of learners.
2	To build on students 'English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
3	To develop analytical thinking skills for problem solving in communicative contexts.
4	To equip them with writing skills needed for academic as well as work place contexts.
5	To equip them with personal skills.

UNIT 1:	**Preparing for a Career**	**3**

Identifying job openings, Applying for a job, Preparing Cover letters, Preparing a CV/Resume and Effective Profiling.

UNIT 2:	**Presentation Skills**	**3**

Preparing a PowerPoint Presentation, Greeting and introducing, Presenting a Paper, Group Discussions, Preparing for and Facing a Job Interview.

UNIT 3:	**Business Communication**	**3**

Preparing Agenda and Minutes for Meetings ,Writing Notices and Memos ,Drafting an E-mail, Press Release ,Correspondence with Govt./Authorities, Office Orders, Enquiries and Replies.

UNIT 4:	**Time & Stress Management**	**3**

Identifying Time Wasters, Time Management Tips, Identifying Factors Responsible for Stress , Stress Management Tips, Test Preparation Tips.

UNIT 5:	**Soft Skills for Leadership and Team Management**	**3**

Qualities of a Good Leader , Leadership Styles ,Decision Making ,Intrapersonal skills , Interpersonal skills, Problem solving , Critical thinking , Negotiation skills.

15 PERIODS

COURSE OUTCOMES

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

CO1:	Listen and comprehend complex academic texts.
CO2:	Read and infer the denotative and connotative meanings of technical texts.
CO3:	Write definitions, descriptions narrations and essays on various topics.
CO4:	Speak fluently and accurately and informal communicative contexts.
CO5:	Express their opinions effectively in both oral and written medium of communication.

TEXT BOOKS & REFERENCES

1.	English for Technical Communication (With CD) by AyshaViswamohan, Mcgraw Hill Education, ISBN: 0070264244.
2.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
3.	Learning to Communicate– Dr.V.Chellammal, Allied Publishing House, New Delhi, 2003.

CO's- PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	0	0	0	0	2	0	1	2	3	1	1	0	0
2	0	0	0	0	1	0	0	1	2	3	1	1	0	0
3	0	0	0	0	1	2	0	0	2	3	1	2	0	0
4	0	0	0	0	1	0	0	0	2	3	1	2	0	0
5	0	0	0	0	1	0	0	0	3	3	1	2	0	0

1.low 2- medium 3- high 0 - No correlation

SEMESTER – 5

BEC301	VLSI AND CHIP DESIGN	L	T	P	C	TOTALMARKS
		3	0	0	3	100

PREREQUISITES: Electronic Devices

COURSEOBJECTIVES:

The main objectives of this course are :

1	To impart fundamental knowledge on the characteristics of MOSFET under ideal, nonideal, static and dynamic conditions
2	To teach the design of combinational logic circuits using various logic families and low power design in CMOS circuits
3	To teach sequential logic circuits and clocking strategies.
4	To teach about Interconnects, Arithmetic circuits, Logic Implementation using Programmable Devices and Memory Architecture.
5	To teach the fundamentals of ASIC Design flow and Testing

UNIT1:	MOS TRANSISTOR PRINCIPLES	9

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, Technology Scaling, power consumption.

UNIT2:	COMBINATIONAL LOGIC CIRCUITS	9

Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT3:	SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES	9

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Non bistable Sequential Circuits. Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.

UNIT4:	INTERCONNECT, MEMORY ARCHITECTURE AND ARITHMETIC CIRCUITS	9

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks, Memory Core and Memory Peripherals Circuitry.

UNIT5:	ASIC DESIGN AND TESTING	9

Introduction to wafer to chip fabrication process flow. Microchip design process & issues in test and verification of complex chips, embedded cores and SOCs, Fault-models, Test coding. ASIC Design Flow, Introduction to ASICs, Introduction to test benches, Writing test benches in Verilog HDL, Automatic test pattern generation, Design for testability, Scan design: Test interface and boundary scan.

45 PERIODS

COURSEOUTCOMES:

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

CO1:	Explain the characteristics of MOSFET under ideal, nonideal, static and dynamic conditions.
CO2:	Design of combinational logic circuits using various logic families and discuss the types of power dissipation in CMOS circuits
CO3:	Describe sequential logic circuits and clocking strategies.
CO4:	Discuss the various types of Interconnects, Arithmetic circuits, Logic Implementation using Programmable Devices and Memory Architecture
CO5:	Explain ASIC Design flow and various types of Testing

TEXTBOOKS

1.	Jan D Rabaey, Anantha Chandrakasan,"Digital Integrated Circuits: A Design Perspective", PHI, 2016.(Units II, III and IV).
2.	Neil HE Weste, Kamran Eshranghian, "Principles of CMOS VLSI Design : A System Perspective," Addison Wesley, 2009.(Units - I, IV).
3.	Michael J Smith, "Application Specific Integrated Circuits, Addison Wesley,(Unit-V)

4.	Samir Palnitkar, “Verilog HDL: A guide to Digital Design and Synthesis”, Second Edition, Pearson Education,2003.(Unit - V)
5.	ParagK.Lala,”Digital CircuitTestingandTestability”, AcademicPress,1997,(Unit-V)
REFERENCES	
1.	D.A.Hodgesand H.G.Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983
2.	P.Rashinkar,PatersonandL.Singh,"System-on-a-ChipVerification-Methodology and Techniques", Kluwer Academic Publishers,2001
3.	Samiha Mourad and Yervant Zorian, “Principles of Testing Electronic Systems”, Wiley 2000
4.	M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, MemoryandMixed-SignalVLSICircuits",KluwerAcademicPublishers,2000

