BE-ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABI 2021
(Choice Based Credit System)

FACULTY OF ENGINEERING

Enable | Enlighten | Enrich
KARPAGAM
ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

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(Deemed University, Established Under Section3ofUGCAct1956)

Eachanari post, COIMBATORE 641021, INDIA

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(Deemed to be University Established Under Section 3 of UGC Act 1956)
Eachanari, Coimbatore-641 021. INDIA
FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

REGULAR PROGRAMME

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

These regulations are effective from the academic year 2021 – 2022 and applicable to the candidates admitted to B. E. / B. Tech. during 2021 – 2022 and onwards.

1. ADMISSION

1.1. Candidates seeking admission to the first semester of the eight semesters B.E./B.Tech. Degree Programme:

Should have passed the Higher Secondary Examination (10+2) (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any similar Examination of any other University or authority accepted by the Karpagam Academy of Higher Education as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering/Technology) as prescribed by the Government of Tamil Nadu.

1.2. Candidates seeking admission to the first semester of the eight semesters B.Tech. (Bio-Technology) Degree Programme:

Should have passed the Higher Secondary Examination (10+2) (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry (or) Physics, Chemistry and Biology as three of the four subjects (or) Physics, Chemistry, Botany and Zoology as subjects of study under Part-III or any similar Examination conducted by any other authority accepted by the Karpagam Academy of Higher Education as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering/Technology) as prescribed by the Government of Tamil Nadu.

1.3. Lateral Entry Admission

Candidates who possess Diploma in Engineering/Technology (10+3 or 10+2+2) awarded by the Directorate of Technical Education, Tamil Nadu or its equivalent and candidates who possess a Bachelor Degree in Science (10+2+3) with Mathematics as one of the subjects, awarded by any University or its equivalent are eligible to apply for admission to the third semester of B.E./B.Tech. Degree Programme.

Eligibility criteria for admission in the first semester are given in the table below.

SL. NO.	PROGRAMME	ELIGIBILITY CRITERIA
1.	B.E. Automobile Engineering	Diploma in Automobile Engineering / Mechanical Engineering / Metallurgy / Mechanical and Rural Engineering / Machine Tool Maintenance and Repairs / Machine Design and Drafting / Refrigeration and Air-conditioning / Production Engineering / Tool and Die Design
2	B.E. Biomedical Engineering	Diploma in Electrical and Electronics Engineering / Electronics and Communication Engineering / Computer Science Engineering / Mechatronics Engineering / Computer Technology / Instrumentation Technology
3	B.E. Civil Engineering	Diploma in Civil Engineering / Sanitary Engineering / Civil and Rural Engineering
4	B.E. Computer Science and Engineering	Diploma in Computer Engineering / Electrical Engineering / Electronics Engineering / Electrical and Electronics Engineering / Electronics and Communication Engineering / Electronics and Telecommunication Engineering / Information Technology / Computer Science / Instrumentation and Control Engineering / Electronics and Instrumentation
5	B.E. Electrical and Electronics Engineering	Diploma in Electrical Engineering / Electronics Engineering / Electrical and Electronics Engineering / Electronics and Communication Engineering / Electronics and Telecommunication Engineering / Information Technology / Computer Science / Instrumentation and Control Engineering / Electronics and Instrumentation
6	B.E. Electronics and Communications Engineering	Diploma in Electronics Engineering / Electronics and Communication Engineering / Electrical Engineering / Instrument Technology / Electronics with specialization in Instrumentation / Electrical and Electronics Engineering / Information Technology / Computer Science / Instrumentation and Control Engineering / Electronics and Telecommunication Engineering
7	B.E. Mechanical Engineering	Diploma in Mechanical Engineering / Metallurgy / Automobile Engineering / Mechanical and Rural Engineering / Machine Tool Maintenance and Repairs / Machine Design and Drafting / Refrigeration and Air-Conditioning / Production Engineering / Tool and Die Design

8	B.Tech. Bio-Technology	Diploma in Chemical Engineering / Leather Technology / Petrochemical Engineering
9	B.Tech. Chemical Engineering	Diploma in Chemical Engineering / Petrochemical Engineering / Chemical Technology / Petroleum Engineering / Polymer Technology / Plastic Technology / Sugar Technology / Pulp and Paper Technology
10	B.Tech. Food Technology	Diploma in Food Technology / Chemical Engineering / Leather Technology / Petrochemical Engineering

1.4. Migration from other University

Candidates who have completed their first to sixth semesters of B.E./B.Tech. study in any University are eligible to apply for admission to their next semester of B.E./B.Tech. in the branch corresponding to their branch of study. The student will be exempted from appearing for Examination of the equivalent courses passed in the earlier programme and will have to appear for courses which he/she has not done during the period of his/her earlier programme. Along with the request letter and mark sheets, he/she has to submit a copy of the syllabus of the programme duly attested by the Registrar/Competent authority, he/she has undergone. Equivalence Certificate shall be provided by the "Students' Affairs Committee" of Karpagam Academy of Higher Education. Students' Affairs Committee comprises all the Heads of the Departments and Dean of the Faculty of Engineering and a nominee of the Registrar.

2. PROGRAMMES OFFERED

A candidate may undergo a programme in any one of the branches of study approved by the University as given below.

List of B.E. and B.Tech. Degree Programmes

1. B.E. Automobile Engineering
2. B.E. Biomedical Engineering
3. B.E. Civil Engineering
4. B.E. Computer Science and Engineering
5. B.E. Electrical and Electronics Engineering
6. B.E. Electronics and Communications Engineering
7. B.E. Mechanical Engineering
8. B.Tech. Bio-Technology
9. B.Tech. Chemical Engineering
10. B.Tech. Food Technology

3. MODE OF STUDY

3.1. Full-Time

In this mode of study, the candidates are required to attend classes regularly on the specified working days of the University.

3.2. Conversion from the full-time mode of study to part-time is not permitted.

3.3. Change from one programme to another is not permitted.

4. STRUCTURE OF PROGRAMMES

4.1. Every programme will have a curriculum with syllabus consisting of theory and practical courses such as:

i. General core courses comprising Mathematics, Basic Sciences, Engineering Sciences and Humanities.

ii. Core courses in Engineering/Technology.

iii. Elective courses for specialization in related fields.

iv. Workshop practice, computer practice, engineering graphics, laboratory work, in-plant training, seminar presentation, project work, industrial visits, camps, etc.

Every student is encouraged to participate in at least any one of the following programmes:

- NSS/Sports/Physical exercise/NCC/YRC/Red Ribbon club/Environment club and Energy club
- Other Co-Curricular and Extra Curricular activities

v. **Choice Based Credit System**

Choice Based Credit System (CBCS) is introduced for students admitted in the academic year 2017-2018. As per AICTE guidelines, CBCS is an approach in which students opt for courses of their choice. CBCS provides greater flexibility with multiple courses and enables students to undergo additional courses. CBCS is applicable to Full Time Undergraduate and Post Graduate Programmes of study. It provides a choice for students to select from the prescribed courses (Professional soft core, Professional hard core, Professional electives, Open electives, Value added courses, Humanity Sciences, Basic Sciences and Engineering Sciences). A course designated as hard core for a particular programme of study must invariably be completed by the student to receive the degree in the programme. The hard core courses cannot be substituted by another course. Students can exercise their choice among a set of soft core courses from the list of soft core courses specified for each Programme of study. The student should meet the criteria for prerequisites to become eligible to register for that course. The student should request for the course for every semester within the first week of the semester. The maximum number

of students to be registered in each course shall depend on the availability of physical facilities, classroom availability and lab capacity. Registration of already requested courses by students in the previous semester is not allowed.

4.2. Each course is normally assigned a certain number of credits.

No. of credits per lecture period per week	: 1
No. of credits per tutorial period per week	: 1
No. of credits for 3 periods of laboratory course per week	: 2
No. of credits for 3 periods of project work per week	: 2
No. of credits for 2 periods of value added course per week	: 1
No. of credits for 3 weeks of in-plant training during semester vacations	: 1

4.3. In every semester, the curriculum shall normally have a blend of theory courses not exceeding 6 and practical courses not exceeding 3.

4.4. The minimum credits required for the award of the degree shall be as specified below.

PROGRAMME	MINIMUM CREDITS
B.E./B.Tech.	162

* Minor variation is allowed.

4.5. The medium of instruction for all Courses, Examinations, Seminar presentations and Project/Thesis reports is English.

4.6. Value Added Course

Besides core courses and elective courses, value added course is introduced. The blend of different courses is so designed that the student would be trained not only in his/her relevant professional field but also as a socially conscious human being.

4.7. Evaluation in the courses comprises two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE). Evaluation in a few courses may be by Internal Assessment only.

5. DURATION OF THE PROGRAMME

5.1. The prescribed duration of the programme shall be

PROGRAMME	MINIMUM NO. OF SEMESTERS	MAXIMUM NO. OF SEMESTERS
B.E./B.Tech. (Higher Secondary Candidates)	8	14
B.E./B.Tech. (Lateral Entry Candidates)	6	12

5.2. Each semester shall normally consist of 90 working days or 540 hours.

5.3. Additional classes for improvement, conduct of the model test, etc., over and above the specified periods shall be arranged, if required. But for the purpose of calculation of attendance requirement for eligibility to appear for the end semester Examinations (as per Clause 11) by the students, 540 hours conducted within the specified academic schedule alone shall be taken into account and the overall percentage of attendance shall be calculated accordingly.

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

6.1. Ideally, every student is expected to attend all classes and secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least 75% of the classes and the conduct of the candidate has been satisfactory during the course.

6.2. A candidate who has secured attendance between 65% and 74% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) or due to participation in University / District / State / National / International level sports or due to participation in Seminar / Conference / Workshop / Training Programme / Voluntary Service / Extension activities or similar programmes with prior permission from the Registrar shall be given exemption from prescribed attendance requirements and shall be permitted to appear for the Examination on the recommendation of the Head of the Department concerned and Dean to condone the lack of attendance. The Head of the Department has to verify and certify the genuineness of the case before recommending to the Dean. However, the candidate has to pay prescribed condonation fees.

6.3. Candidates who are not recommended for condonation and those who have less than 65% attendance will not be permitted to proceed to the next semester and have to redo the course. However, they are permitted to write the arrear Examinations, if any.

