

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

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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	Extern Al
			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 and abroad.
- 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.

$$\text{GPA} = \frac{\sum_{i=1}^N C_i \text{GP}_i}{\sum_{i=1}^N C_i} \qquad \text{CGPA} = \frac{\sum_{i=1}^N C_i \text{GP}_i}{\sum_{i=1}^N C_i}$$

Where

C_i – Credits for the course

G_{P_i} – Grade Point for the course

\sum – 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
$\geq 6.00 < 7.50$	First Class
$\geq 5.00 < 6.0$	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 STUDENT 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.

Director Academic

Registrar

St.Peter's Institute of Higher Education and Research
Department of Electronics and Communication Engineering
Curriculum 2023

Semester I										
S.n o	Course Code	Course type	Category	Course Name	Category	L	T	P	E L	C
1	BMA121	Theory	BSC	Algebra and Calculus	BSC	3	2	0	0	4
2	BPH121	Theory + Lab	BSC	Engineering Physics	BSC	3	0	2	0	4
3	BCY121	Theory+Lab	BSC	Engineering Chemistry	BSC	3	0	2	0	4
4	BEN121	Theory+Lab	HSC	English for Engineers	HSC	3	0	2	0	4
5	BME121	Theory	ESC	Engineering Graphics	ESC	2	2	0	0	3
6	BCS121	Theory	ESC	Fundamentals of Computing and Python Programming	ESC	3	0	0	0	3
7	BCS107	Practical	ESC	Python Programming Laboratory	ESC	0	0	4	0	2
Total Credits						17	4	10	0	24
Semester 2										
S.n o	Course Code	Course type	Category	Course Name	Category	L	T	P	E L	C
1	BMA131	Theory	BSC	Partial Differential Equations and Transforms	BSC	3	2	0	0	4
2	BEE131	Theory	ESC	Basic Electrical and Instrumentation Engineering	ESC	3	0	0	0	3
3	BBO131	Theory	BSC	Environmental Science	BSC	2	0	0	0	2
4	BEC111	Theory+Lab	PCC	Electronics Devices	PCC	3	0	2	0	4
5	BBM111	Theory+Lab	PCC	Bioscience	PCC	3	0	2	0	4
6	BCS131	Theory+Lab	ESC	C Programming and Data Structures	ESC	2	0	2	0	3
7	BME117	Practical	ESC	Engineering Practices	ESC	0	0	4	0	2
8	BEO131	Theory	MAC	Mandatory Audit Course-1	MAC	1	0	0	3	0
9		Theory	VAC	Value added Course-1	VAC	0	0	0	0	0

Total Credits						17	2	10	3	22
Semester 3										
S.no	Course Code	Course type	Category	Course Name	Category	L	T	P	EL	C
1		Theory + Project	HSC	Humanities Elective I	HSC	2	0	0	3	3
2		Theory	BSC	Mathematics Elective	BSC	3	2	0	0	4
3	BBM201	Theory	PCC	Medical Physics	PCC	3	0	0	0	3
4	BBM202	Theory+Lab	PCC	Anatomy and Human Physiology	PCC	3	0	2	0	4
5	BEC203	Theory	PCC	Signals and Systems	PCC	3	0	0	0	3
6	BBM203	Theory	PCC	Analog and Digital Integrated Circuits	PCC	3	0	0	0	3
7	BEN221	Skill	EEC	Essential skills and Aptitude for Engineers	EEC	0	0	0	3	1
8	BBM207	Practical	PCC	Analog and Digital Integrated Circuits Laboratory	PCC	0	0	4	0	2
Total Credits						17	2	6	6	23
Semester 4										
S.no	Course Code	Course type	Category	Course Name	Category	L	T	P	EL	C
1	BBM211	Theory	PCC	Biocontrol System	PCC	3	1	0	0	4
2	BBM212	Theory	PCC	Biomaterials and Artificial Organs	PCC	3	0	0	0	3
3	BEC213	Theory+Lab	PCC	Digital Signal Processing	PCC	3	1	2	0	4
4	BBM213	Theory	PCC	Biomedical Instrumentation	PCC	3	0	0	0	3
5	BBM214	Theory	PCC	Biosensors and Transducers	PCC	3	0	0	0	3
6	BBM217	Practical	PCC	Biomedical Instrumentation Laboratory	PCC	0	0	4	0	2
7	BBM218	Practical	PCC	Biosensors and Transducers Laboratory	PCC	0	0	4	0	2
8	BEN231	Skill	EEC	Communication skills for career success	EEC	0	0	0	3	1
9	BEO231	Theory	MAC	Mandatory Audit Course-1	MAC	1	0	0	3	0
10		Theory	VAC	Value added Course-2	VAC	0	0	0	0	0
Total Credits						16	2	10	6	22

Summer Internships (6-8 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 next semester (semester V).

Semester 5										
S.no	Course Code	Course type	Category	Course Name	Category	L	T	P	EL	C
1	BBM301	Theory + Project	PCC	Microcontroller Architecture and Programming	PCC	2	0	2	3	4
2	BBM302	Theory	PCC	Diagnostic and Therapeutic Equipment - I	PCC	3	0	0	0	3
3	BBM303	Theory	PCC	Radiological Equipment	PCC	3	0	0	0	3
4		Theory	PEC	Professional Elective 1	PEC	3	0	0	0	3
5		Theory	PEC	Professional Elective 2	PEC	3	0	0	0	3
6		Theory	OEC	Open Elective 1	OEC	3	0	0	0	3
7	BBM309	Skill	EEC	Internship	EEC	0	0	0	3	1
8	BBM310	Project	EEC	Design Thinking and Innovations	EEC	0	0	4	1	2
9	BEN321	Skill	EEC	Leadership skills and Personality Development	EEC	0	0	0	3	1
Total Credits						17	0	6	10	23
Semester 6										
S.no	Course Code	Course type	Category	Course Name	Category	L	T	P	EL	C
1	BBM311	Theory + Project	PCC	Embedded Systems and IoT Design	PCC	2	0	2	3	4
2	BBM312	Theory	PCC	Diagnostic and Therapeutic Equipment - II	PCC	3	0	0	0	3
3	BBM313	Theory	PCC	Artificial Intelligence in Biomedical Engineering	PCC	3	0	0	0	3
4		Theory	PEC	Professional Elective 3	PEC	3	0	0	0	3
5		Theory	PEC	Professional Elective 4	PEC	3	0	0	0	3
7		Theory	OEC	Open Elective 2	OEC	3	0	0	0	3
8	BBM217	Practical	PCC	Diagnostic and Therapeutic Equipment Laboratory	PCC	0	0	4	0	2
Total Credits						16	0	4	3	18