CO’s-PO’s&PSO’sMAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1									1	3	2
CO2	3	2	1									1	3	2
CO3	3	2	1									1	3	2
CO4	3	2	1									1	3	2
CO5	3	2	1									1	3	2

1-low,2-medium, 3 -high,

BEC302	WIRELESS COMMUNICATION	L	T	P	C	TOTALMARKS
		3	0	2	4	100

PREREQUISITES: Analog and Digital Communication

COURSEOBJECTIVES

The main objectives of this course are :

1	To introduce the concepts and design of a Cellular System
2	To teach the types of Mobile Radio Propagation and Digital Modulation Techniques.
3	To provide fundamental knowledge on Multiple Access Techniques and Wireless Networks

UNIT 1: THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS **9**

Introduction-Frequency Reuse-Channel Assignment Strategies-Handoff Strategies: Prioritizing Handoffs, Practical Handoff Considerations. Interference And System Capacity: Co-Channel Interference and System Capacity-Channel Planning for Wireless Systems, Adjacent Channel Interference, Power Control for Reducing Interference, Trunking And Grade Of Service. Improving Coverage and Capacity In Cellular Systems: Cell Splitting, Sectoring

UNIT 2: MOBILE RADIO PROPAGATION **9**

Large Scale Path Loss: Introduction To Radio Wave Propagation - Free Space Propagation Model – Three Basic Propagation Mechanism: Reflection – Brewster Angle- Diffraction Scattering. Small Scale Fading And Multipath: Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. Types Of Small- Scale Fading: Fading Effects Due To Multipath Time Delay Spread, Fading Effects Due To Doppler Spread

UNIT 3: MODULATION TECHNIQUES AND EQUALIZATION AND DIVERSITY **9**

Digital Modulation – An Overview: Factors That Influence The Choice Of Digital Modulation, Linear Modulation Techniques: Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying(GMSK), Spread Spectrum Modulation Techniques: Pseudo- Noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance In Fading And Multipath Channels- Equalization, Diversity And Channel Coding: Introduction-Fundamentals Of Equalization- Diversity Techniques: Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity.

UNIT 4: MULTIPLE ACCESS TECHNIQUES **9**

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access(FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)- Capacity Of Cellular Systems: Capacity Of Cellular CDMA, Capacity Of CDMA With Multiple Cells..

UNIT 5: WIRELESS NETWORKING **9**

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public Switched Telephone Network(PSTN), Development Of Wireless Networks: First Generation Wireless Networks, Second Generation Wireless Networks, Third Generation Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing In Wireless Networks: Circuit Switching, Packet Switching-Personal Communication Services/ Networks(PCS/PCNs):Packet Vs Circuit Switching For PCN, Cellular Packet- Switched Architecture- Packet Reservation Multiple Access(PRMA)- Network Databases: Distributed Database For Mobility Management- Universal Mobile Telecommunication Systems(UMTS).

45 PERIODS

PRACTICALEXERCISES: 15PERIODS

1.	Modeling and simulation of Two ray multipath propagation channel using matlab.
2.	Modeling and simulation of free-space propagation model using matlab
3.	Modeling and simulation of Rayleigh and Rician multipath fading channel using matlab
4.	Analyze the BER performance of wireless standards for 64bit QAM.
5.	Performance measurements such as BER, PER, BLER for 4G and 5G using Matlab
6.	Performance measurements such as throughput, capacity, ACLR, EVM for 4G and 5G using Matlab
7.	Spread Spectrum – DSSS Modulation & Demodulation
8.	Modeling and simulation of TDMA and FDMA for wireless communication
9.	Modeling and simulation of CDMA and SDMA 1for wireless communication
10.	Wireless Channel equalization: Zero-Forcing Equalizer (ZFE), MMSE Equalizer(MMSEE),
11.	Wireless Channel equalization: Adaptive Equalizer (ADE), Decision Feedback Equalizer (DFE)

TOTAL: 60PERIODS

COURSEOUTCOMES	
At the end of this course, the students will be able to:	
CO1:	Explain channel assignment strategies, interference, coverage and capacity of cellular systems.
CO2:	Describe Mobile Radio Propagation and Various Digital Modulation Techniques
CO3:	Enumerate the Concepts of Multiple Access Techniques and Wireless Networks
CO4:	Characterize a wireless channel and evolve the system design specifications
CO5:	Design a cellular system based on resource availability and traffic demands.
TEXTBOOKS	
1.	Rappaport,T.S.,-Wireless communications", Pearson Education, Second Edition, 2010
REFERENCES	
1.	Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2.	Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications, Artech House, 2000
3.	David Tse and PramodViswanath, ―Fundamentals of Wireless Communication, Cambridge University Press, 2005
4.	Upena Dalal, ―Wireless Communication", Oxford University Press, 2009
5.	Andreas.F. Molisch, ―Wireless Communications", John Wiley – India, 2006.
6.	Wireless Communication and Networks –William Stallings ,Pearson Education, Second Edition 2002

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	1							1	3	3
CO2	3	2	1	2	1							1	3	3
CO3	3	2	1	2	1							1	3	3
CO4	3	2	1	2	1							1	3	3
CO5	3	2	1	2	1							1	3	3

1-low,2-medium,3-high

BEC303	TRANSMISSION LINES AND RF SYSTEMS	L	T	P	C	TOTALMARKS
		3	0	0	3	100

PREREQUISITES: Electromagnetic Field Theory

COURSEOBJECTIVES

The main objectives of this course are :