7. CLASS ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a teacher of the Department who shall function as Class Advisor for those students throughout their period of study. Such Class Advisors shall advise the students and monitor the courses undergone by the students, check the attendance and progress of the students and counsel them periodically. If necessary, the Class Advisor may display the cumulative attendance particulars in the Department notice board and also discuss with or inform the Parents/Guardian about the progress of the students. Each student shall be provided with the course plan for each course at the beginning of each semester.

8. CLASS COMMITTEE

8.1. Every class shall have a class committee consisting of teachers of the class concerned, Maximum of six student representatives (boys and girls) and the concerned Head of the Department. It is like the 'Quality Circle' with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Clarifying the regulations of the degree programme and the details of rules therein particularly Clause 4 and 5 which should be displayed on Department Notice-Board.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory/drawing/ project work/seminar, etc.) the breakup of marks for each experiment/exercise/ module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Solving problems experienced by students in the classroom and in the laboratories.
- Informing the student representatives the academic schedule, including the dates of assessments and the syllabus coverage for each assessment.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any and requesting the teachers concerned to provide some additional academic support.

8.2. The class committee for a class under a particular branch is normally constituted by the Head of the Department (HOD). However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Dean.

8.3. The class committee shall be constituted within the first week of each semester.

8.4. The Chairperson of the Class Committee may convene the meeting of the class committee.

8.5. The Dean may participate in any Class Committee of the Faculty.

8.6. The Chairperson is required to prepare the minutes of every meeting, submit the same to Dean through the HOD within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the Management, the same shall be brought to the notice of the Registrar by the HOD through Dean.

8.7. The first meeting of the Class Committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the regulations. Two subsequent meetings may be held in a semester at suitable intervals. During these meetings, the student members representing the entire class shall meaningfully interact and express their opinions

and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group shall have a "Course Committee" comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Dean depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the Course Committee may also prepare a common question paper for the Internal Assessment test(s).

10. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

10.1. Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' (Log book) which consists of attendance marked in each theory or practical or project work class, the test marks and the record of class work (topic covered), separately for each course.

10.2. Continuous Internal Assessment (CIA): The performance of students in each subject will be continuously assessed by the respective teachers as per the guidelines given below:

THEORY COURSES:

SL. NO.	CATEGORY	MAXIMUM MARKS
1.	Assignment	5
2.	Seminar *	5
3.	Attendance	5
4.	Test - I	8
5.	Test - II	8
6.	Test - III	9
Continuous Internal Assessment: TOTAL		40

* Evaluation shall be made by a committee.

PATTERN OF TEST QUESTION PAPER (Test I & II)

INSTRUCTION	REMARKS
Maximum Marks	60
Duration	2 hours
Part-A	1 to 9 two mark questions, uniformly covering the two units of the syllabus. All the 9 questions are to be answered. **(9 × 2 = 18 marks)**
Part-B	Question 10 to 12 will be of either or type, covering two units of the syllabus. Each question may have subdivision. **(3 × 14 = 42 marks)**

PATTERN OF TEST QUESTION PAPER (Test III)

INSTRUCTION	REMARKS
Maximum Marks	100
Duration	3 hours
Part-A	Part A will be online Examination. 20 objective type questions covering all the 5 units. **(20 × 1 = 20 marks) (Online examination)**
Part-B	21 to 25 two mark questions, uniformly covering the five units of the syllabus. All the 5 questions are to be answered. **(5 × 2 = 10 marks)**
Part-C	Question 26 to 30 will be of either or type, covering five units of the syllabus. Each question may have subdivision. **(5 × 14 = 70 marks)**

PRACTICAL COURSES:

SL. NO.	CATEGORY	MAXIMUM MARKS
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Model Examination	15
5.	Viva-voce (Comprehensive)	10
Continuous Internal Assessment: TOTAL		40

Every practical exercise/experiment shall be evaluated based on the conduct of exercise/experiment and records maintained.

INTEGRATED THEORY AND PRACTICAL COURSES:

The Continuous Internal Assessment for Integrated Theory Course is awarded for 40 marks with mark split up similar to regular theory course.

The external evaluation of integrated practical component from End Semester Examination by internal mode is awarded for 50 marks and later scaled down to 15 marks and similarly the external evaluation for integrated theory from End Semester Examination is awarded for 100 marks and later scaled down to 45 marks. Hence the external assessment for integrated theory and practical components contribute to 60 marks.

10.3. ATTENDANCE

Attendance carries a maximum of 5 marks and the distribution is as under:

SL. NO.	ATTENDANCE %	MARKS
1	91 and above	5
2	81 – 90	4
3	76 – 80	3

10.4. PROJECT WORK/INTERNSHIPS

Final year project work will be always in-house. However, as a special case, if a student is able to get a project from a government organization or private or public sector company, the student may be permitted to do his/her project work in reputed institution/research organization/industry. Hence final year students may have the commencement of eighth semester classes for 30 days in fast track mode and complete their final semester and are made eligible for undergoing internships in industry and also interested students are permitted for doing projects in industries.

10.5. CERTIFICATION COURSES

Students have to undergo a minimum of one value added course beyond curriculum as a certified course per semester for duration not less than 30 hours**.**

11. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION (ESE)

A candidate shall normally be permitted to appear for the ESE of any semester commencing from I semester if he/she has satisfied the semester completion requirements (Subject to Clause 5) and has registered for Examination in all courses of the semester. Registration is mandatory

for Semester Examinations as well as arrear Examinations failing which the candidate will not be permitted to attend the next semester. A candidate already appeared for a subject in a semester and passed the Examination is not entitled to reappear in the same subject of the semester for improvement of grade.

12. END SEMESTER EXAMINATION

ESE will be held at the end of each semester for each subject, for 100 marks, later scaled down to 60 marks.

PATTERN OF ESE QUESTION PAPER:

INSTRUCTION	REMARKS
Maximum Marks	100
Duration	3 hours
Part-A	Part A will be online Examination. 20 objective type questions covering all the 5 units. **(20 × 1 = 20 marks) (Online examination)**
Part-B	21 to 25 two mark questions, uniformly covering the five units of the syllabus. All the 5 questions are to be answered. **(5 × 2 = 10 marks)**
Part-C	Question 26 to 30 will be of either or type, covering five units of the syllabus. Each question may have subdivision. **(5 × 14 = 70 marks)**

13. PASSING REQUIREMENTS

13.1. Passing minimum: The passing minimum for CIA is 20 (i.e. out of 40 marks). The passing minimum for ESE is 30 (i.e. out of 60 marks). The overall passing minimum for theory/laboratory course is 50 (Sum of his/her score in CIA and ESE) out of 100 marks.

13.1.1. The passing minimum for value added course is 50 marks out of 100 marks. There will be two tests, the first covering 50% of the syllabus for 50 marks and the other for 50 marks.

13.2. If the candidate fails to secure a pass in a particular course ESE, it is mandatory that candidate shall register and reappear for the Examination in that course during the subsequent semester when Examination is conducted in that course. Further, the candidate should continue to register and reappear for the Examination till a pass is secured in such supplementary Examination within the stipulated maximum duration of the programme (Clause 5.1).

The CIA marks obtained by the candidate in his/her first or subsequent appearance where he/she secures a pass shall be retained by the office of the Controller of Examinations (COE) and considered valid for all remaining attempts till the candidate secures a pass in his/her ESE.

13.3. If the candidate fails to secure a pass in a particular course in CIA, it is mandatory that candidate shall register and reappear for the CIA in that course during the subsequent semester when CIA is conducted in that course by the faculty member assigned for that particular course during that semester by the concerned HOD. Further, the candidate should continue to register and reappear for the CIA till a pass is secured in such subsequent Examination within the stipulated maximum duration of the programme (Clause 5.1).

13.3.1. If a candidate fails to secure a pass in value added course, he/she has to appear for the tests when the course is conducted subsequently.

13.4. ONLINE COURSE (MOOC) COORDINATOR

To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a MOOC coordinator for the online courses. The online course MOOC coordinator shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinator shall advise the students regarding the online courses and monitor their course.

13.4.1. A student shall study at least one online course from Swayam in any one of the first seven semesters for which examination shall be conducted at the end of the course by the respective organization/body. The student can register to the courses which are approved by the department. The student shall produce a pass certificate from the respective body before the end of the seventh semester.

14. AWARD OF LETTER GRADES

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

LETTER GRADE	MARKS RANGE	GRADE POINT	DESCRIPTION
O	91 – 100	10	OUTSTANDING
A+	81 – 90	9	EXCELLENT
A	71 – 80	8	VERY GOOD
B+	66 – 70	7	GOOD
B	61 – 65	6	ABOVE AVERAGE
C	55 – 60	5	AVERAGE
D	50 – 54	4	PASS
RA	< 50	–	REAPPEARANCE
AB	–	0	ABSENT

14.2. GRADE SHEET

After results are declared, Grade sheet will be issued to each student which will contain the following details:

i. The list of courses enrolled during the semester and the grade scored,

ii. The Grade Point Average (GPA) for the semester and

iii. The Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

GPA is the ratio of the sum of the products of the number of Credits (C) of courses enrolled and the Grade Points (GP) corresponding to the grades scored in those courses, taken for all the courses to the sum of the number of credits of all the courses in the semester.

$$\text{GPA} = \frac{\sum(\text{Number of Credits} \times \text{Grade Points})}{\sum\text{Number of Credits}}$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from the first semester. RA grade and value added course will be excluded for calculating GPA and CGPA.

14.3. REVALUATION

Revaluation and re-totalling are allowed on representation. A candidate can apply for revaluation of his/her semester Examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Department and Dean. A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects

at a time. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the Head of the Department and Dean. Revaluation is not permitted for Supplementary Examinations, Practical Examinations, Technical Seminars, In-plant Training and Project Work.

14.4. TRANSPARENCY AND GRIEVANCE COMMITTEE

A student may get the Photostat copy of the answer script on payment of prescribed fee if he/she wishes. The students can represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HOD, the Dean of another Faculty nominated by the University), HOD of the Department concerned, the faculty of the course and Dean from other discipline nominated by the University and the COE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External Examiner will be final. The student has to pay the prescribed fee for the same.

15. ELIGIBILITY FOR AWARD OF DEGREE

A student shall be declared to be eligible for award of Degree if he/she has

- Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
- No disciplinary action is pending against him/her.

The award of the degree must be approved by the Board of Management of Karpagam Academy of Higher Education.