Summer Internships (6-8 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	Category	L	T	P	EL	C
1	BBM401	Theory+Lab	PCC	Medical Image Processing	PCC	3	0	2	0	4
3		Theory	PEC	Professional Elective 5	PEC	3	0	0	0	3
3		Theory	PEC	Professional Elective 6	PEC	3	0	0	0	3
4		Theory	HSC	Humanities Elective -II	HSC	2	0	0	0	2
5		Theory	OEC	Open Elective 3	OEC	3	0	0	0	3
6	BBM409	Skill	EEC	Internship	EEC	0	0	0	3	1
7	BBM410	Project	EEC	Project Work (Phase-I)	EEC	0	0	6	0	3
8		Theory	VAC	Value Added Course-4	VAC	1	0	0	3	0
9	BMCX01	Skill		NCC/YRC/NSS/Rotary Club		0	0	0	3	1
Total Credits						15	0	8	9	20
Semester 8										
S.no	Course Code	Course type	Category	Course Name	Category	L	T	P	EL	C
1	BBM420	Project	EEC	Project Work (Phase-II)	EEC	0	0	14	0	7
2		Theory	OEC	Mooc courses*	OEC	3	0	0	0	3
Total Credits						3	0	0	0	10
						Total credits				165

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, 10 th Edition, New Delhi, 2016.								
2.	Grewal. B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44 th Edition, 2018.								

3.	Bali.N.,Goyal.M.and Watkins.C., “Advanced Engineering Mathematics”, Firewall Media(An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi,7 th Edition, 2009.
4.	Jain.R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5 th 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	PSO3
CO1:	2	2	2	1	2	1	3	2	1	2	3	2	1	2	2
CO2:	2	2	2	2	2	3	3	2	3	2	2	2	2	2	2
CO3:	2	2	3	2	2	2	2	1	3	3	2	3	1	2	2
CO4:	3	2	2	2	2	3	3	2	2	3	2	2	3	3	3
CO5:	3	2	2	3	3	1	1	2	2	1	3	1	3	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 and Compressibility 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 properties of 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 joints and 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". Dhanpat Rai Publishers, 12.
3.	Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2012.
4.	Properties of Matter by Brij Lal and N. Subramaniam, S. Chand & Co., New Delhi (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	PSO3
CO1:	3	2	2	1	2	2	1	2	1	2	1	3	1	1	2
CO2:	3	2	2	1	2	2	1	2	1	2	1	3	3	3	2
CO3:	3	2	2	1	2	2	1	2	1	2	1	3	3	2	2
CO4:	3	2	2	1	2	2	1	2	1	2	1	3	1	1	2
CO5:	3	2	2	1	2	2	1	2	1	2	1	3	3	3	2
CO	3	2	2	1	2	2	1	2	1	2	1	3	2.2	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 and ultimate), 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. CO ₂ 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: H ₂ -O ₂ 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 and grammar 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 technical Contexts).						
UNIT 2:						9
Listening - Listening to podcast, anecdotes/stories/event narration; documentaries and Interviews. Speaking - Narrating personal experiences/events; Interviewing a celebrity; Reporting and summarizing 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 and Summarizing 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 chart etc.) 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 panel discussions. 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:	
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	PSO3
CO1:	3	2	3	1	2	1	1	1	1	2	2	2	2	2	2
CO2:	3	2	2	1	2	1	1	1	1	2	2	2	2	2	2
CO3:	3	2	2	1	2	1	1	1	1	2	2	2	2	2	2
CO4:	3	2	2	1	2	1	1	1	1	2	2	2	2	2	2
CO5:	3	2	2	1	2	1	1	1	1	2	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	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 of OS 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 Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4.	Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5.	John V Guttag, "Introduction to Computation and Programming Using Python", MIT Press, 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:	PARTIAL DIFFERENTIAL EQUATIONS					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:	FOURIER TRANSFORMS					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-TRANSFORMS AND LAPLACE 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, 44 th Edition, 2018.
3.	Bali .N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7 th Edition,. 2009

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PSO3
CO1:	3	3	3	2	2	2	3	2	2	3	3	2	2	2	3
CO2:	3	2	2	3	2	3	2	2	3	3	3	2	3	2	3
CO3:	1	2	3	2	3	2	3	2	3	2	2	3	2	2	1
CO4:	2	3	2	3	3	2	2	2	2	3	2	2	3	3	2
CO5:	3	2	1	2	3	2	2	2	2	1	3	1	3	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	PSO3
CO1:	3	2	3	1	1	1	2	1	1	1	2	1	2	2	2
CO2:	3	1	3	1	1	1	2	1	1	1	2	1	2	3	2
CO3:	3	2	3	1	1	1	2	1	1	1	2	1	3	2	3
CO4:	3	2	3	1	1	1	2	1	1	1	2	1	2	3	2
CO5:	3	2	3	1	1	1	2	1	1	1	2	1	3	2	3