1.	To introduce various types of transmission lines and their characteristics.
2.	To give thorough understanding about high frequency line, power and impedance measurements
3.	To impart technical knowledge in impedance matching using smith chart
4.	To introduce passive filters and basic knowledge of active RF components
5.	To teach the design of RF system transceiver design

UNIT 1: TRANSMISSION LINE THEORY **9**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z_0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT 2: HIGH FREQUENCY TRANSMISSION LINES **9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT 3: IMPEDANCE MATCHING IN HIGH FREQUENCY LINES **9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT 4: WAVEGUIDES **9**

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides

UNIT 5: RF SYSTEM DESIGN CONCEPTS **9**

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

45 PERIODS

COURSEOUTCOMES

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

CO1	Explain the characteristics of transmission lines and its losses
CO2	Derive the standing wave ratio and input impedance in high frequency transmission lines
CO3	Analyze impedance matching by stubs using smith charts
CO4	Analyze the characteristics of TE and TM waves in different types of waveguides
CO5	Explain the design concepts of a RF transceiver system used for wireless communication

TEXTBOOKS/ REFERENCES

1.	John D Ryder, ―Networks, lines and fields‖, 2nd Edition, Prentice Hall India, 2015. (UNIT I-IV)
2.	Mathew M. Radmanesh, ―Radio Frequency &Microwave Electronics‖, Pearson Education Asia, Second Edition,2002. (UNIT V)
3.	Reinhold Ludwig and Powel Bretchko,‖ RF Circuit Design – Theory and Applications‖, Pearson Education Asia, First Edition,2001
4.	D. K. Misra, ―Radio Frequency and Microwave Communication Circuits- Analysis and Design‖, John Wiley & Sons, 2004.

5.	E.C.Jordan and K.G. Balmain, ―Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
6.	G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education, First edition 2005.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**3**	**2**	**1**									**1**	**3**	**3**
CO2	**3**	**2**	**1**									**1**	**3**	**3**
CO3	**3**	**2**	**1**									**1**	**3**	**3**
CO4	**3**	**2**	**1**									**1**	**3**	**3**
CO5	**3**	**2**	**1**									**1**	**3**	**3**

1-low,2-medium,3-high

BEC304	OPTICAL COMMUNICATION & NETWORKS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES

COURSE OBJECTIVES

The main objectives of this course are to:

1	To introduce the types of Optical Fiber Modes, Configuration of Optical Fibers
2	To provide an understanding of the Transmission Characteristics of Optical Fibers.
3	To teach about the various Optical Sources, Detectors and Transmission Techniques.
4	To explore different types of Optical Fiber Measurements and Coupling Techniques.
5	To teach about Optical Communication Systems and Networks.

UNIT 1: INTRODUCTION TO OPTICAL FIBER COMMUNICATION **9**

Introduction - The General Systems - Advantages of Optical Fiber Communication- Ray Theory Transmission : Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays - Electromagnetic Mode Theory for Optical Propagation: Modes in a Planar Guide, Phase and group velocity - Cylindrical Fiber: Step index fibers, Graded index fibers - Single mode fibers: Cutoff wavelength.

UNIT 2: TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS **9**

Attenuation - Material absorption losses in silica glass fibers: Intrinsic absorption, Extrinsic absorption - Linear scattering losses: Rayleigh Scattering, Mie Scattering -Nonlinear scattering losses: Stimulated Brillouin Scattering, Stimulated Raman Scattering – Fiber Bend Loss – Dispersion- Chromatic dispersion: Material dispersion, Waveguide dispersion- Intermodal dispersion : Multimode step index fiber, Multimode graded index fiber.

UNIT 3: OPTICAL SOURCES AND OPTICAL DETECTORS **9**

The laser: Introduction - Basic concepts: Absorption and emission of radiation, Population inversion , Optical feedback and laser oscillation, Threshold condition for laser oscillation- Optical emission from semiconductors: The PN junction, Spontaneous emission, Carrier recombination, Stimulated emission and lasing, Hetero junctions- LED: Introduction- Power and Efficiency - LED structures: Planar LED, Dome LED, Surface emitter LED, Edge emitter LED- LED Characteristics. Optical Detectors:Introduction ,Optical Detection Principles, Quantum Efficiency, Resposivity, P-N Photodiode ,P-I-N Photo Diode and Avalanche Photodiode.

UNIT 4: OPTICAL FIBER MEASUREMENTS **9**

Introduction- Total Fiber Attenuation Measurement, Fiber Dispersion Measurements in Time Domain and Frequency Domain, Fiber Cut off Wavelength Measurements, Numerical Aperture Measurements. Fiber Diameter Measurements,.Reflectance And Optical Return Loss, Field Measurements.

UNIT 5: OPTICAL NETWORKS **9**

Introduction- Optical Network Concepts: Optical Networking Terminology, Optical Network Node And Switching Elements, Wavelength Division Multiplexed Networks, Public Telecommunications Network Overview- Optical Network Transmission Modes, Layers And Protocols: Synchronous Networks, Asynchronous Transfer Mode, Open System Interconnection Reference Model, Optical Transport Network, Internet Protocol- Wavelength Routing Networks: Routing And Wavelength Assignment- Optical Switching Networks: Optical Circuit Switched Networks, Optical Packet Switched Networks, Multiprotocol Label Switching, Optical Burst Switching Networks- Optical Network Deployment : Long Haul Networks, Metropolitan area networks, Access networks, Local Area Networks- Optical Ethernet: Network protection, restoration and survivability.