16. CLASSIFICATION OF THE DEGREE AWARDED

16.1. A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses in his/her first appearance within the specified minimum number of semesters (vide Clause 5.1) securing a CGPA of not less than 8 shall be declared to have passed the Examination in First Class with Distinction.

16.2. A regular candidate or a lateral entrant is eligible to register for B.E. (Honors)/B.Tech. (Honors). If, he/she has passed all the courses in the first appearance and holds/maintains a CGPA of 8. He/She has to take an additional 20 credits by studying online courses through Swayam. Such a candidate is eligible for the award of B.E. (Honors)/B.Tech. (Honors). However, is he/she fails in securing 20 additional credits but maintains CGPA of 8 and above is not eligible for Honors degree but eligible for First Class with Distinction.

16.3. A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses within the specified minimum number of semesters (vide

Clause 5.1) plus one year (two semesters), securing CGPA of not less than 6.5 shall be declared to have passed the Examination in First Class.

16.4. All other candidates (not covered in Clauses 17.1 and 17.2) who qualify for the award of the degree (vide Clause 15) shall be declared to have passed the Examination in Second Class.

17. PROVISION FOR WITHDRAWAL FROM END SEMESTER EXAMINATION

17.1. A candidate may for valid reasons and on a prior application, be granted permission to withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

17.2. Such withdrawal shall be permitted only once during the entire duration of the degree programme. Withdrawal application shall be valid only if the candidate is otherwise eligible to write the Examination.

17.3. Withdrawal application is valid only if it is made within 10 days prior to the commencement of the Examination in that course or courses and recommended by the Head of the Department, Dean and approved by the Registrar.

17.3.1. Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions may be considered on the merit of the case.

17.4. Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction. This provision is not applicable to those who seek withdrawal during III semester.

17.5. Withdrawal from the ESE is NOT applicable to arrear Examinations.

17.6. The candidate shall reappear for the withdrawn courses during the Examination conducted in the subsequent semester.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

18.1. Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in an extraordinary situation, the candidate may apply for an additional break of study not exceeding another one year by paying the prescribed fee for the break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he/she applies to the Registrar, through the Head of the Department and Dean stating reasons thereof and the probable date of rejoining the programme.

18.2. The total number of semesters for completion of the programme from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum no. of semesters specified in Clause 5.1 irrespective of the period of break of study (vide Clause 18) in order that he/she may be eligible for the award of the degree (vide Clause 15). The candidate thus permitted to rejoin the programme at the commencement of the semester after the break shall be governed by the curriculum and regulations in force at the time of rejoining. Such candidates may have to do additional courses as per the curriculum and regulations in force at that period of time.

18.3. The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification (vide Clause 17). However, an additional break of study granted will be counted for the purpose of classification.

18.4. The total period for completion of the programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in Clause 5.1 irrespective of the period of break of study (vide Clause 18.3) in order that he/she may be eligible for the award of the degree.

18.5. If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Withdrawal' or 'Break of Study'.

19. SUPPLEMENTARY ESE

After the publication of VIII semester results, if a student has ONE arrear in any theory course of the entire programme, he/she will be permitted to apply within 15 days of the publication of results and appear for Supplementary Examination.

20. INDUSTRIAL VISIT

Every student is required to undergo one industrial visit for every semester, starting from the third semester of the programme.

21. DISCIPLINE

Every student is required to observe discipline and decorous behaviour both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. The erring student will be referred to the Disciplinary Committee constituted by the University, to enquire into acts of indiscipline and recommend to the University about the disciplinary action to be taken.

If a student indulges in malpractice in any of the ESE/CIA, he/she shall be liable for punitive action as prescribed by the University from time to time.

22. REVISION OF REGULATION AND CURRICULUM

The University may from time to time revise, amend or change the Regulations, Scheme of Examinations and Syllabi if found necessary on the recommendations of Board of Studies, Academic Council and Board of Management of Karpagam Academy of Higher Education.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs):

1. To impart skill based training to apply engineering practices to design, implement model and analyze real time problems and interpret the result.
2. To impart students with strong fundamental knowledge in the field of Electronics and Communication Engineering to meet the emerging industrial needs and to promote Research
3. To build and lead cross-functional teams upholding the professional responsibilities & ethical values.

PROGRAMME OUTCOMES (POs)

a) Apply knowledge of mathematics, basic sciences, engineering fundamentals and specialization to solve engineering problems

b) Identify , design, formulate analyze & interpret data

c) Design an integrated system with due considerations to public health, safely, societal and environment

d) Investigate , formulate and solve industrial engineering problems

e) Acquire skills to use modern engineering tools and software to solve complex engineering problems

f) Apply societal and cultural issues in professional engineering practice.

g) Understand the impact of engineering solutions in global and societal context

h) Function as a member of multidisciplinary team

i) Communicate effectively both orally and in writing

j) Recognize the need for ability to engage in lifelong learning

k) Understand the project management and finance

l) Acquire knowledge to design, develop, predict and model an electronic system and also to implement communication protocols

PROGRAMME SPECIFIC OUTCOMES(PSOs)

m) Be acquainted with the continuous learning in the field of Embedded systems, VLSI design, Communication and Signal Processing and hold expertise in the modern tools for quenching the techno-thirsty society.

n) Incorporate the socio-responsible electronics and communication engineer with leadership, teamwork skills and exhibit a commitment to the lifelong learning

SEMESTER I										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BECC101	English	2,3	e,f,g,i	2	0	2	3	40	60	100
21BECC102	Mathematics -I	1,3	a,e,g,j,k	3	1	0	4	40	60	100
21BECC141	Engineering Physics	1,3	a,b,d,e,g,j, k,l	3	1	2	5	40	60	100
21BECC142	Engineering Chemistry	2	a,b,j	3	0	4	5	40	60	100
21BEEC143	Python Programming	1,3	a,b,d,e,g,j	2	0	2	3	40	60	100
21BEEC144	Basic Electrical and Electronics Engineering	1,2	a,b,d.h,j	3	1	2	5	40	60	100
TOTAL				16	3	12	25	240	360	600

SEMESTER II										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BECC201	Communicative English	2,3	e,f,g,i	2	0	2	3	40	60	100
21BECC202	Mathematics - II	1,3	a,e,g,j,k	3	1	0	4	40	60	100
21BECC203	Semiconductor Physics	1,3	a,b,d,e,g,j, k,l	3	0	0	3	40	60	100
21BECC204	Environmental Studies	1,2,5	b,c,e,j	3	0	0	3	40	60	100
21BEEC205	Electronic Devices	1,2	a,d,j,l	3	0	0	3	40	60	100

21BEEC211	Workshop Practices	1,2	a,b,e,j	0	0	4	2	40	60	100
21BEEC212	Electronic Devices Laboratory	1,2	a,d,e,l	0	0	2	1	40	60	100
21BEEC251	Essence of Indian Knowledge Tradition	3	f	1	0	0	0	100	-	100
TOTAL				**15**	**1**	**8**	**19**	**380**	**420**	**800**

SEMESTER III										
Course Code	**Course Title**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**		
		PEO	**PO**	**L**	**T**	**P**		**CIA**	**ESE**	**Total**
								40	**60**	**100**
21BEEC301	Mathematics - III (Linear Algebra and Partial Differential Equations)	1,3	a,e,g,j,k	3	1	0	4	40	60	100
21BEEC302	Digital System Design	1,2	a,b,c,d,e,l	3	0	0	3	40	60	100
21BEEC303	Signals and Systems	1,2	a,b,c,d,l	3	0	0	3	40	60	100
21BEEC304	Electromagnetic Field	1,2	a,d,g,l	3	1	0	4	40	60	100
21BEEC305	Network Theory	1,2	a,b,c,d,j,l	3	0	0	3	40	60	100
21BEEC341	Datastructure & Algorithms	1,2	a,e,g,h	3	0	4	5	40	60	100
21BEEC311	Digital System Design Laboratory	1,2	a,b,c,d,e,l	0	0	2	1	40	60	100
21BEEC351	Constitution of India	3	f	1	0	0	0	100	-	100
TOTAL				**19**	**2**	**6**	**23**	**380**	**420**	**800**

SEMESTER IV										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC401	Mathematics - IV (Probability and Statistics)	1,3	a,e,g,j,k	4	0	0	4	40	60	100
21BEEC402	Analog Circuits	1,2	a,b,c,g,l	3	0	0	3	40	60	100
21BEEC403	Analog and Digital Communication	1,2	a,b,c,d,g,l, m	3	0	0	3	40	60	100
21BEEC404	Microprocessor & Microcontroller	1,2	a,b,c,d,g,l	3	0	0	3	40	60	100
21BEEC405	Control Systems	1,2	a,b,c,d,h,l	3	1	0	4	40	60	100
21BEEC411	Analog Circuits Laboratory	1,2	a,b,c,e,g,l	0	0	2	1	40	60	100
21BEEC412	Analog and Digital Communication Laboratory	1,2	a,b,c,d,g,l, m	0	0	2	1	40	60	100
21BEEC413	Microprocessor & Microcontroller Laboratory	1,2	a,b,c,d,g,l	0	0	2	1	40	60	100
21BEEC451	Internship	1,2,3	d,f,g,l	0	0	0	0	100	-	100
TOTAL				16	1	6	20	420	480	900

SEMESTER V										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC501	Antennas and Wave Propagation	1,2	a,b,c,d,l,m	3	1	0	4	40	60	100
21BEEC502	Internet of things	1,2	a,b,c,d,e,h l	3	0	0	3	40	60	100
21BEEC503	Digital Signal Processing	1,2	a,b,c,d,j,l, m	3	1	0	4	40	60	100
21BEEC504	Measurements and Instrumentation	1,2	a,d,j,l	3	0	0	3	40	60	100
21BEEC505	Long term Evolution (LTE) and 4G Communication	1,2	a,b,c,d,j,l	3	0	0	3	40	60	100
21BEEC5E**	Professional Elective-I	1,2	a,b,c,d,f,l	3	0	0	3	40	60	100
21BEEC511	Digital Signal Processing Laboratory	1,2	a,b,c,d,e,j, l,m	0	0	2	1	40	60	100
21BEEC512	Antenna Laboratory	1,2	a,b,c,d,e,l, m	0	0	2	1	40	60	100
21BEEC551	In plant Training	1,2,3	a,b,c,d,e,g, h,j,l	0	0	0	0	100	-	100
TOTAL				**18**	**2**	**4**	**22**	**420**	**480**	**900**