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	PSO3
CO1:	2	1	3	1	2	2	2	1	1	1	1	1	3	2	2
CO2:	3	2	3	1	2	2	2	1	1	1	1	1	2	3	2
CO3:	2	2	3	1	2	1	2	1	1	1	1	1	3	2	3
CO4:	3	1	2	1	2	2	2	1	1	1	1	1	2	3	2
CO5:	3	2	3	1	1	1	2	1	1	1	1	1	3	2	3

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	2	3	3	1	2	1	1	1	3	1	1	2	3	2	3
CO2:	3	3	2	1	2	1	1	1	2	1	1	2	3	2	3
CO3:	3	3	3	1	2	1	1	1	2	1	1	2	3	2	3
CO4:	3	3	3	1	2	1	1	1	3	1	1	2	2	1	3
CO5:	3	3	3	2	3	1	1	1	3	1	1	2	3	1	2

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

1 - low, 2 - medium, 3 - high

BBM111		BIOSCIENCE		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 study structural and functional properties of carbohydrates, proteins, lipids and amino acids.							
2	To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules.							
3	Gain knowledge on the structural and functional aspects of living organisms.							
4	Know the etiology and remedy in treating the pathological diseases.							
UNIT 1:		FUNDAMENTALS TO BIOCHEMISTRY						9
Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane.								
UNIT 2:		CARBOHYDRATES, LIPIDS, PROTEINS						9
Classification of carbohydrates - Structure, physical and chemical properties of carbohydrates - Classification of lipids- simple, compound, and derived lipids. Structure and properties of proteins, classification and properties of amino acids. Nucleic acid: Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides, Double helical structure of DNA (Watson-Crick model), various forms of RNA.								
UNIT 3:		CELL DEGENERATION, REPAIR AND NEOPLASIA						9
Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.								
UNIT 4:		FLUID AND HEMODYNAMIC DERANGEMENTS						9
Edema, Hyperemia, Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders Bleeding disorders, Leukaemias, Lymphomas Haemorrhage.								
UNIT 5:		FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY						9
Structure of Bacteria and Virus - Morphological features and structural organization of bacteria and virus. Basics of Microscopes : Light microscope, Electron microscope (TEM & SEM). - Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury, Immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies.								
45 PERIODS								
PRACTICAL EXERCISES: 15 PERIODS								
1.	Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions.							
2.	Standardization of pH meter, preparation of buffers, emulsions.							
3.	General tests for carbohydrates, proteins and lipids.							
4.	Basic staining – Hematoxylin and eosin staining.							
5.	Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS .							
6.	Types of Staining : Simple stain, Gram stain.							

7.	Study of parts of compound microscope.
8.	Study of Histopathological slides of benign and malignant tumours.
9.	Study of Haematology slides of anemia and leukemia.
COURSE OUTCOMES	
At the end of this course, the students will be able to:	
CO1:	Explain the fundamentals of biochemistry.
CO2:	Analyze structural and functional aspects of living organisms.
CO3:	Explain the function of microscope.
CO4:	Interpret the fluid and hemodynamics in human body.
CO5:	Describe methods involved in treating the pathological diseases.
TOTAL:60 PERIODS	
TEXT BOOKS	
1.	RAFI MD “Text book of biochemistry for Medical Student” Fourth Edition, Universities Press, Orient Blackswan Private Limited - New Delhi 2021.
2.	Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, “Pathologic Basis of Diseases”, 10th edition: South Asia Edition Elsevier India, 2020. (Units III & IV)
3.	Ananthanarayanan & Panicker, “Microbiology” Orientblackswan, 2017 10th edition. (Units III,IV and V).
REFERENCES	
1.	Keith Wilson & John Walker, “Practical Biochemistry - Principles & Techniques”, Oxford University Press, 2009.
2.	. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
3.	Dubey RC and Maheswari DK. “A Text Book of Microbiology” Chand & Company Ltd, 2007
4.	Prescott, Harley and Klein, “Microbiology”, 10th edition, 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	PSO3
CO1:	2	3	3	1	2	1	1	1	3	1	1	2	3	2	3
CO2:	3	3	2	1	2	1	1	1	2	1	1	2	3	2	3
CO3:	3	3	3	1	2	1	1	1	2	1	1	2	3	2	3
CO4:	3	3	3	1	2	1	1	1	3	1	1	2	2	1	3
CO5:	3	3	3	2	3	1	1	1	3	1	1	2	3	1	2

1 - low, 2 - medium, 3 - high

CS131	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	PSO3
CO1:	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
CO2:	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
CO3:	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
CO4:	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
CO5:	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3

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.	<p style="text-align: center;"><u>GROUP A (CIVIL & MECHANICAL)</u></p> <p>I CIVIL ENGINEERING PRACTICE Buildings: (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.</p> <p>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.</p> <p>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.</p> <p>II MECHANICAL ENGINEERING PRACTICE Welding: (a) Preparation of arc welding of butt joints, lap joints and teejoints. (b) Gas welding practice</p> <p>Basic Machining: (a) Simple Turning and Taper turning (b) Drilling Practice</p> <p>Sheet Metal Work: (a) Forming & Bending: (b) Model making – Trays, funnels, etc. (c) Different type of joints.</p> <p>Machine assembly practice: (a) Study of centrifugal pump (b) Study of air conditioner</p> <p>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.</p>					