45 PERIODS

COURSE OUTCOMES

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

CO1:	Explain the basic elements in optical Fibers, different Modes and Configurations.
CO2:	Explain the types of attenuation, scattering, dispersion losses in optical fibers.
CO3:	Describe the types of Optical Sources and Detectors and their use in optical Communication System.

CO4:	Discuss fiber optic attenuation, dispersion, wavelength measurement techniques.
CO5:	Explain Optical Communication Networks and their applications.
TEXT BOOKS	
1.	John M.Senior, "Optical Fiber Communication", Pearson Education, Fouth Edition.2010.

REFERENCES	
1.	Gred Keiser,"Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.
2.	Govind P. Agrawal, "Fiber-Optic Communication Systems", Third Edition, John Wiley & Sons, 2004.
3.	J.Gower, "Optical Communication System", Prentice Hall Of India, 2001
4.	Rajiv Ramaswami, "Optical Networks " , Second Edition, Elsevier , 2004.
5.	P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India)Private Limited, 2016

CO's-PO's & PSO's MAPPING

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1									1	3	2
CO2	3	2	1									1	3	2
CO3	3	2	1									1	3	2
CO4	3	2	1									1	3	2
CO5	3	2	1									1	3	2

1-low, 2 - medium, 3 - high

BEC307	VLSI LABOATORY	L	T	P	C	TOTALMARKS
		0	0	4	2	100

PREREQUISITES: Digital Electronics, Linear Integrated Circuits

COURSEOBJECTIVES

The main objectives of this course are to:

1.	To teach combinational and sequential circuit deisgn using Hardware Descriptive Language (Verilog)
2.	To familiarize implementation of logical modules on FPGAs.

PRACTICAL EXERCISES: **30 PERIODS**

1.	Realization of Logic Gates using behavioral modelling
2.	Synthesis of Half adder and Full adder
3.	Synthesis of Ripple Carry Adder
4.	Synthesis of multiplier
5.	Synthesis of MUX/ DEMUX and
6.	Synthesis of Encoder/Decoder
7.	Synthesis of Binary to Gray code counters
8.	Synthesis of Flip Flops
9.	Synthesis of Pseudo Random Binary Sequence
10.	Synthesis of of up-down counter
11.	Synthesis of Shift register
12.	Design of Sequence Detector
13.	Design and Implementation of adder circuit
14.	Design and Implementation of multiplier circuit
15.	Design and Implementation of ALU

COURSEOUTCOMES

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

CO1:	Write Verilog code for combinational circuits and sequential circuits and simulate it using Xilinx ISE
CO2:	Synthesize and Implement the designed digital circuits using Spartan FPGA kits.

CO's-PO's&PSO'sMAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	3	1	1	1	1	1	1	1	1	3	3
CO2	3	2	1	3	1	1	1	1	1	1	1	1	3	3

1-low,2-medium,3-high

BEN321	LEADERSHIP SKILLS AND PERSONALITY DEVELOPMENT	L	T	P	C	TOTALMARKS
		0	0	2	1	100

PREREQUISITES:NIL

COURSEOBJECTIVES:

The main objectives of this course are to:

1	To help students in enhancing their self-awareness, interpersonal skills and overall personal grooming
2	To foster personal growth and development by focusing on self- awareness, communication skills, emotional intelligence and goal setting
3	To explore various aspects of personality enhancement and leadership qualities for improving their confidence, firmness and relationships with others

UNIT 1:	**PERSONALITY ENHANCEMENT**	**3**

Introduction- Definitions- Importance of Personality Enhancement
Types – (i) Extroverts and (ii) Introverts

UNIT 2:	**HEREDITARY FACTORS INFLUENCING PERSONALITY:**	**3**

Introduction- Physique and Physical Health- Endocrine System- Nervous System

UNIT 3:	**TIPS FOR ENHANCING PERSONALITY:**	**3**

Think Positive- Avoid Backbiting- Be Soft-spoken- Be Confident- Be Optimistic- Be an Attentive Listener- Improve Communication Skills- Be Loving and Congenial- Seek Feedback

UNIT 4:	**LEADERSHIP DEVELOPMENT**	**3**

Introduction- Definitions- Importance of Leadership Development- Evolution of Leadership in Indian Context

UNIT 5:	**Communication Skills for Leaders:** **Active Listening- Public Speaking and Presentation- Giving and Receiving Feedback- Non-verbal communication**	**3**

Qualities of a Good Leader , Leadership Styles ,Decision Making ,Intrapersonal skills , Interpersonal skills , Problem solving , Critical thinking , Negotiation skills.

15 PERIODS

COURSE OUTCOMES

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

CO1:	To comprehend the role of confidence and self-esteem in personal development
CO2:	To create a comprehensive action plan for personality enhancement and leadership development
CO3:	To cultivate personality and leadership qualities in Diverse and Inclusive Environments

TEXT BOOKS & REFERENCES

1.	D. P. Subharwal – Personality Development Handbook Rajiv Mishra – Personality Development: Transform Yourself
2.	Dr. ShaileshTondon& Dr. AsishKaushal – Personality Development & Grooming Del Carnegie – The Leader in You Andrew Bryant – Self Leadership
3.	Peter G. Northouse – Leadership: Theory and Practice Radcliffe – Leadership: Plain and Simple

BEC312	EMBEDDED SYSTEMS AND IOT DESIGN	L	T	P	C	TOTAL MARKS
		3	0	2	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES

The main objectives of this course are :

1.	To teach the architecture and features of 8051
2.	To introduce the design process of an embedded system
3.	To provide basic understanding on the real – time processing in an embedded system
4.	To teach the architecture and design flow of IoT
5.	To teach design of IoT based system for simple real time application.