SEMESTER VI										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC601	Very Large Scale Integrated (VLSI)design	1,2	a,b,c,d,e, g,h,j,l,m	3	0	0	3	40	60	100
21BEEC602	Embedded System	1,2	a,b,c,d,e, g,h,j,l,m	3	0	0	3	40	60	100
21BEEC603	Microwave Engineering	1,2	a,b,c,d,g,l	3	0	0	3	40	60	100
21BEEC6E**	Professional Elective-II	1,2	a,b,c,d,g, h,l	3	0	0	3	40	60	100
21BECSOE**/ 21BEEEOE**/ 21BEBMEOE**	Open Elective-I	1,2,3	c,e,h,j,l	3	0	0	3	40	60	100
21BEEC611	VLSI design Laboratory	1,2	a,b,c,d,e, g,h,j,l,m	0	0	2	1	40	60	100
21BEEC612	Embedded System Laboratory	1,2	a,b,c,d,e, g,h,j,l,m	0	0	2	1	40	60	100
21BEEC613	Microwave Engineering Laboratory	1,2	a,b,c,d,g,l	0	0	2	1	40	60	100
21BEEC614	Mini Project	1,2,3	a,b,c,d,e, g,h,j,l	0	0	4	2	100	-	100
TOTAL				**15**	**0**	**10**	**20**	**420**	**480**	**900**

SEMESTER VII										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC701	Universal Human Values and Understanding Harmony	3	a,f,g,h,i,j,k, n	3	0	0	3	40	60	100
21BEEC702	Artificial Intelligence (AI)	1,2	a,b,c,d,f,h, j,l	3	0	0	3	40	60	100
21BEEC703	Digital Image Processing	1,2	a,b,c,d,l	3	0	0	3	40	60	100
21BEEC7E**	Professional Elective-III	1,2	a,b,c,j,l,m	3	0	0	3	40	60	100
21BECSOE**/ 21BEEEOE**/ 21BEBMEOE**	Open Elective-II	1,2,3	c,e,h,j,l	3	0	0	3	40	60	100
21BEEC711	Digital image processing Laboratory	1,2	a,b,c,d,e,l	0	0	2	1	40	60	100
21BEEC712	Technical Seminar	3	a,i,h,f,g	0	0	2	1	100	-	100
21BEEC791	Project Work-Phase I	1,2	a,b,c,d,e,g, h,j,l	0	0	8	4	100	-	100
TOTAL				**15**	**0**	**12**	**21**	**440**	**360**	**800**

SEMESTER VIII										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC8E**	Professional Elective-IV	1,2	a,b,c,d,e,g, h,j,l,m	3	0	0	3	40	60	100
21BEEC8E**	Professional Elective-V	1,2	a,b,c,d,e,g, h,j,l,m	3	0	0	3	40	60	100
21BEEC891	Project Work-Phase-II &Viva-Voce	1,2	a,b,c,d,e,g, h,j,l	0	0	16	8	120	180	300
TOTAL				**6**	**0**	**16**	**14**	**200**	**300**	**500**

PROFESSIONAL ELECTIVE LIST

SEMESTER V-ELECTIVE I

SEMESTER V										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC5E01	Sensors and Transducers	1,2	a,b,c,d,f,l	3	0	0	3	40	60	100
21BEEC5E02	Biomedical Electronics	1,2	a,b,c,h,l,m	3	0	0	3	40	60	100
21BEEC5E03	Fiber optic communication	1,2	a,b,c,d,f,l	3	0	0	3	40	60	100
21BEEC5E04	RADAR communication	1,2	a,b,c,d,h,l, m	3	0	0	3	40	60	100
TOTAL				12	0	0	12	160	240	400

SEMESTER VI -ELECTIVE II

SEMESTER VI										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC6E01	Multimedia Compression Techniques	1,2,3	c,e,h,j,l	3	0	0	3	40	60	100
21BEEC6E02	Pattern Recogintion	1,2	a,b,c,d,h,	3	0	0	3	40	60	100
21BEEC6E03	Nano Electronics	1,2,3	c,e,h,j,l	3	0	0	3	40	60	100
21BEEC6E04	Micro Electronic Mechanical System (MEMS)	1,2	a,c,d,g,h, m	3	0	0	3	40	60	100
TOTAL				12	0	0	12	160	240	400

SEMESTER VII - ELECTIVES III

SEMESTER VII										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC7E01	Application Specific Integrated Circuit (ASIC) Design	1,2	a,b,c,j,l,m	3	0	0	3	40	60	100
21BEEC7E02	Wireless Sensor Networks	1,2	a,b,c,d	3	0	0	3	40	60	100
21BEEC7E03	Speech and Audio Processing	1,2	a,b,c,h, j,l,m	3	0	0	3	40	60	100
21BEEC7E04	Big Data Analytics	1,2,3	a,b,c,d,e,f, g,h,k,n	3	0	0	3	40	60	100
TOTAL				12	0	0	12	160	240	400

SEMESTER VIII - ELECTIVE IV,V

SEMESTER VIII										
Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
21BEEC8E01	Field Programmable Gate Array (FPGA) based System Design	1,2	a,b,c,j,l,m	3	0	0	3	40	60	100
21BEEC8E02	Advanced Embedded Systems	1,2	a,b,c,d,e,g, h,j,l,m	3	0	0	3	40	60	100
21BEEC8E03	Smart Antennas	1,2	a,b,c,d,l,m	3	0	0	3	40	60	100
21BEEC8E04	Computer Networks	1,2	a,b,c,d,e	3	0	0	3	40	60	100
21BEEC8E05	Natural Language Processing (NLP)	1,2	b,h,	3	0	0	3	40	60	100

21BEEC8E06	Robotics and Automation	1,2	a,b,c,g,h,l	3	0	0	3	40	60	100
21BEEC8E07	Micro and Smart System Technology	1,2	a,c,d,g,h, m	3	0	0	3	40	60	100
21BEEC8E08	Cryptography and Network Security	1,2	a,b,c,h	3	0	0	3	40	60	100
TOTAL				**24**	**0**	**0**	**24**	**320**	**480**	**800**

OPEN ELECTIVE LIST

SEMESTER VI &VII

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
Biomedical Engineering										
21BEBMEOE01	Robotics in Medicine	1,3	a,d,e,l,m	3	0	0	3	40	60	100
21BEBMEOE02	Artificial organs and Implants	1,3	c,l	3	0	0	3	40	60	100
Computer Science and Engineering										
21BECSOE01	Internet Programming	1,3	a,b,c,d,e	3	0	0	3	40	60	100
21BECSOE02	Machine Learning	1,3	a,b,c,d,e,j	3	0	0	3	40	60	100
Electrical and Electronics Engineering										
21BEEEOE01	Electric Hybrid Vehicles	1,3	a,b,c,d,e,l	3	0	0	3	40	60	100
21BEEEOE02	Renewable Energy Resources	1,3	a,d,f,g,k	3	0	0	3	40	60	100

COURSES OFFERED TO OTHER DEPARTMENTS

Course Code	Course Title	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks		
		PEO	PO	L	T	P		CIA	ESE	Total
								40	60	100
Electronics and Communication Engineering										
21BEECOE01	Neural Networks and its Applications	1,2,3	a,b,c,d,e,j,l,m	3	0	0	3	40	60	100
21BEECOE02	Principles of Modern Communication System	1,2,3	a,b,c,d,e,j,l,m	3	0	0	3	40	60	100

Total number of credits: 164

Total Marks : 6200

Color code	Total Count
Employability	55
Skill Development	20
Enterpreneurship	4

B.E Electronics and Communication Engineering **2021-2022**

Semester-I

21BECC101/21BTCC101 **ENGLISH** **4H-3C**

Instruction Hours/week: L:2 T:0 P:2 **Marks:** Internal**:40** External**:60**Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To enable students to attain fluency and accuracy to inculcate proficiency in professional communication to meet the growing demand in the field of Global communication.
- To help students acquire their ability to speak effectively in real life situations.
- To inculcate the habit of reading.
- To develop their effective reading skills.
- To ensure that students use dictionary to improve their active and passive vocabulary.
- To enable students to improve their lexical, grammatical and communicative competence.

Course Outcomes

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

- Use English language for communication: verbal & non –verbal.
- Enrich comprehension and acquisition of speaking & writing ability.
- Gain confidence in using English language in real life situations.
- Improve word power: lexical, grammatical and communication competence.
- To guide the students to write business letters and other forms of technical writing.
- To enable students to prepare for oral communication in formal contexts.

UNIT I **BASIC WRITING SKILLS**

Sentence Structures - Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence- Organizing principles of paragraphs in documents - Techniques for writing precisely

UNIT II VOCABULARY BUILDING

The concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance, with prefixes and suffixes from foreign languages in English to form derivatives. - Synonyms, antonyms, and standard abbreviations.

UNIT III GRAMMAR AND USAGE

Subject-verb agreement - Noun-pronoun agreement - Misplaced modifiers – Articles – Prepositions – Redundancies – Clichés

UNIT IV LISTENING AND READING SKILLS

Note taking- viewing model interviews – listening to informal conversations – improving listening / reading comprehension – reading model prose / poems – reading exercise

UNIT V WRITING PRACTICES

Comprehension - Précis Writing - Essay Writing Listening Comprehension - Common Everyday Situations: Conversations and Dialogues - Communication at Workplace – Interviews - Formal Presentations

Note: Students shall have hands on training in improving listening skill in the language laboratory @ 2 periods per each unit.

Suggested Readings

1. Sangeeta Sharma , Meenakshi Raman, .(2015),Technical Communication: Principles And Practice, 2nd Edition, OUP, New Delhi.
2. Sanjay Kumar and PushpLata, (2011), Communication Skills ,Oxford University Press.
3. Liz Hamp - Lyons and Ben Heasly, (2006), Study Writing, Cambridge University Press
4. F.T. Wood., (2007), Remedial English Grammar, Macmillan.
5. Michael Swan, (1995). Practical English Usage, OUP.

21BECC102/21BTCC102 **Semester-I**

MATHEMATICS -I **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To understand geometrical aspects of curvature and elegant application of differential calculus which are needed in Engineering applications.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model Engineering problems.
- To familiarize the student with functions of several variables which is the foundation for many branches of Engineering.
- To introduce sequence and series which is central to many applications in Engineering.