2.	<p style="text-align: center;"><u>GROUP B (ELECTRICAL & ELECTRONICS)</u></p> <p>III ELECTRICAL ENGINEERING PRACTICE</p> <ol style="list-style-type: none"> 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. <p>IV ELECTRONICS ENGINEERING PRACTICE</p> <ol style="list-style-type: none"> 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	PSO3
CO1:	2	1	1	1	3	2	2	2	3	1	1	2	2	2	2
CO2:	2	1	1	1	3	2	2	2	3	1	1	2	2	2	2
CO3:	2	1	1	1	3	2	2	2	3	1	1	2	2	2	2
CO4:	2	1	1	1	3	2	2	2	3	1	1	2	2	2	2
CO5:	2	1	1	1	3	2	2	2	3	1	1	2	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	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	PSO3
CO1:	2	3	3	1	2	1	1	1	2	1	1	2	3	2	3
CO2:	3	3	2	1	2	1	1	1	2	1	1	2	3	2	3
CO3:	3	3	3	1	2	1	1	1	2	1	1	2	3	2	3
CO4:	3	3	3	1	2	1	1	1	3	1	1	2	2	3	3
CO5:	3	3	3	2	3	1	1	1	3	1	1	2	3	3	2

1 - low, 2 - medium, 3 - high

III SEMESTER

BBM201	MEDICAL PHYSICS	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 provide understanding of the application of the radiation concepts and methods of Physics in Medical science.					
2	To accentuate the principle, effects and clinical applications of ionizing, non-ionizing and electromagnetic radiation.					
3	To enunciate the fundamentals of acoustic waves and their interaction with human tissues.					
4	To explore the effects of radiation in matter and how isotopes are produced.					
5	To study effects of sound and light in human body.					
UNIT 1:	LOW ENERGY ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION					9
Physics of light, Intensity of light, limits of vision and color vision an overview, Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Tissue as a leaky dielectric-Low Frequency Effects- Higher frequency effects.Thermography– Application.						
UNIT 2:	PRINCIPLES OF RADIOACTIVE NUCLIDES					9
Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radionuclide-fission and neutron capture reaction, radionuclide Generator-Technetium generator.						
UNIT 3:	INTERACTION OF RADIATION WITH MATTER LIPIDS					9
Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.						
UNIT 4:	RADIATION DOSE AND ITS EFFECTS					9
Dose and Exposure measurements – Units (SI), Inverse square law, Maximum permissible exposure, relationship between the dosimetric quantities, Radiation biology – effects of radiation, concept of LD 50, Stochastic and Non-stochastic effects, Radiation Syndrome.						
UNIT 5:	PRINCIPLES AND APPLICATIONS OF SOUND IN MEDICINE					9
Physics of sound, Normal sound levels, ultrasound fundamentals, Generation of ultrasound (Ultrasound Transducer), Interaction of Ultrasound with matter- Cavitations, Reflection, Transmission, Scanning methods, Artifacts, Ultrasound- Doppler effect, Clinical Applications.						
45 PERIODS						
COURSE OUTCOMES:						
Upon successful completion of the course, students will be able to:						
CO1:	Interpret the properties of electromagnetic radiations and its effect on human.					
CO2:	Apply the principles and understand the production of radioactive nuclides.					
CO3:	Explain the interaction of radiation with matter.					
CO4:	Identify and analyse the radiation quantities and its effects.					
CO5:	Demonstrate the knowledge on the properties of sound and its application in medicine.					

TEXT BOOKS	
1.	B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford, D.R. Hose, —Medical Physics and Biomedical Engineering, Institute of physics publishing, Bristol and Philadelphia, 1999.
2.	Gopal B. Saha —Physics and Radiobiology of Nuclear Medicine, Fourth edition Springer, 2006.
REFERENCES	
1.	W.J. Meredith and J.B. Massey “Fundamental Physics of Radiology” Varghese Publishing house, Third Edition, 2013.
2.	Steve Webb, The Physics of Medical Imaging, Taylor & Francis, Newyork, Second Edition, 2012.
3.	R.S. Khandpur, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, 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	PSO3
CO1:	3	1	1	-	3	-	-	-	-	-	-	-	-	-	1
CO2:	3	1	1	-	-	-	-	-	-	-	-	-	-	3	-
CO3:	3	2	-	-	2	-	-	-	-	-	-	-	2	-	-
CO4:	3	2	-	-	2	2	-	-	-	-	-	1	-	-	1
CO5:	3	2	1	3	3	2	-	-	-	-	-	1	-	2	1
CO	3	2													

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

BBM202	ANATOMY AND HUMAN PHYSIOLOGY	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 identify all the organelles of an animal cell and their function.					
2	To understand structure and functions of the various types of systems of human body.					
3	To demonstrate their knowledge of importance of anatomical features and physiology of human systems.					
UNIT 1:	CELL AND TISSUE STRUCTURE					9
Structure of Cell – structure and functions of sub organelles – Cell Membrane –Transport of Across Cell Membrane - Action Potential – Cell to Cell Signaling – Cell Division. Types of Specialized tissues – Functions.						
UNIT 2:	SKELETAL, MUSCULAR AND RESPIRATORY SYSTEMS					9
.Skeletal::Types of Bone and function – Physiology of Bone formation – Division of Skeleton – Types of joints and function – Types of cartilage and function. Muscular: Parts of Muscle – Movements. Respiratory: Parts of Respiratory Systems – Types of respiration - Mechanisms of Breathing – Regulation of Respiration.						
UNIT 3:	CARDIOVASCULAR AND LYMPHATIC SYSTEMS					9
Cardiovascular: Components of Blood and functions.- Blood Groups and importance – Structure of Heart – Conducting System of Heart – Properties of Cardiac Muscle - Cardiac Cycle - Heart Beat – Types of Blood vessel – Regulation of Heart rate and Blood pressure. Lymphatic: Parts and Functions of Lymphatic systems – Types of Lymphatic organs and vessels.						
UNIT 4:	NERVOUS AND ENDOCRINE SYSTEMS AND SENSE ORGANS					9
Nervous: Cells of Nervous systems – Types of Neuron and Synapses – Mechanisms of Nerve impulse – Brain : Parts of Brain – Spinal Cord – Tract and Pathways of Spines – Reflex Mechanism – Classification of Nerves - Autonomic Nervous systems and its functions. Endocrine - Pituitary and thyroid gland, Sense Organs: Eye and Ear.						
UNIT 5:	DIGESTIVE AND URINARY SYSTEMS					9
Digestive: Organs of Digestive system – Digestion and Absorption. Urinary: Structure of Kidney and Nephron – Mechanisms of Urine formation – Regulation of Blood pressure by Urinary System – Urinary reflex.						
						45 PERIODS
COURSE OUTCOMES:						
Upon successful completion of the course, students will be able to:						
CO1:	Explain basic structure and functions of cell and tissues.					
CO2:	Discuss about anatomy and physiology of skeletal, muscular and Respiratory systems.					
CO3:	Interpret the cardiovascular and Lymphatic Systems.					
CO4:	Describe about Nervous and endocrine systems and sense organs.					
CO5:	Explain the structure and function of digestive and urinary system.					
TEXT BOOKS						
1.	Prabhjot Kaur. Text Book of Anatomy and Physiology. Lotus Publsiher. 2014.					
2.	Elaine.N. Marieb , “Essential of Human Anatomy and Physiology”, Eight Edition, Pearson Education, New Delhi, 2007					
REFERENCES						