UNIT 1: 8051 MICROCONTROLLER **9**

Microcontrollers for an Embedded System – 8051 – Architecture – Addressing Modes – Instruction Set – Program and Data Memory – Stacks – Interrupts – Timers/Counters – Serial Ports – Programming.

UNIT 2: EMBEDDED SYSTEMS **9**

Embedded System Design Process – Model Train Controller – ARM Processor – Instruction Set Preliminaries – CPU – Programming Input and Output – Supervisor Mode – Exceptions and Trap – Models for programs – Assembly, Linking and Loading – Compilation Techniques – Program Level Performance Analysis.

UNIT 3: PROCESSES AND OPERATING SYSTEMS **9**

Structure of a real – time system – Task Assignment and Scheduling – Multiple Tasks and Multiple Processes – Multirate Systems – Pre emptive real – time Operating systems – Priority based scheduling – Interprocess Communication Mechanisms – Distributed Embedded Systems – MPSoCs and Shared Memory Multiprocessors – Design Example – Audio Player, Engine Control Unit and Video Accelerator

UNIT 4: IOT ARCHITECTURE AND PROTOCOLS **9**

Internet – of – Things – Physical Design, Logical Design – IoT Enabling Technologies – Domain Specific IoTs – IoT and M2M – IoT System Management with NETCONF – YANG – IoT Platform Design – Methodology – IoT Reference Model – Domain Model – Communication Model – IoT Reference Architecture – IoT Protocols - MQTT, XMPP, Modbus, CANBUS and BACNet.

UNIT 5: IOT SYSTEM DESIGN **9**

Basic building blocks of an IoT device – Raspberry Pi – Board – Linux on Raspberry Pi – Interfaces – Programming with Python – Case Studies: Home Automation, Smart Cities, Environment and Agriculture.

45 PERIODS

PRACTICAL EXERCISES: **15 PERIODS**

Experiments using 8051:

1.	Programming Arithmetic and Logical Operations in 8051
2.	Generation of Square waveform using 8051.
3.	Design of a Digital Clock using Timers/Counters in 8051

Experiments using ARM

4.	Interfacing ADC and DAC
5.	Blinking of LEDs and LCD
6.	Interfacing keyboard and Stepper Motor

Miniprojects for IoT

7.	Garbage Segregator and Bin Level Indicator
8.	Colour based Product Sorting
9.	Image Processing based Fire Detection/ Vehicle Number Plate Detection
10.	Smart Lock System

COURSE OUTCOMES

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

CO1:	Explain the architecture and features of 8051 microcontroller
CO2:	Describe embedded system design process.
CO3:	Explain different types of operating systems used in embedded systems and Distributed Embedded Systems
CO4:	Explain the architecture and protocols of IoT.
CO5:	Design an IoT based system for simple real time application.
TEXT BOOKS/ REFERENCES	
1.	S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. Availability: https://www.amazon.in/Introduction-IoT-Sudip Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr= 8-1.
2.	S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. Availability:https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+mis r a&qid=1627 359971&sr=8-3
3.	Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017
4.	Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016
5.	Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016

CO-PO Mapping

1 - low, 2 - medium, 3 - high

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	1	1	1	1	1	1	3	3
CO2	3	2	2	2	2	1	1	1	1	1	1	3	3
CO3	3	2	2	2	2	1	1	1	1	1	1	3	3
CO4	3	2	2	2	2	1	1	1	1	1	1	3	3
CO5	3	2	2	2	2	1	1	1	1	1	1	3	3

BEC313	ANTENNA DESIGN	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES: NIL

COURSEOBJECTIVES

The main objectives of this course are :

1.	To emphasize antenna array concepts and beamforming techniques
2.	To provide foundational knowledge of random processes and their classification
3.	To familiarize students with various AoA estimation algorithms and methods
4.	To enable analysis and design of fixed beamforming architecture
5.	To introduce the fundamentals of smart antennas and the motivation for adaptive beamforming

UNIT 1:	**ANTENNA ARRAY FUNDAMENTALS**	**9**

Linear arrays: Two element and Uniform N element array – Array weighting: Beam steered and weighted arrays – Circular arrays – Rectangular planar arrays – Fixed beam arrays – Butler Matrices – Fixed sidelobe cancelling – Retrodirective arrays: Passive and active retrodirective arrays.

UNIT 2:	**PRINCIPLES OF RANDOM VARIABLES AND PROCESSES**	**9**

Definition of Random Variables – Probability Density Functions – Expectation and Moment -Common Probability Density Functions – Stationarity and Ergodicity – Autocorrelation and Power Spectral Density – Correlation Matrix

UNIT 3:	**ANGLE OF ARRIVAL ESTIMATION**	**9**

Fundamentals of Matrix Algebra: Vector basics – Matrix basics – Array Correlation Matrix – AOA Estimation Methods: Bartlett AOA estimate, Capon AOA estimate, Linear prediction AOA estimate, Maximum entropy AOA estimate, Pisarenko harmonic decomposition AOA estimate, Min-norm AOA estimate, MUSIC AOA estimate, Root-MUSIC AOA estimate, ESPRIT AOA estimate

UNIT 4:	**SMART ANTENNAS: FIXED WEIGHT BEAMFORMING**	**9**

Introduction – Historical Development of Smart Antennas – Fixed Weight Beamforming Basics: Maximum signal-to-interference ratio, Minimum mean-square error, Maximum likelihood, Minimum variance.