Course Outcomes

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

- To solve the rank, Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices and the students will be able to use matrix algebra techniques for practical applications.
- To equip the students to have basic knowledge and understanding in one field of materials, differential calculus
- To solve simple standard examples using the ideas of differential equations.
- To apply various techniques to solve Partial Differential Equations
- To develop the tool of power series for learning advanced Engineering Mathematics.
- To apply the knowledge acquired to solve various Engineering problems.

UNIT I MATRICES

Introduction - Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic forms – Reduction to canonical form through orthogonal reduction. Simple problems using Scilab.

UNIT II DIFFERENTIAL CALCULUS

Overview of Derivatives - Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes- Evolutes as Envelope of normals

UNIT III DIFFERENTIAL EQUATIONS

Linear Differential equations of second and higher order with constant coefficients – Homogeneous equation of Euler's and Legendre's type – Method of variation parameters.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives- Homogeneous functions and Euler's theorem - Total derivative -Differentiation of implicit functions - Jacobians -Partial differentiation of implicit functions-Taylor's series for functions of two variables- Errors and approximations - Maxima and minima of functions of two variables- Lagrange's method of undetermined multipliers.

UNIT V SEQUENCES AND SERIES

Sequences: Definition and examples – **Series:** Types and Convergence – Series of positive terms – Tests of convergence: Comparision test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

Total : 60

Suggested Readings:

1. Grewal B.S., (2014), Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Delhi.
2. Erwin Kreyszig, (2016), Advanced Engineering Mathematics, 10th Edition, John Wiley, India.
3. BaliN.P. and Manish Goyal, (2014), A text book of Engineering Mathematics, Laxmi Publications, New Delhi, India.
4. Veerarajan T**,** (2008), Engineering Mathematics for first year,Tata McGraw-Hill, New Delhi,.
5. Ramana B.V**,** (2010), Higher Engineering Mathematics, 11th Reprint, Tata McGraw Hill New Delhi.
6. Hemamalini. P.T**,** (2014), Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.
7. ThomasG.B and. FinneyR.L**,** (2002), Calculus and Analytic geometry, 9th Edition,Pearson**,**.
8. Michale D. Greenberg, (2011),Advanced Engineering Mathematics, 2nd Edition, Books Pearson Education, First Indian reprint.
9. Peter V. O'Neil,(2012), Advanced Engineering Mathematics, 7th Edition, Cengage learning.
10. Gilbert Strang, (2009), Introduction to Linear Algebra, 4th Edition, Wellesley- Cambridge Press.

Websites :

1. www.efunda.com
2. www.mathcentre.ac.uk
3. www.intmath.com/matrices-determinants
4. www. Intmath.com/calculus/calculus-intro.php

21BECC141/21BTCC141 **Semester-I**

Engineering Physics **6H-5C**
(Theory & Lab.)

Instruction Hours/week: L:3 T: 1 P:2 **Marks:** Internal**:40** External**:60** Total**:100**
End Semester Exam:3 Hours

(i)Theory

Course Objectives

The Goal of this course is for students to

- Inculcate the basics of properties of matter, sound and its applications.
- Learn laser with appropriate applications.
- Learn optical fiber with its applications.
- Disseminate the fundamentals of thermal physics and their applications.
- Introduce the concepts of quantum mechanics for diverse applications.
- Impart the basic knowledge of crystal and its various crystal structures.

Course Outcomes

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

- Understand the elastic nature of materials.
- Infer the characteristics of laser for various engineering applications.
- Extend the knowledge on optical fiber for communication purposes.
- Illustrate the thermal properties of materials through various methods.
- Develop the idea of quantum mechanics through applications.
- Identify the different atomic arrangements of crystals and its defects.

UNIT I PROPERTIES OF MATTER AND SOUND

Elasticity – basic definitions, stress - strain diagram - factors affecting elastic modulus and tensile strength – Poisson's ratio – Twisting couple - Torsion pendulum- bending of beams – bending moment – young's modulus – cantilever method, uniform and non-uniform bending – I- shaped girders.

Loudness, decibel, echo, reverberation, Sabine's formula, Ultrasonic – Production, Industrial and medical applications.

UNIT II LIGHT, LASER AND FIBER OPTICS

Light – interference – reflection, refraction – Air wedge - LASER- Principle – characteristics - emission and absorption process - Einstein's coefficients derivation. Types of LASER - Nd:YAG, CO_2, Semiconductor LASER- Applications of LASER in industry and medicine.

Fiber optics: Total internal reflection – modes of propagation of light in optical fibers – numerical aperture and acceptance angle – types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram) - Fiber optic sensors: pressure and displacement.

UNIT III THERMAL PHYSICS

Introduction– thermal expansion of solids and liquids – expansion joints – bimetallic strips – Mode of heat transfer - heat conductions in solids – thermal conductivity – derivation, Phonons - 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 IV – QUANTUM PHYSICS

Merits of quantum theory, Demerits of classical theory – Black body radiation, Photo electric effect – Compton scattering: experimental description, dual nature of matter and radiation – de Broglie wavelength, uncertainty principle – Schrödinger's wave equation – time dependent and time independent equations – particle in one dimensional box- physical significance of wave function, Scanning Electron Microscope, Transmission Electron Microscope.

UNIT V – CRYSTAL PHYSICS

Crystalline materials – types - unit cell, primitive cell, intercepts, interfacial angle - crystal systems, Bravais lattices, Miller indices – determination of inter-planar distances - Coordination number and packing factor for SC, BCC, FCC, HCP structures-crystal imperfections: point defect, line defect, surface and volume defect. Crystal growth techniques: Czochralski and Bridgman method.

Suggested Readings

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, 2015.
2. Gaur R.K. and Gupta S.L, Engineering Physics, Dhanpat Rai Publications, 2012.
3. Pandey .B.K. & Chaturvedi .S, Engineering Physics, Cengage Learning India, 2012.
4. Halliday.D., Resnick R. & Walker. J, Principles of Physics, Wiley, 2015.
5. Charles Kittel, Kittel's Introduction to Solid State Physics, Wiley India Edition, 2019.
6. P.M. Mathews, K.Venkatesan, A text book of Quantum Mechanics, 2/e, Mc Graw Hill Education, 2017.
7. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
8. Fiber Optics and Optoelectronics, R P Khare, Oxford, 2012.
9. Daniel V.Schroeder, An Introduction to Thermal Physics, Pearson, 2014.
10. D.S. Mathur, Elements of properties of matter, S.Chand, 2010.

Journals

1. Nature Physics.
2. Journal of Applied Mechanics (ASME).
3. Ultrasonics and sonochemistry (Elsevier).
4. Journal of Light wave Technology (IEEE).
5. Optics and Laser Technology (Elsevier).
6. Applied Thermal Engineering (Elsevier).
7. Physical Review B (American Physical Society).

Web links

1. https://nptel.ac.in/courses/122/103/122103011/
2. https://nptel.ac.in/courses/113/104/113104081/
3. http://hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html

(ii) Laboratory

Course Objective:

- To learn the basic concepts in physics relevant to different branches of Engineering and Technology.

Course Outcome:

- To familiarize the properties of material and basic concepts in physics.

List of Experiments (Any 10 Experiments)

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
2. Uniform bending (or) Non-uniform Bending – Determination of young's modulus.
3. Viscosity of liquids-Determination of co-efficient of viscosity of a liquid by Poiseuille's flow .
4. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
5. Laser- Determination of the wave length of the laser using grating, Acceptance angle of optical fiber.
6. Spectrometer- Determination of wavelength using grating.
7. Air wedge – Determination of thickness of a thin sheet/wire.
8. Lee's disc – Determination of thermal conductivity.
9. Determination of Band gap of a semiconductor.
10. Potentiometer – Determination of thermo emf of a thermo couple.
11. Characteristics of photo diode.
12. Particle size determination using LASER.

21BECC142 **ENGINEERING CHEMISTRY** **7H-5C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Concepts in chemistry for engineering

Course Objective

The goal of this course is for students to

- Study the basics of Periodic properties, Intermolecular forces
- Understand the terminologies of electrochemistry
- Study about energy storage devices
- Understand the concept of corrosion and its prevention
- Comprehend the basic water technology and its purification.
- Study about spectroscopic technique

Course Outcomes

Upon completion of the course the students will be able to

- Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- Analyze the mechanism of different energy storage devices.
- Rationalize different types of corrosion and its prevention.
- List the various methods in the purification of water.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I PERIODIC PROPERTIES, INTERMOLECULAR FORCES

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICES

Thermodynamic functions. Free energy and emf. Cell potentials, the Nernst equation and applications. Types of electrodes Standard Hydrogen Electrode (SHE) & Calomel. Energy storage devices Primary and secondary cells leclanche cell, Lead Acid Battery, Nickel Cadmium Battery, Lithium Battery Charging and discarging reactions.

UNIT III CORROSION AND ITS CONTROL

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions –Inorganic coatings-Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hot dipping

UNIT IV WATER TECHNOLOGY

Sources-Characteristics – Specification for drinking water, BIS &WHO-Alkalinity – Types of alkalinity and determination – Hardness – Types and estimation by EDTA method - Domestic water treatment – Disinfection methods (Chlorination, Ozonation. UV treatment) – Boiler feed water – Requirements – Disadvantages of using hard water in boilers – Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) – External conditioning – Demineralization process – Desalination - Reverse osmosis.

UNIT V SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Spectroscopy (Principles and Instrumentation only).Electronic spectroscopy.Vibrational and rotational spectroscopy. Applications. Surface characterization techniques Scanning electron microscope (SEM) and Transmission electron microscopy (TEM). Fluorescence and its applications in medicine.