1.	Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew, Fundamentals of Anatomy and Physiology. Pearson Publishers, 2014.
2.	Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2013.
3.	William F. Ganong, “Review of Medical Physiology”, 22nd Edition, Mc Graw Hill, New Delhi, 2010.

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	2	1	-	1	-	-	-	1	-	-	1	-	-	1
CO2:	3	2	1	-	1	-	-	-	1	-	-	1	-	-	-
CO3:	3	2	-	-	1	-	-	-	1	-	-	1	2	-	-
CO4:	3	2	-	-	1	-	-	-	1	-	-	1	-	-	-
CO5:	3	2	1	-	1	-	-	-	1	-	-	1	-	-	-
CO	3	2			1				1			1			

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

BBM203	ANALOG AND DIGITAL ICs	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 study the application of analog ICs in the designing circuit.					
2	To study the applications of these Digital ICs.					
3	To understand the basic of the Digital systems.					
4	To study the design of the various functional circuits using these ICs.					
UNIT 1:	NUMBER SYSTEMS AND LOGIC GATES					9
Decimal, Binary, Octal and Hexadecimal Numbers.-Conversion between these number systems.-Complements r's and (r-1)'s complements.- subtraction using complements – Encoding numbers and characters using Binary digits. –Binary coded Decimal –Gray code - Binary to Gray code conversion – ASCII Code. Logic gates – Truth tables – NOT, AND, OR, NOR, NAND, XOR, XNOR - Boolean Laws and theorems – Solving Boolean expressions, Truth Tables and Logic circuits – The Karnaugh Map – half adder, full adder, Multiplexers and Demultiplexers - Decoders and encoders. Coding of Combination Circuits in verilog.						
UNIT 2:	REGISTERS AND COUNTERS					9
Flip Flops – RS, D, T, JK Flip Flops – Characteristic equations, exciting tables – JK Master – Slave flip-flop – Universal shift register. Design of modulo-N counters – counter design using state diagram. sequential circuit design with verilog.						
UNIT 3:	OPERATIONAL AMPLIFIERS					9
The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth - equivalent circuit of an op-Amp – virtual ground concept – Linear applications of op-amp – inverting and noninverting amplifier, summing, subtracting, averaging amplifier - voltage to current converter– current to voltage converter – Differential amplifiers – differentiator and integrator. Nonlinear applications – comparator – Schmitt Triggers – Precision Diode Half wave and full wave rectifiers – Average detectors – peak detector.						
UNIT 4:	ACTIVE FILTERS AND SIGNAL GENERATOR					9
Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters (notch filters). Oscillators - RC Phase shift and Weinbridge. Waveform generators - Square, triangular and saw tooth.						
UNIT 5:	TIMER, PLL, A/D AND D/A CONVERTERS					9
555 Timer (internal diagram) and its applications – monostable multivibrator, astable multivibrator. Phase locked Loop (565 - block diagram approach) and its applications - Frequency multiplication, Frequency translation, voltage to frequency and frequency to voltage converters. DAC – Binary weighted DAC and R-2R DAC. ADC – single slope and dual slope ADCs, successive approximation ADC						
45 PERIODS						
COURSE OUTCOMES:						
Upon successful completion of the course, students will be able to:						
CO1:	Explain the application of analog ICs in the designing circuit.					
CO2:	Apply digital concepts to design circuits using Flipflops, counters and Digital ICs.					
CO3:	Understand the basics of the Digital systems using Operational amplifiers					
CO4:	Design various functional circuits using these ICs such as filters.					
CO5:	Summarize and design the digital circuits using timer, PLL and convertors					
TEXT BOOKS						
1.	M. Morris Mano , “Digital Logic and Computer design “ Prentice Hall 1994.					
2.	Ramakant A. Gayakwad , “Op-AMP and Linear Ics”, Prince Hall, 1994					
REFERENCES						
1.	Robert B.Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, CRC Press, 2004					

2.	John. F. Wakerly, “Digital Design Principles and Practices”, Fourth Edition, Pearson Education, 2007
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CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	2	1	-	3	-	-	-	-	-	-	1	-	-	1
CO2:	3	3	2	-	-	-	-	-	-	-	-	1	-	3	-
CO3:	3	2	2	-	3	-	-	-	-	-	-	1	2	-	-
CO4:	3	3	2	-	3	-	-	-	-	-	-	1	-	3	1
CO5:	3	2	2	2	3	-	-	-	-	-	-	1	-	3	1
CO	3											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	PSO3
CO1:	3	1	3	-	3	2	-	-	-	-	-	3	-	-	1
CO2:	3	1	3	-	-	2	-	-	-	-	-	3	-	3	-
CO3:	3	3	-	-	3	2	-	-	-	-	-	3	2	-	-
CO4:	3	3	-	-	3	2	-	-	-	-	-	3	-	3	1
CO5:	3	3	3	3	3	2	-	-	-	-	-	3	-	3	1
CO	3														