UNIT 5:	**SMART ANTENNAS: ADAPTIVE BEAMFORMING**	**9**

Adaptive Beamforming: Least mean squares, Sample matrix inversion, Recursive least squares, Constant modulus, Least squares constant modulus, Conjugate gradient method, Spreading sequence array weights, Description of the new SDMA receiver.

45 PERIODS

COURSEOUTCOMES

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

CO1:	Describe the basics of phased array antennas
CO2:	Use random process and its application in Smart antennas
CO3:	Estimate the weights of the antenna array based on the angle of arrival
CO4:	Analyze the fixed weight beam forming in smart antennas
CO5:	Analyze adaptive beamforming in smart antennas

TEXTBOOKS/ REFERENCES

1.	Frank Gross, Smart antennas for wireless communications, McGra-Hill, 2006.
2.	S. Chandran, Adaptive antenna arrays, trends and applications, Springer, 2009.
3.	T. S. Rappaport, Smart antennas: Adaptive arrays, algorithms and wireless position location, IEEE Press, 1998.
4.	Robert A.Monzingo, Randy L. Haupt and Thomas W.Miller, Introduction to Adaptive arrays, 2nd Edition, IET, 2011.
5.	Thomas Kaiser, Smart Antennas: State of the Art, Hindawi, 2005

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1			1	1				1	3	3
CO2	3	2	1			1	1				1	3	3
CO3	3	2	1			1	1				1	3	3
CO4	3	2	1			1	1				1	3	3
CO5	3	2	1			1	1				1	3	3

1 - low, 2 - medium, 3 - high

BEC314	MICROWAVE ENGINEERING	L	T	P	C	TOTALMARKS
		3	0	0	3	100

PREREQUISITES:

COURSEOBJECTIVES

The main objectives of this course are to:

1	To introduce the fundamentals of two-port RF and microwave network representations using low- and high-frequency parameters.
2	To explain the principles of microwave transistor amplifiers including gain, stability, noise, and matching concepts.
3	To describe the operation and applications of passive and active microwave components and circuits.
4	To explain the principles of microwave generation using vacuum tube and solid-state devices.
5	To familiarize students with microwave measurement instruments and techniques for RF parameter evaluation.

UNIT 1:	TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION	9

Low frequency parameters- impedance , admittance, hybrid and ABCD. High frequency parameters- Formulation of S parameters, properties of S parameters ,Reciprocal and lossless networks, transmission matrix, Introduction to component basics, wire, resistor, capacitor and inductor , application of RF.

UNIT 2:	MICROWAVE TRANSISTOR AMPLIFIER DESIGN AND MATCHING NETWORKS	9

Amplifier power relation, stability considerations, gain considerations, noise figure, impedance matching networks, frequency response, T and Π matching networks, microstripline matching networks

UNIT 3:	PASSIVE AND ACTIVE MICROWAVE DEVICES AND CIRCUITS	9

Open, short and matched terminations; coupling probes and loops; power divider; directional coupler; attenuators; phase shifter; circulator; isolator; Impedance matching Devices– Tuning screw, stub and quarter-wave transformers. Crystal diodes and Schottky diode detector and mixers; PIN diode switch, Gunn diode oscillator; IMPATT diode oscillator and amplifier; varactor diode; Introduction to MIC.

UNIT 4:	MICROWAVE GENERATION	9

High frequency effects in Tubes, Two cavity klystron amplifier; Reflex klystron oscillator; TWT amplifier, Backwards wave oscillator; Magnetron oscillator – Theory and applications.

UNIT 5:	MICROWAVE MEASUREMENTS	9

Measuring Instruments – VSWR meter, Power meter, Spectrum Analyser, Network Analyser – principles; Measurement of Impedance, frequency, power, VSWR, Q factor, dielectric constant, S-Parameter.

45 PERIODS

PRACTICAL EXERCISES:

1. Study of microwave components.
2. Determination of the characteristics of a Reflex Klystron.
3. Measurement of V–I characteristics of a Gunn diode.
4. Measurement of microwave frequency and impedance.
5. Determination of wavelength in a microwave system.
6. Measurement of directional coupler characteristics
7. Determination of isolator characteristics.
8. Measurement of attenuation and microwave power.
9. Determination of circulator characteristics.
10. Measurement of VSWR in microwave systems.

COURSEOUTCOMES

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

CO1:	Select suitable microwave components for high frequency applications.

CO2:	Analyze the performance characteristics of various microwave sources and solid state devices
CO3:	Measure S parameters of microwave components
CO4:	Analyze the operation and performance characteristics of microwave tubes and solid-state microwave devices.
CO5:	Evaluate microwave measurement techniques and design microwave links based on measured parameters.

TEXT BOOKS:

1. Robert E.Colin, ―Foundations for Microwave Engineering‖, 2 edition, McGraw Hill, 2001.
2. Reinhold.Ludwig and Pavel Bretshko _RF Circuit Design‖, Pearson Education, Inc., 2006.
3. Guillermo Gonzalez,‖Microwave transistor amplifier design ―Second edition.Prentice hall,1997.
4. Annapurna Das and Sisir K Das, ―Microwave Engineering‖, Tata Mc Graw Hill Inc., 2004.