Suggested Readings

1. B. H. Mahan, (2010).University chemistry, Pearson Education,
2. M. J. Sienko and R. A. Plane, Chemistry: Principles and Applications.
3. C. N. Banwell, (2001)Fundamentals of Molecular Spectroscopy, McGraw-Hill,.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)
5. P. W. Atkins, (2009).Physical Chemistry, Oxford University Press,
6. K. P. C. Volhardt and N. E. Schore, (2014).5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman,
7. P C Jain & Monica Jain, (2015).Engineering Chemistry, DhanpatRai Publishing Company,

(ii) Chemistry Laboratory

Course Objectives

The goal of this course is for students

- To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

Course Outcomes

Upon completion of the course the students will be able to

1. The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
2. Estimate rate constants of reactions from concentration of reactants/products as a function of time
3. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc

Choice of 10 experiments from the following:

1. Determination of surface tension and viscosity
2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixure using volumetric titration
3. Determination of Ca / Mg using complexometric titration
4. Thin layer chromatography
5. Determination of chloride content of water
6. Determination of the rate constant of a reaction
7. Conductometry - Determination of cell constant and conductance of solutions
8. pH Metry – Determination of Acid / Base
9. Potentiometry - determination of redox potentials and emfs
10. Saponification/acid value of an oil
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Semester-I

21BECC143 **PYTHON PROGRAMMING** **4H-3C**

(Theory & Lab)

Instruction Hours/week: L:2 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

Students undergoing this course are exposed to:

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Indicate the use of regular expressions and built-in functions to navigate the file system.
- Infer the Object-oriented Programming concepts in Python.
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications.

COURSE OUTCOMES:

Upon Completion of this course, the student will be able to:

- Explain various operators used in python.
- Apply the string handling functions to solve the given problem
- Describe Object oriented concepts with python
- Use image processing techniques in python programming to solve a given problem
- Discuss the functions of networking in python
- Solve a given analogy

UNIT I INTRODUCTION

Installing Python; basic syntax, interactive shell, editing, saving, and running a script variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages;

UNIT II CONDITIONAL STATEMENT & STRING HANDLING

Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation – Manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-

separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers.

UNIT III OBJECT ORIENTED PROGRAMMING WITH PYTHON

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects – OOP, continued: inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block

UNIT IV IMAGE PROCESSING WITH PYTHON

Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions Simple Graphics and Image Processing: "turtle" module; simple 2d drawing – colors, shapes; digital images, image file formats, image processing Simple image manipulations with 'image' module (convert to b/w, rayscale, blur, etc).

UNIT V NETWORKING WITH PYTHON

Multithreading, Networks, and Client/Server Programming; introduction to HTML, interacting with remote HTML server, running html-based queries, downloading pages; CGI programming, programming a simple CGI form.

TEXT BOOK:

1. Shroff ,"Learning Python: Powerful Object-Oriented Programming: 5th Edition, Fifth edition (24 July 2013)
2. Timothy A. Budd 'Exploring Python' – TATA McGRAW-HILL Edition - 2011
3. Vamsi Kurama , "Python Programming: A Modern Approach", Pearson Education, 2018.

REFERENCE BOOKS :

1. "Python Essential Reference". Addison-Wesley Professional; 4 edition (July 19, 2009) by David M.Baezly
2. "Python Cookbook" O'Reilly Media; 3rd edition (June 1, 2013) by David M. Baezly.
3. Guido Van Rossum, Fred . L. Drake 'Introduction to Python' – Network Theory Limited – March 2011
4. Alex Martelli 'Python in a Nutshell' - O'Reilly - 2nd Edition, 2006

WEBSITES:

1. https://www.codecademy.com/learn/python
2. www.learnpython.org/

(ii) Laboratory

PYTHON PROGRAMMING

Course objectives:

Students undergoing this course are exposed to:

- Write simple Python programs.
- Test and debug Python Programs.
- Implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.

Course Outcomes:

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

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

List Of Experiments:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball in Pygame

21BEEC144 **Basic Electrical & Electronics Engineering (Theory & Lab.)** **6H-5C**

Instruction Hours/week: L:3 T:1 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

i)Theory

Course Objectives

The goal of this course for students is :

- To impart the basic knowledge about the Electric circuits.
- To understand the concept of Electro Mechanical Energy Conversion and Transformers.
- To inculcate the knowledge of two port networks.
- To understand the working of Semiconductor devices and Measuring Instruments.
- To design digital circuits for real time applications.
- To impart the basic knowledge of Digital Circuits.

Course Outcomes

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

- Attributing the electric circuits with DC and AC excitation by applying various circuit laws.
- Attributing the magnetic circuits and transformer.
- Reproduce the two port networks.
- Evaluate the various digital circuits in real time applications.
- Analysis various semiconductor devices in real time applications.
- Reproduce the Measuring Instruments.

UNIT I DC CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT II AC CIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III ELECTRICAL MACHINES AND TRANSFORMER

Construction and working of a three-phase and Single-phase induction motor. Construction, working and speed control of DC motor. Magnetic materials, BH characteristics, Construction and working principle of ideal and practical transformer.

UNIT IV SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS

Bipolar Junction Transistor – Characteristics. Introduction to operational Amplifier –Model– Applications. Number systems – binary codes - logic gates - Boolean algebra, laws & theorems

UNIT V MEASURING INSTRUMENTS AND ELECTRICAL INSTALLATION

Principle, construction, and operation of moving coil and moving iron meters-Measurement of Power. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, RCCB, MCCB. Earthing. Types of Batteries and its application in Electric Vehicle, Important Characteristics for Batteries. Elementary calculations for energy consumption and battery back up

Suggested Readings

1. S.K.Bhattacharya, "Basic Electrical Engineering", Pearson, 2019.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
4. V N Mittle and Arvind Mittal,(2006) ,Basic Electrical Engineeering, McGraw Hill.
5. A.Sudhaka and Shyammohan S Palli,(2013), Circuits and Networks, McGraw Hill.
6. R.Muthusubramanian and S.Salivahanan,(2014),Basic Electrical and Electronics Engineering, McGraw Hill.

WEBSITES:

1. www. nptel.ac.in.
2. encyclopedia-magnetica.com/doku.php/coenergy.
3. https://en.wikibooks.org/wiki/electronics/measuring instruments.

ii) Basic Electrical & Electronics Engineering Laboratory

COURSE OBJECTIVES

The goal of this course is for students to

a. Impart the basic knowledge about the DC and AC Electric circuits.
b. Understand the working of DC Machines and Energy Meter.
c. Impart the knowledge of Logical digital circuits and their differences.

COURSE OUTCOMES

After completion of this course, students will be able to

d. Understand and analyze basic electric and magnetic circuits.
e. Understand and analyze the working principles of DC Machines and Energy Meter.
f. Verify the truth table of Logic Gates.

List of Experiments

1. Experimental verification of electrical circuit problems using Ohms law
2. Experimental verification of electrical circuit problems using Kirchoff's Voltage law.
3. Experimental verification of electrical circuit problems using Kirchoff's Current law.
4. Measurement of electrical quantities – voltage, current, power & power factor in R load.
5. Measurement of energy using single phase energy meter.
6. Speed control of DC Shunt Motor.
7. Verification of truth table of Logic Gates.

Semester-II

21BECC201/21BTCC201 COMMUNICATIVE ENGLISH 4H-3C

Instruction Hours/week: L:2 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students :

- To help students acquire their ability to speak effectively in real life situations.
- To enable students to communicate in effective way without any barriers.
- To inculcate the habit of listening
- To develop their effective listening skills.
- To ensure that students use different aids in order to attain effective communication.
- To enable students to improve their group behavior and presentation skill.

Course Outcomes

Students undergoing this course will be able to:

- Enrich comprehension and acquisition of listening, speaking & writing ability.
- Gain confidence in using English language and develop leadership qualities.
- Guide the students to effectively manage the team as a team player.
- Develop the students Interpersonal and Interview skills.
- Use English language for communication: verbal & non –verbal
- Prepare for oral communication in formal contexts.

UNIT I COMMUNICATION SKILLS

Communication Skills: Introduction, Definition, The Importance of Communication

The Communication Process – Source, Message, Encoding, Channel, Decoding Receiver, Feedback, Context

Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional Barriers

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective-Past Experiences, Prejudices, Feelings, Environment

UNIT II ELEMENTS OF COMMUNICATION

Introduction, Face to Face Communication- Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

UNIT III BASIC LISTENING SKILLS

Introduction, Self-Awareness, Active Listening, Becoming anActive Listener, Listening in Difficult Situations.

Effective Written Communication: Introduction, When and When Not to Use Written Communication-Complexity of the Topic, Amount of Discussion's Required, Shades of Meaning, Formal Communication.

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience Organization of the Message.

UNIT IV INTERVIEW SKILLS AND GIVING PRESENTATIONS

Purpose of an interview, Do's and Don'ts of an interview- Dealing with Fears, planning your Presentation, Structuring YourPresentation, Delivering Your Presentation, Techniques of Delivery.

UNIT V WRITING PRACTICES

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion

Note: Students shall have hands on training in improving Speaking skill in the language laboratory @ 2 periods per each unit.

Suggested Readings

1. SanjayKumar,Pushpalata, (2011),Communicationskills,1st EditionOxfordPress.
2. Konarnira, (2011), Communication Skills forprofessionals,2nd EditionNew arrivals.
3. JohnAdair,4th Edition, (2009), . Effectivecommunication, 1stEdition CengageLearning
4. Indiapvt.ltd
5. ButterField, (2011), Softskillforeveryone, Macmillan.
6. Stephen.P.Robbins, (2013).Communicationskills, OxfordPress

B.E Electronics and Communication Engineering **2021-2022**

21BECC202/21BTCC202 **Semester-II**

Mathematics -II **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for the students

- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To calculate and establish identities connecting these quantities, to evaluate line, surface and volume integrals in simple coordinate systems and to use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
- To enable the students to apply the knowledge of Mathematics in various Engineering fields.
- To identify the functions in engineering problems as analytic function and their study as a function of a complex variables.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, to specify some difficult integration that appear in applications can be solved by complex integration in application areas such as fluid dynamics and flow of the electric current.
- To use Laplace transforms efficiently for solving the problems that occur in various branches of engineering disciplines.

Course Outcomes:

Upon completion of this course the students will be able to:

- Apply integration to compute multiple integrals, area, volume, integrals in polar and Cartesian coordinates, in addition to change of order and vector integration.
- Acquaint the student with the concepts of vector calculus, needed for problems in all Engineering disciplines
- Find the Analytic functions using the Cauchy Riemann equations and they will learn mapping properties of elementary functions and mapping properties of some special transcendental functions.
- Understand relations between conformal mappings and quadratic differentials and how geometric structures are changing under conformal mappings.
- Evaluate complex integrals using the Cauchy integral formula and the residue Theorem and to appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

UNIT I MULTIPLE INTEGRALS

Double integral – Cartesian coordinates – Polar coordinates – Area as double integrals -Change of order of integration – Triple integration in Cartesian co-ordinates

UNIT II VECTOR CALCULUS

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem, Gauss divergence theorem and Stoke's theorems (Statement Only)- Surfaces : hemisphere and rectangular parallelopipeds.