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

BBM207	ANALOG AND DIGITAL ICS LABORATORY	L	T	P	C	TOTAL MARKS
		0	0	4	2	100
PREREQUISITES: BBM203 ANALOG AND DIGITAL ICS						
COURSE OBJECTIVES:						
The main objectives of this course are to:						
1	Design digital logic and circuits					
2	Learn the function of different ICs					
3	Understand the applications of operation amplifier.					
4	Learn the working of multivibrators					
5	Design circuits for generating waveforms using ICs.					
List of Experiments						
1. Study of logic gates, Half adder and Full adder						
2. Encoder and BCD to 7 segment decoder						
3. Multiplexer and demultiplexer using digital ICs						
4. Universal shift register using flip flops						
5. Design of mod-N counter						
6. Inverting, non-inverting amplifier and comparator						
7. Integrator and Differentiator						
8. Active filter – first order and second order LPF and HPF						
9. Current to Voltage convertor and Voltage to Current Convertor						
10. Comparator, Peak detector and Average detector						
11. Instrumentation amplifier using IC741						
12. Wein bridge oscillator						
13. Multivibrator using IC555 Timer						
14. Timer						
15. Phase Lock Loop						
16. A/D and D/A convertor						
						30 PERIODS
COURSE OUTCOMES:						
Upon successful completion of the course, students will be able to:						
CO1:	Design Circuits using logic gates					
CO2:	Build Circuits for different application using opamp.					
CO3:	Differentiate between oscillator and wave form generator					
CO4:	Analyze the response of Timer.					
CO5:	Convert Signals from Analog to Digital Vice versa					

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	2	3	-	3	-	-	-	-	-	-	1	-	-	1
CO2:	3	1	1	-	3	-	-	-	-	-	-	1	-	3	-
CO3:	3	2	3	-	3	-	-	-	-	-	-	1	2	-	-
CO4:	3	2	1	-	3	-	-	-	-	-	-	1	-	3	1
CO5:	3	2	3	-	3	-	-	-	-	-	-	1	-	3	1
CO	3														

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

IV SEMESTER

BBM211		BIOCONTROL SYSTEMS		L	T	P	C	TOTAL MARKS
				4	0	0	4	100
PREREQUISITES: NONE								
COURSE OBJECTIVES:								
The main objectives of this course are to:								
1	To understand the concept behind feedback and continuum in various systems and subsystems.							
2	To analyse the systems in time and frequency domain and to understand the concept of stability.							
3	To apply mathematical modelling principles in understanding the various fundamental biological systems.							
4	To analyse biological system models using MATLAB.							
UNIT 1:		INTRODUCTION						12
Open and Closed loop Systems, Modeling and Block Diagrams, Block diagram and signal flow graph representation of systems, reduction of block diagram and signal flow graph, Introduction to Physiological control systems- Illustration, Linear models of physiological systems, Difference between engineering and physiological control system.								
UNIT 2:		TIME RESPONSE ANALYSIS						12
Step and impulse responses of first order and second order systems, time domain specifications of first and second order systems, steady state error constants, Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability.								
UNIT 3:		FREQUENCY RESPONSE ANALYSIS						12
Frequency domain specifications - Polar plots, Bode plots, Nyquist plot, Nyquist stability criterion, closed loop stability, Constant M and N circles, Nichol's chart.								
UNIT 4:		BIOLOGICAL SYSTEM MODELS						12
Distributed parameter versus lumped parameter models, Model development of Cardiovascular system- Heart model-circulatory model, Pulmonary mechanics- Lung tissue visco-elasticity-chest wall- airways, Interaction of Pulmonary and Cardiovascular models, Static analysis of physiological systems – Regulation of cardiac output, Regulation of ventilation.								
UNIT 5:		BIOLOGICAL CONTROL SYSTEM ANALYSIS						12
Simple models of muscle stretch reflex action, Study of steady state analysis of muscle stretch reflex action, Study of transient response analysis of neuromuscular reflex model action, Study of frequency response of circulatory control model, Stability analysis of Pupillary light reflex.								
60 PERIODS								
COURSE OUTCOMES:								
Upon successful completion of the course, students will be able to:								
CO1:	Understand the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems							
CO2:	Analyze the time response of various systems and discuss the concept of system stability							
CO3:	Analyze the frequency response characteristics of various systems using different charts							
CO4:	Understand the concept of modeling basic physiological systems							
CO5:	Comprehend the application aspects of time and frequency response analysis in physiological control systems							
TEXT BOOKS								
1.	I.J. Nagarath and M. Gopal "Control Systems Engineering", Fifth Edition, Anshan Publishers, 2008.							
2.	Michael C K Khoo, "Physiological Control Systems", IEEE Press, Prentice Hall of India,2005.							
REFERENCES								
1.	Benjamin C. Kuo, "Automatic Control Systems", Prentice Hall of India, 1995.							
2.	John Enderle Susan Blanchard, Joseph Bronzino "Introduction to Biomedical Engineering",second edition, Academic Press, 2005.							