REFERENCE BOOKS

1. Thomas H.Lee, ―Planar Microwave Engineering‖, Cambridge University Press,2004
2. M.M.Radmanesh,―RF and Microwave Electronics‖, Pearson Education, Inc., first edition 2005
4. D.M.Pozar, ―Microwave Engineering.‖, John Wiley & sons, Inc., 2006

CO's-PO's&PSO'sMAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1			1	1				1	3	2
CO2	3	2	1			1	1				1	3	2
CO3	3	2	1			1	1				1	3	2
CO4	3	2	1			1	1				1	3	2
CO5	3	2	1			1	1				1	3	2

1-low,2-medium,3–high

BEC347	INDUSTRY 5.0 FOR ELECTRONICS ENGINEERS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES:

COURSE OBJECTIVES

The main objectives of this course are to:

1	Provide a thorough understanding of Industry 5.0, its evolution from previous industrial revolutions, and its relevance to the electronics sector.
2	Emphasize the integration of human intelligence with smart machines, highlighting human-machine collaboration.
3	Present key enablers such as AI, robotics, IoT, cyber-physical systems, edge computing, 6G, and quantum electronics.
4	Incorporate topics like green electronics, circular economy, and ethical AI into electronics engineering design.
5	Equip students with practical skills through simulations, case studies, and prototyping relevant to Industry 5.0 applications.

UNIT 1: INDUSTRY 4.0 — **9**

Introduction to Industry 4.0, Industry 4.0: The Fourth Industrial Revolution, History of Industry 4.0, Industry 4.0 by definition, Component of Industry 4.0, The opportunities in Industry 4.0, Industrial Internet, Smart Factory, Smart Buildings, Smart Manufacturing, Smart Farming.

UNIT 2: INDUSTRY 5.0 — **9**

Evolution from Industry 1.0 to 5.0, Introduction to Industry 5.0, Globalization and Emerging Issues, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories, Healthcare and Human computer interactions, Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Big Data and Advanced Analysis.

UNIT 3: DIGITAL TRANSFORMATION — **9**

Digital Transformation, Introduction to Digital Transformation, Digital business transformation, Causes of disruption and transformation, Digital transformation myths and realities, Digital transformation across various industries, Retail industry, Urban Development, e-Governance and the public sector, Insurance industry, Healthcare, Food, Manufacturing, Disaster Control, Elements of Society 5.0, Data Driven to Society, Humanity Vs Society 5.0

UNIT 4: SMART WORLD — **9**

Introduction: Sensing & actuation, Communication, Electronics in Smart city, 5G Technology, Communication protocols, Integration of Sensors in Robots and Artificial Intelligence, Human-Machine Interaction, Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management., Intellectual Property Rights- Case Studies - Milk Processing and Packaging Industries.

UNIT 5: CYBER SECURITY IN INDUSTRY 5.0 — **9**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Intellectual Property Rights (IPR): Case Studies- Augmented Reality Virtual Reality

45 PERIODS

COURSE OUTCOMES

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

CO1:	Explain the principles and roadmap of Industry 5.0 and its difference from Industry 4.0.
CO2:	Analyze the role of electronics in enabling technologies such as smart sensors, edge AI, and robotics in Industry 5.0.
CO3:	Design and simulate electronic circuits and systems that support collaborative robotics and intelligent automation.
CO4:	Evaluate ethical, environmental, and sustainability aspects in the design of electronic products for Industry 5.0.

CO5:	Develop prototype solutions or case studies demonstrating human-centric, resilient, and sustainable electronics systems.
TEXT BOOKS	
1.	Ahmet Bindal,"Electronics for Embedded Systems: Foundations, Applications, and Advances", Springer
2.	Benny Mandler, Industry 5.0: A Human-Centric Solution, Springer, 2023
REFERENCES	
1.	Krzysztof Iniewski, Smart Sensors and Systems for Industrial Applications, CRC Press
2.	Houbing Song, Danda B. Rawat, Sabina Jeschke, Christian Brecher, Cyber-Physical Systems: Foundations, Principles and Applications, Elsevier
3.	Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, Industrial Internet of Things: Cyber manufacturing Systems, Springer

CO's-PO's & PSO's MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO2
CO1:	3	2	2	2	1	3	1	1	1	1	2	3	3	3
CO2:	3	3	2	2	1	1	1	1	1	1	1	2	3	3
CO3:	2	3	3	2	1	2	1	1	1	1	3	2	3	2
CO4:	3	3	2	2	3	2	1	1	1	1	2	1	3	3
CO5:	1	2	3	3	2	1	1	1	1	1	2	1	3	2

1 - low, 2 - medium, 3 - high

BEC355	REAL TIME OPERATING SYSTEM	L	T	P	C	TOTAL MARKS
		2	0	2	3	100

PREREQUISITES: Microprocessor/Microcontroller

COURSE OBJECTIVES

The main objectives of this course are to:

1	To Understand the architecture and core concepts of the QNX RTOS.
2	To Learn to develop and debug applications using the QNX Momentics IDE.
3	To Gain knowledge of process and thread management, including synchronization techniques.
4	To Explore inter-process communication (IPC) methods and their applications in QNX.
5	To Understand hardware programming concepts, including interrupt handling and memory access & Learn to build and configure QNX boot/OS images for embedded systems.

UNIT 1:	INTRODUCTION TO QNX OS ARCHITECTURE	6

Overview of QNX OS architecture: microkernel, process manager, and standards - Protected address spaces- process/thread model-scheduling, Introduction to inter-process communication (IPC) and synchronization - Resource managers and shared objects.