UNIT III ANALYTIC FUNCTIONS

Analytic functions - Cauchy-Riemann equations in Cartesian and polar forms – Sufficient condition for an analytic function (Statement Only) - Properties of analytic functions – Constructions of an analytic function - Conformal mapping: w = z+a, az, 1/z and bilinear transformation.

UNITI V COMPLEX INTEGRATION

Complex Integration - Cauchy's integral theorem and integral formula (Statement Only) – Taylor series and Laurent series - Residues – Cauchy's residue theorem (Statement Only) - Applications of Residue theorem to evaluate real integrals around unit circle and semi circle (excluding poles on the real axis).

UNIT V LAPLACE TRANSFORM

Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and final value theorems. Inverse Laplace transforms – Convolution theorem (statement only) – Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms – Transform of periodic functions.

Total : 60

Suggested Readings:

1. Grewal, B.S., (2014), Higher Engineering Mathematics Khanna Publishers, New Delhi, 43rd Edition.
2. Kreyszig Erwin, (2016), Advanced Engineering Mathematics , John Wiley and Sons, 10th Edition, New Delhi.
3. Bali N. P and Manish Goyal, (2011), A Text book of Engineering Mathematics, Eighth Edition, Laxmi Publications Pvt Ltd.
4. Ramana B.V, (2008), Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi.
5. Kandasamy. P, Thilagavathy. K, Gunavathy. K.,(2008), Engineering Mathematics, S Chand & Co. Ltd, New Delhi.
6. Hemamalini. P.T**,** (2014), Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.

7. Venkataraman, M. K.,(2005), Engineering Mathematics, The National Publishing Company, Chennai.
8. Dass, H.K., and Er. Rajnish Verma,(2011), Higher Engineering Mathematics, S. Chand Private Ltd.
9. Glyn James,(2012), Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education,
10. Peter V. O'Neil,(2012), Advanced Engineering Mathematics, 7th Edition, Cengage learning.
11. Sastry.S.S,(2014), Engineering Mathematics''. Vol.I&II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi.
12. Wylie, R.C. and Barrett. L.C., (2012), Advanced Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi.
13. Narayanan. S, Manicavachagampillay.T.K and Ramaniah, (2002),Advanced Mathematics for Engineering Students, Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai.

Websites:

1. www.intmath.com
2. www.efunda.com
3. www.mathcentre.ac.uk
4. www.sosmath.com/diffeq/laplace/basic/basic.html

21BECC203 **Semester-II**

Semiconductor Physics **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The Goal of this course is for students to

- Understand the fundamentals of electrons flow and band structure.
- Inculcate the characteristics of electronic materials through basics.
- Divulge knowledge on the basics of semiconducting materials for diode applications.
- Introduce the features of light interaction with semiconductor for optoelectronic applications.
- Impart the basic knowledge of new semiconducting materials for engineering applications.
- Know the various properties of semiconductors and diverse applications.

Course Outcomes

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

- Acquire knowledge on the transport of electrons and various bands in solid structure.
- Get the fundamental concepts semiconductors for device fabrication process.
- understand the magnetic, dielectric and superconting properties for various engineering applications.
- Have sound knowledge on interaction of light with semiconductor for different optoelectronic device applications.
- Acquire the knowledge on basic properties of modern electronic materials and their engineering applications.
- Understand the various properties of semiconductors and diverse applications.

UNIT I ELECTRONIC MATERIALS

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass.

UNIT II SEMICONDUCTORS

Intrinsic and extrinsic semiconductors – carrier concentration, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Hall effect – Determination of Hall coefficient.

UNIT III MAGNETIC, DIELECTRIC, SUPERCONDUCTING PROPERTIES OF MATERIALS

Magnetism in materials - magnetic field and induction - magnetization, magnetic permeability and susceptibility, types of magnetic materials - Ferromagnetism: origin and exchange interaction, Domain Theory, soft and Hard magnetic materials - Dielectric materials: Polarization, Types - dielectric loss, internal field, Clausius - Mosotti relation, dielectric breakdown - Superconductors – properties – Applications.

UNIT IV LIGHT-SEMICONDUCTOR INTERACTION

Optical transitions in bulk semiconductors - Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model - Principle, construction, working and applications of LED, Solar cell, photo diode, QLED (Quantum dot LED).

UNIT V ENGINEERED SEMICONDUCTOR MATERIALS

Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots- Nanostructures - design, fabrication, methods of fabrication (anyone physical and chemical method) – Carbon nanotubes - Coulomb blockade, single electron transistor, Giant magneto resistance (GMR), spintronics.

Suggested Readings

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, (2015).
2. J Donald Neamen, Dhrubes Biswas Semiconductor Physics And Devices, McGraw Hill Education; 4 edition, (2017).
3. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, wiley Publishers, (2006).
4. Leszek Malkinski, Advanced Magnetic Materials , Published by InTech, (2012).
5. Michael Shur, Physics of Semiconductor Devices, Published by Pearson Education; First edition, (2019).
6. Kulkarni, Sulabha K , Nanotechnology: Principles and Practices, Springer International Publishing, (2015).

Journals

1. IEEE Transactions for Semiconductor Manufacturing (IEEE).
2. Materials Science in Semiconductor Processing (Elsevier).
3. Semiconductor Science and Technology (Institute of Physics).
4. Journal of Electronic Materials (IEEE/TMS).
5. Nature Nanotecnnolgy.

Web Links

1. https://nptel.ac.in/courses/115102025/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/MIT6_012F09_lec01.pdf

21BECC204 **ENVIRONMENTAL STUDIES** **3H-3C**

Instruction Hours / week L: 3 T: 0 P: 0 **Marks:**Internal:**40** External:**60** Total: **100**

End Semester Exam: 3 Hours

Course Objectives

The goal of this course is for students to

- Create the awareness about environmental problems among people.
- Develop an attitude of concern for the environment.
- Motivate public to participate in environment protection and improvement.
- Understand concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Develop an attitude towards cross-cultural and historical context of environmental issues
- Understand about their roles and responsibilities as citizens & consumers

Course Outcomes (COs)

Upon completion of the course the students will be able to

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem.

Forest ecosystem, GrasslandEcosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES

Natural resources - Renewable and Non – Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources -Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources- Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water.Use of alternate energy sources, growing energy needs, case studies.Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III BIODIVERSITY AND ITS CONSERVATION

Levels of biological diversity - genetic, species and ecosystem diversity.Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution.Nuclear hazards and human health risks. Solid waste management and control measures of urban, industrial and e-wastes. Role of an individual in prevention of pollution. Case studies.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT

Concept of sustainability and sustainable development. Water conservation -Rain water harvesting, watershed management.Climate change, global warming, ozone layer depletion,acid rain andits impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols).Resettlement and rehabilitation of projectaffected persons.Disaster management (floods, earthquake, cyclones and landslides).EnvironmentalMovements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Roleof Indianand other religions and cultures in environmental conservation. Environmental communication and public awareness,case studies (e.g., CNG vehicles in Delhi).Human population growth: Impacts on environment, human health and welfare.

Suggested Readings

1. Anonymous. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
2. Anubha Kaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
4. Daniel, B. Botkin., and Edward, A. Keller. 1995. Environmental Science John Wiley and Sons, Inc., New York.
5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S.Chand& CompanyPvt. Ltd., New Delhi.
6. Odum,E.P., Odum, H.T. and Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
7. Rajagopalan, R. 2016.Environmental Studies: From Crisis to Cure, Oxford University Press**.**
8. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
9. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources.Daya Publishing House, New Delhi.
10. Tripathy. S.N., andSunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.
11. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology).S.Chand and Company Ltd, New Delhi.
12. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

21BEEC205 **ELECTRONIC DEVICES** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

Course Objectives

The goal of this course for students is :

- To understand the working of Semiconductor PN junction
- To familiarize the working of special purpose diodes
- To study the working principle of Bipolar Transistors (BJT)
- To impart knowledge on working of Field Effect Transistor (FET)
- To understand the concept of Rectifiers and Voltage regulators.
- To provide the knowledge about the fabrication process of monolithic Integrated Circuits (IC)

Course outcomes

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

- Identify the operating characteristics of various diodes
- Analyze the biasing circuits for transistor
- Examine the VI characteristics of various FET devices
- Design power supply for various application
- Design regulators for different application
- Gain knowledge about IC fabrication process.

UNIT I SEMICONDUCTOR DIODES

Overview of Semiconductors: Intrinsic Semiconductor – Extrinsic Semiconductor – Drift – Diffusion. Semiconductor Diode : Formation of PN Junction Diode Working principle – VI characteristics– Voltage Breakdown in Diodes.

Special Purpose Diodes : Zener Diode –Varactor Diode – Point-Contact Diode – Backward Diode - Step Recovery Diode – Schottky Diode - PNPN Diode –Schottky Diode – LED and its applications

UNIT II BIPOLAR JUNCTION TRANSISTOR

Bipolar Transistors: Construction – working – Ebers - Moll model- large signal current gains. Transistor Configurations: Common base configurations, common emitter configurations and common collector configurations - Input and output characteristics - Early effect - regions of operation. - Need for stability of Q-Point - Bias stability - fixed bias - collector to base bias - self bias –Application of transistor

UNIT III FIELD EFFECT TRANSISTORS

Field-Effect Transistors: construction, working and VI characteristics of JFET – comparison of BJT and JFET – MOSFET: Enhancement MOSFET- Depletion MOSFET - Working Principle and VI Characteristics of MOSFET and its applications - Comparison of MOSFET with JFET - Comparison of D MOSFET with E MOSFET.

UNIT IV DC POWER SUPPLIES

Rectifiers and Filters: Block schematic of a typical DC power supply - single phase Half Wave Rectifier - Full Wave Rectifier - full wave bridge rectifier - power supply filters (ripple factor and efficiency analysis)

Voltage regulators: voltage regulator –types of Voltage Regulator - Series Voltage regulator - Zener Diode Shunt Regulator - Transistor Series Regulator - Transistor Shunt Regulator - Switching Regulators

UNIT V IC FABRICATION

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering.