3.	Richard C. Dorf, Robert H. Bishop, “Modern control systems”, Pearson, 2004.
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CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	2	2	-	1	-	-	-	-	-	-	1	-	-	1
CO2:	3	2	2	-	1		-	-	-	-	-	1	-	3	-
CO3:	3	2	2	-	1	-	-	-	-	-	-	1	2	-	-
CO4:	3	2	2	-	1	-	-	-	-	-	-	1	-	3	1
CO5:	3	2	2	3	1	-	-	-	-	-	-	1	-	3	1
CO	3	2	2		1	-						1			

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

BBM212	BIOMATERIALS AND ARTIFICIAL ORGANS	L	T	P	C	TOTAL MARKS
		3	0	0	3	100
PREREQUISITES: BBM202Anatomy and Human Physiology						
COURSE OBJECTIVES:						
The main objectives of this course are to:						
1	To study the characteristics and classification of biomaterials.					
2	To learn about the polymeric materials and composites in tissue replacements.					
3	To describe the principles of implant design with a case study.					
4	To explain the implant design parameters and solution in use.					
5	To know the compatibility and functioning of artificial organs inside the living system.					
UNIT 1:	INTRODUCTION TO BIO-MATERIALS					9
Definition and classification of bio-materials, mechanical properties, visco elasticity, biomaterial performance, body response to implants, wound healing, blood compatibility, Nano scale phenomena. Metallic implants - Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion, ceramic implant – bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics.						
UNIT 2:	POLYMERIC IMPLANT MATERIALS					9
Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin. Medical Textiles, Materials for ophthalmology: contact lens, intraocular lens. Membranes for plasma separation and Blood oxygenation, electro spinning: a new approach.						
UNIT 3:	TISSUE REPLACEMENT IMPLANTS					9
Small intestinal sub mucosa and other decellularized matrix biomaterials for tissue repair: Extra cellular Matrix. Softtissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, tissue scaffolding and engineering using Nano biomaterials.						
UNIT 4:	ARTIFICIAL ORGANS &PRINCIPLES OF IMPLANT DESIGN					9
Introduction, outlook for organ replacements, design consideration, evaluation process. TRANSPLANTS:- Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea. Principles of implant design, Clinical problems requiring implants for solution, Tissue engineering, scaffolds, cells and regulators criteria for materials selection.						
UNIT 5:	BLOOD INTERFACING IMPLANTS&TESTING OF BIOMATERIAL					9
Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood. Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation. Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity and special tests, Invitro and Invivo testing; Sterilisation of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.						
45 PERIODS						
COURSE OUTCOMES:						
Upon successful completion of the course, students will be able to:						
CO1:	Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.					
CO2:	Identify significant gap required to overcome challenges and further development in metallic and ceramic materials, polymer materials.					
CO3:	Gain adequate knowledge about artificial organs & transplants					
CO4:	Have in-depth knowledge about Artificial organs					
CO5:	Develop a knowledge on blood interfacing implants and testing of Biomaterials					
TEXT BOOKS						
1.	Sujata V. Bhatt, —Biomaterials‡, Second Edition, Narosa Publishing House, 2005.					
2.	Sreeram Ramakrishna, MuruganRamalingam, T. S. Sampath Kumar, and Winston O. Soboyejo, —Biomaterials: A Nano Approach‡, CRC Press, 2010.					

REFERENCES	
1.	Park J.B., —Biomaterials Science and EngineeringI, Plenum Press, 1984.
2.	Myer Kutz, —Standard Handbook of Biomedical Engineering & DesignI, McGraw-Hill, 2003.
3.	John Enderle, Joseph D. Bronzino, Susan M.Blanchard, —Introduction to BiomedicalEngineeringI Elsevier, 2005.

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	1	1	-	2	2	-	-	-	-	-	1	-	-	1
CO2:	3	1	1	-	2	2	-	-	-	-	-	1	-	3	-
CO3:	3	2	1	-	2	2	-	-	-	-	-	1	2	-	-
CO4:	3	2	-	-	2	2	-	-	-	-	-	1	-	3	1
CO5:	3	2	1	3	2	2	-	-	-	-	-	1	-	3	1
CO	3	2	1		2	2						1		3	1

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

BBM213	Bio Medical Instrumentation	L	T	P	C	TOTAL MARKS
		3	0	0	3	100
PREREQUISITES: BBM202 Anatomy and Human Physiology						
COURSE OBJECTIVES:						
The main objectives of this course are to:						
1	Illustrate origin of bio potentials and its propagations.					
2	Understand the different types of electrodes and its placement for various recordings.					
3	Design bio amplifier for various physiological recordings.					
4	Learn the different measurement techniques for non-physiological parameters.					
5	Summarize different biochemical measurements.					
UNIT 1:	BIO POTENTIAL ELECTRODES					9
Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.						
UNIT 2:	BIO SIGNAL RECORDING					9
ECG: origin, waveforms and their characteristics, Einthoven triangle, lead configurations, electrocardiograph, 12 lead ECG machine circuit, common mode and interference reduction circuits, Vector cardiograph, Recording of EMG, EEG : origin, waveforms and their characteristics, 10-20 electrode placement system, Electro encephalogram, Magneto encephalogram, EOG & ERG: origin, measurement of EOG, electroretinogram, Heart sounds: origin, phonocardiography.						
UNIT 3:	BIO AMPLIFIERS					9
Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation -isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference.						
UNIT 4:	BIO ANALITICAL EQUIPMENTS AND PATIENT SAFETY					9
Blood cell counters –microscopic method, automatic optical, method, coulter counter,automatic recognition and differential counting of cells, flow cytometer, Selective ion electrodes, ion analyzer, Electric shock hazards, micro current shock, leakage currents, Precautions to minimize electric hazards, safety codes for electro medical equipment, electrical safety analyzer.						
UNIT 5:	BIO CHEMICAL MEASUREMENTS					9
pH, pco2, po2, - colorimeter, spectrophotometer, flame photometer. Autoanalyser.						
						45 PERIODS
COURSE OUTCOMES:						
Upon successful completion of the course, students will be able to:						
CO1:	Compare the different types of electrodes and draw its equivalent circuit.					
CO2:	Explain how record the various bio signals.					
CO3:	Classify various amplifiers used for measuring biosignals.					
CO4:	Discuss the importance of Bio safety of medical equipments					
CO5:	Summarize the Bio chemical measurements.					
TEXT BOOKS						
1.	John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2004.					
2.	Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.(Units II & IV)					
REFERENCES						
1.	Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 2007.					
2.	Myer Kutz, “Standard Handbook of Biomedical Engineering and Design”, McGraw Hill Publisher, 2003.					