UNIT 2:	PROCESSES, THREADS, AND SYNCHRONIZATION	6

Process management: creation, termination, and memory protection -Thread management: creation, termination, and synchronization - Synchronization techniques: mutexes, semaphores, and condition variables - Hands-on exercises: process/thread creation and synchronization.

UNIT 3:	INTER-PROCESS COMMUNICATION (IPC)	6

Overview of IPC methods in QNX: message passing, pulses, and shared memory - Comparing IPC methods: advantages and disadvantages - Practical implementation of IPC in QNX - Hands- on exercises: message passing and shared memory.

UNIT 4:	HARDWARE PROGRAMMING AND TIMING	6

Hardware access methods: IO-mapped and memory-mapped IO ,Interrupt handling and DMA-safe memory allocation -Timing architecture: periodic timing, one-shot timing, and timeouts - Hands-on exercises: interrupt handling and timing mechanisms

UNIT 5:	BUILDING AND CONFIGURING QNX BOOT/OS IMAGES	6

Overview of QNX boot/OS image structure - Components of a boot image: startup code, kernel, drivers, and scripts - Building and loading boot images onto target hardware - Introduction to resource managers and their implementation.

30 PERIODS

COURSE OUTCOMES

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

CO1:	Describe the QNX OS architecture and its microkernel-based design.
CO2:	Develop and debug QNX-based applications using appropriate tools.
CO3:	Apply process/thread management and synchronization techniques in QNX.
CO4:	Implement inter-process communication methods for real-time systems.
CO5:	Configure and build QNX boot/OS images for specific hardware platforms & Develop strong knowledge on the POSIX standards that help in System Application Development

PRACTICAL EXPERIMENTS **Total Lab Contact Hours: 30**

1.	QNX configuration and application development using QNX Momentics IDE.
2.	Process and thread creation, management, and synchronization.
3.	Concurrent Array Update Using POSIX Threads and Mutex Locks.
4.	Thread-Safe Bounded Buffer Implementation Using POSIX Threads
5.	Implementation of IPC methods: passing message and shared memory.

6.	Message-Driven Client–Server Communication in QNX RTOS
7.	Pulse Handling and Asynchronous Communication in QNX RTOS
8.	Interrupt handling and hardware access programming.
9.	Building and deploying QNX boot/OS images.
10.	Mini capstone project: Design and implement a QNX-based embedded system.

TEXT BOOK:

1. Programming for Embedded Systems, Michael Barr, O'Reilly Media.
2. Hands-on RTOS with Microcontrollers, Brian Amos, Packt Publishing, 2020.
3. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 9th Edition, Wiley, 2018.

REFERENCE:

1.QNX Neutrino RTOS User's Guide, QNX Software Systems.

2.Online Resource

a. QNX online training
b. QNX training material
c. QNX Documentation for SDP 8.0
d. QNXEverywhere page - https://blackberry.qnx.com/en/products/qnx-everywhere
e. QNX Gitlab page - https://gitlab.com/qnx
f. **QNX Developer Community:** Access to forums and communities where they can
g. ask questions and interact with other QNX developers.
h. QNX on Reddit: https://www.reddit.com/r/QNX/
i. QNX on StackOverflow: https://stackoverflow.com/questions/tagged/qnx
j. QNX on YouTube: https://www.youtube.com/qnxcam
Collection of open-source projects (incl Links) for QNX: https://gitlab.com/qnx/projects
k. Ported libraries that work on QNX: https://github.com/qnx-ports

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	3	2	2	2	2				0	1	1	1	3	3
CO2:	3	2	2	2	2				1	1	1	1	3	3
CO3:	3	2	2	2	2				1	1	1	1	3	3
CO4:	3	2	2	2	2				0	1	1	1	3	3
CO5:	3	2	2	2	2				0	1	1	1	3	3

1 - low, 2 - medium, 3 - high

BEC401	MULTI-CORE ARCHITECTURE AND PROGRAMMING	L	T	P	C	TOTAL MARKS
		3	0	0	3	100

PREREQUISITES:

COURSE OBJECTIVES

The main objectives of this course are to:

1	To provide fundamental knowledge on the need for multi-core processors, and their architecture.
2	To teach the challenges in parallel and multithreaded programming.
3	To introduce various parallel programming paradigms.
4	To develop multicore programs and design parallel solutions.

UNIT 1: MULTI-CORE PROCESSORS — **9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

UNIT 2: PARALLEL PROGRAM CHALLENGES — **9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes)

UNIT 3: SHARED MEMORY PROGRAMMING WITH OpenMP — **9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations

UNIT 4: DISTRIBUTED MEMORY PROGRAMMING WITH MPI — **9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

UNIT 5: PARALLEL PROGRAM DEVELOPMENT — **9**

Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

45 PERIODS

COURSE OUTCOMES

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

CO1:	Describe multicore architectures and identify their characteristics and challenges.
CO2:	Identify the issues in programming Parallel Processors.
CO3:	Write programs using OpenMP and MPI.
CO4:	Design parallel programming solutions to common problems.
CO5:	Compare programming for serial processors and programming for parallel professors

TEXT BOOKS

1.	Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021.
2.	Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003

REFERENCES

1.	Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris,
2.	Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3.	Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015

CO's-PO's & PSO's MAPPING

CO / PO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO1 0	PO1 1	PSO1	PSO2
CO1	3	1	1									1	3	2
CO2	3	1	1									1	3	2
CO3	3	1	1									1	3	2
CO4	3	1	1									1	3	2
CO5	3	1	1									1	3	2

1 - low, 2 - medium, 3 - high