3.	Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004.
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CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	1	1	1	1	-	-	-	-	-	-	1	2	2	-
CO2:	3	1	2	1	2	-	-	-	-	-	-	1	2	2	-
CO3:	3	1	1	2	1	-	-	-	-	-	-	1	2	2	-
CO4:	3	1	2	1	-	-	-	-	-	-	-	1	2	2	-
CO5:	3	1	1	1	1	-	-	-	-	-	-	1	2	2	-
CO	3	1	1	1	1				-			1	2	2	-

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

BBM214		Bio Sensors and Transducers		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 provide the basics of measurements, knowledge on the principle and operation of different medical transducers.							
2	To introduce the application of sensors and transducers in the physiological parameter measuring system.							
3	Know the principle of transduction, classifications and the characteristics of different transducers							
4	Know the different bridges for measurement.							
5	Know the different display and recording devices.							
UNIT 1:		INTRODUCTION TO SENSORS AND TRANSDUCER						9
Transducer and Measurement system - Static Characteristics – Dynamic Characteristics –Standards and Calibration – Types of Error.Bioelectric and Biomagnetic Measurement: Bioelectric events, Biomagnetic events. Electrode theory – Electrode-Electrolyte interface – Liquid junction potentials – Double layer – Electrode potentials. Surface Potential Electrodes: ECG electrodes – EMG electrodes – ECG electrodes. Glass electrodes – Metal Electrodes – Suction electrodes. Bio Magnetism: Biomagnetic fields –Magnetopneumography.								
UNIT 2:		PRESSURE MEASUREMENTS						9
Requirements of pressure measurements, Direct pressure measurement: Catheters and diaphragm type pressure measurement – Catheter tip pressure transducer, Pressure measurement in small vessels - Servo controlled, Pressure measurement in collapsible vessels – Interstitial pressure measurement – Differential pressure measurement. Indirect pressure measurement – Systolic, Diastolic and Mean blood pressure – Auscultatory and Oscillometric method.								
UNIT 3:		FLOW MEASUREMENT						9
Requirements of flow measurement, Blood flow meters in single vessel –Electromagnetic flow meter – Ultrasound flow meter – Indicator dilution method. Tissue blood flow meter – Venous Occlusion plethysmography. Respiratory Gas flow measurements – Gas flow sensors - Lung plethysmography.								
UNIT 4:		MOTION AND FORCE MEASUREMENTS						9
Objects of Measurements, Motion Measurements: Displacement and rotation measurements by contact transducers - Displacement and rotation measurements of body in extracted tissue – Displacement measurement in vivo, Non contact measurement of displacement and rotation. Force measurements: Muscle contraction measurement – Force measurements in isolated muscles – In vivo measurement of muscle contraction.								
UNIT 5:		TEMPERATURE MEASUREMENT						9
Requirements of temperature measurement, Temperature transducers – Thermistor - Thermocouple– Thin film thermo resistive element – p-n junction diodes and transistors. Clinical thermometers: Indwelling thermometer probes – Rectal, Esophageal and Bladder temperature measurement, Tympanic thermometer, Zero heat flow thermometer.								
45 PERIODS								
COURSE OUTCOMES:								
Upon successful completion of the course, students will be able to:								
CO1:	Explain the principles and applications of electrodes.							
CO2:	Apply direct and indirect pressure measurement methods.							
CO3:	Distinguish fluid and gas flow measurements.							
CO4:	Describe the methods of motion and force measurements.							
CO5:	Implement temperature sensors for temperature measurements.							

TEXT BOOKS	
1.	Tatsuo Togawa, Toshiyo Tamura, P. Ake Oberg, “Biomedical Transducers and Instruments”, CRC Press.
2.	John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2004.
REFERENCES	
1.	Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 5th edition, Mc Graw-Hill, 2007. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.
2.	Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 2007.
3.	L.A Geddas and L.E.Baker, “Principles of Applied Biomedical Instrumentation”, John Wiley and Sons, Third Edition, Reprint 2008.

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:	3	1	2	2	-	-	-	-	1	-	-	1	2	3	-
CO2:	3	1	2	2	-	-	-	-	1	-	-	1	2	-	-
CO3:	3	1	2	2	-	-	-	-	1	-	-	1	2	-	-
CO4:	3	1	2	2	-	-	-	-	1	-	-	1	2	-	-
CO5:	3	1	2	2	-	-	-	-	1	-	-	1	2	-	-
CO	3	1	2	2					1	-		1	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 to:								
1	To learn discrete Fourier transform, properties of DFT and its application to linear filtering							
2	To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands							
3	To understand the effects of finite precision representation on digital filters							
4	To understand 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, BRFF) - 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.							
5.	Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation							

6.	Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations
7.	Study of architecture of Digital Signal Processor
8.	MAC operation using various addressing modes.
9.	Linear Convolution.
10.	Circular Convolution.
11.	FFT Implementation.
12.	Wave form generation.
13.	IIR and FIR Implementation.
14.	Finite Word Length Effect.
TOTAL PERIODS :60	
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	0	0	0	0	1	1	3	3	2
CO2	3	3	3	3	2	2	0	0	0	0	1	1	2	2	2
CO3	3	3	2	2	2	2	0	0	0	0	1	1	1	2	2
CO4	3	3	2	2	3	1	0	0	0	0	1	1	2	2	3
CO5	3	3	2	2	3	2	0	0	0	0	1	1	2	2	1
CO	3	3	2	2	2	2	0	0	0	0	1	1	2	2	2

1 - low, 2 - medium, 3 – high

BEN231		COMMUNICATION SKILLS FOR CAREER SUCCESS		L	T	P	EL	C	TOTAL MARKS
				0	0	0	3	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.								
TOTAL:60 PERIODS									
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