Suggested Readings

1. Millman J and Grabel A, "Microelectronics", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Third Edition, 2000.
2. Boylestead L R and Nashelsky L, "Electronic Devices and Circuit theory", Pearson Education India, New Delhi,Ninth Edition, 2006.
3. Thomas L Floyd, "Electronic Devices", Pearson Education India, New Delhi, Seventh Edition, 2007.
4. David A Bell, "Electronic Devices and Circuits", Prentice Hall of India, New Delhi, Fourth Edition 2000.
5. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
6. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education 2003.
7. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.
8. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press,2010.
9. Salivahanan Electronic Devices and circuits Tata McGraw-Hill publishing company 2007

Web links

1. https://nptel.ac.in/courses/117102061/
2. https://nptel.ac.in/courses/117103063/
3. https://nptel.ac.in/content/syllabus_pdf/113106062.pdf
4. https://swayam.gov.in/nd1_noc19_ee54/preview
5. https://onlinecourses.nptel.ac.in/noc17-ee02/preview
6. www.vidyathiplus.in/2011/11electronic-device-and-circuits-edc.html/

Semester-II

21BEEC211 **WORKSHOP PRACTICES** **4H-2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam: 3 Hours

Course Objectives

The goal of this course for students is :

- To prepare the students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare the students to communicate effectively
- To use the techniques, skills, and modern engineering tools necessary for engineering practice
- To understand assembling of different components
- To fabricate components using different materials.
- To understand practical knowledge of dimensional accuracies and dimensional tolerances.

Course Outcomes

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

- Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
- Students will be able to fabricate components with their own hands.
- Gain knowledge on dimensional accuracies.
- Acquire dimensional tolerances possible with different manufacturing processes.
- Assemble different components
- Design and manufacture small devices of their interest.

(i) Lectures &videos:

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic molding, glass cutting
7. Metal casting
8. Welding

(ii) Workshop Practice:

1. Machine shop
2. Fitting shop

3. Carpentry
4. Electrical &Electronics
5. Welding shop
6. Casting
7. Plumbing Exercises

Suggested readings

1. Gowri S, Jeyapoovan, T.,Engineering Practices Lab Manual, 5th edition, Vikas Publishing House Pvt. Ltd, Chennai. 2017.
2. Bawa, H.S, Workshop Practice, 2nd edition, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2009.
3. Choudhry S K, Elements of workshop technology, Vol 2, 13th edition, Indian book distributing company, Kolkatta,2010.
4. D K Singh, Manufacturing Technology, 2nd edition, Pearson Education,2008.
5. Kalpakjian S., Steven S. Schmid, Manufacturing Engineering and Technology, 4thedition,Pearson Education India Edition,2001.
6. Roy A. Lindberg, Processes and Materials of Manufacture, 4th edition, Prentice Hall India,1997.
7. Rao P.N., Manufacturing Technology, Vol. I and Vol. II, 4th edition, Tata McGrawHill House,2018.

Semester-II

21BEEC212 ELECTRONIC DEVICES LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study the characteristics of various basic electronic devices
- To understand the characteristics of various configuration of BJT
- To learn the characteristics of JFET
- To study the working principle of rectifiers
- To expose them to power supply design
- To simulate characteristics of various circuits using PSPICE or Multisim.

Course Outcomes

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

- Design various electronic circuits for various configurations
- Analyze the working of JFET in different regions
- Describe the working of MOSFET devices
- Identify the characteristics of LDR and Photo-diode
- Construct power supply and regulators for various application
- Design and simulate circuits using simulation software

List of Experiments

1. Characteristics of PN junction and Zener diode.
2. Input, Output and Transfer characteristics of CE Configuration.
3. Input, Output and Transfer characteristics of CC Configuration.
4. Characteristics of LDR, Photo-diode and Phototransistor.
5. Transfer characteristics of MOSFET. (with depletion and enhancement mode)
6. Characteristics of LED with three different wavelengths.
7. Half wave rectifier, Full wave rectifier and Full wave Bridge rectifier with Capacitive filter.
8. Series voltage Regulator.
9. Simulation experiments1, 2,3,5,6 using PSPICE or Multisim.

21BEEC251 ESSENCE OF INDIAN KNOWLEDGE TRADITION 1H-0C

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:100** External**:-**Total**:100**

End Semester Exam:3 Hours

Course objective

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. This course focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

Course Contents

1. Basic structure of Indian Knowledge System: अ′दशिव –४वेद,४उपवेद (आयुवद, धनुवद, गववेद, ′थाप आिद) ६वेदांग (श ि, क, न ी, करण, तष, छंद) ४ उपाङ्ग (धम ा शा ◌, मीमांसा, पुराण, तक ा शा ◌)
2. Modern Science and Indian Knowledge System
3. Yoga and Holistic Health care
4. Case studies

References

1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
4. Fritzof Capra, Tao of Physics
5. Fritzof Capra, The Wave of life
6. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
7. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
8. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016
9. RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016
10. P B Sharma (English translation), Shodashang Hridayan

Semester-III

21BEEC301 MATHEMATICS-III 4H-4C

(LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS)

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives:

The goal of this course is for the students

- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations.
- To give an integrated approach to number theory and abstract algebra,
- To provide a firm basis for further reading and study in the subject.

Course outcomes:

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

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Explain the various types of partial differential equations.
- Solve the various types of partial differential equations.
- Solve Engineering problems using Fourier series.

UNIT I VECTOR SPACES

Vector spaces- Definition, Axioms, Examples of vector spaces or not vector spaces – Basic Theorems-Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence of vector spaces-Spanning of a subspace– Bases and dimensions.

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION

Linear transformation on vector space, properties of the function T- Null spaces and ranges, Definition and Examples - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

UNIT III INNER PRODUCT SPACES

Inner product space, Definitions and Examples, norms-Orthogonal and Ortho normal Basis - Gram Schmidt orthogonalization process –Ortho normal complement - Adjoint of linear operations - Least square approximation.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange‘s linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Dirichlet‘s conditions – General Fourier series – Half range sine and cosine series - Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

Total: 60

Suggested readings:

1. Grewal B.S.,(2014), Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition.
2. Friedberg, A.H., Insel, A.J. and Spence, L.,(2004), Linear Algebra, Prentice Hall of India, New Delhi.
3. James, G., (2007), Advanced Modern Engineering Mathematics, Pearson Education.
4. Kolman, B. Hill, D.R., (2009), Introductory Linear Algebra‖, Pearson Education, New Delhi, First Reprint.
5. Kumaresan, S.,(2010), Linear Algebra – A Geometric Approach, Prentice – Hall of India, New Delhi, Reprint.
6. Lay, D.C., (2015), Linear Algebra and its Applications, 5th Edition, Pearson Education.
7. O‘Neil, P.V.,(2007), Advanced Engineering Mathematics, Cengage Learning,.
8. Strang, G., (2005), Linear Algebra and its applications, Thomson (Brooks/Cole), New Delhi.
9. Sundarapandian, V. (2008), Numerical Linear Algebra, Prentice Hall of India, New Delhi.
10. Jin Ho Kwak and Sungpyo Hong, (2010), Linear Algebra, Second edition, Springer.
11. Stephen Andrilli and David Hecher,(2006), Elementary Linear Algebra, 3rd Edition, Academic Press.
12. Charles W. Curtis,(2004), Linear Algebra, Springer.
13. Howard Anton and Robert C Busby, (2003), Contemporary linear algebra, John Wiley.
14. Gilbert Strang,(2009), Introduction to Linear Algebra, 4th Edition, Wellesley- Cambridge Press.

Websites:

1. www.sosmath.com
2. www.mathworld.wolfram.com
3. www.nptel.ac.in

Semester-III

21BEEC302 **DIGITAL SYSTEM DESIGN** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To introduce basic postulates of Boolean algebra
- To simplify the Boolean expressions.
- To impart knowledge on combinational circuits.
- To design synchronous sequential circuits.
- To learn about asynchronous sequential circuits design.
- To introduce the concept of Very high speed integrated circuits Hardware Description programming Language.

Course Outcomes

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

- Design combinational circuits with optimized inputs
- Identify various computer codes and code conversion.
- Analyze various combinational logic circuits like adders and subtractors
- Design synchronous sequential logic circuits
- Analyze asynchronous sequential circuits
- Apply HDL for simulation of digital logic circuits

UNIT I NUMBER SYSTEMS AND BOOLEAN ALGEBRA

Number Systems and its conversions Number representation : Signed, Unsigned, Fixed point, Floating point. Computer codes: Weighted - BCD -2421, Gray code, Excess 3 code, ASCII code, Error detection and correction codes, Parity codes, Hamming codes, conversion from one code to another. Boolean postulates and laws –De-Morgan's Theorem–Boolean expression – Boolean function- Minimization of Boolean expressions – Sum of Products (SOP) –Product of Sums (POS)- Minterm- Maxterm- Canonical forms – Conversion between canonical forms –Karnaugh map up to 6 variable Minimization – Don't care conditions.

UNIT II LOGIC GATES AND COMBINATIONAL CIRCUITS

LOGIC GATES: AND, OR, NOT, NAND, NOR, Exclusive – OR and Exclusive – NOR- Implementations of Logic Functions using gates, NAND –NOR implementations –Multi level gate implementations - Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates.

COMBINATIONAL CIRCUITS: Design procedure – Adders-Subtractors – Serial adder/ Subtractor - Parallel adder/ Subtractor- Carry look ahead adder- BCD adder- Magnitude Comparator- Multiplexer/ Demultiplexer- encoder / decoder – parity checker. Implementation of combinational logic using MUX.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUIT

Flip flops SR, JK, T, D and Master slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering –Realization of one flip flop using other flip flops –Ripple counters – Synchronous counters –Modulo – n counter –Classification of sequential circuits – Moore and Mealy -Design of Synchronous counters: state diagram- State table –State minimization –State assignment- ASM-Excitation table and maps-Circuit implementation - Register – shift registers- Universal shift register – Shift counters – Ring counters.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS

Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table – Excitation map- cycles – Races – Hazards: Static –Dynamic –Essential –Hazards elimination.

UNIT V INTRODUCTION TO VHDL

VLSI Design flow: Design entry: Schematic, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, VHDL Simulation, VHDL constructs and codes for combinational and sequential circuits.

Suggested Readings

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition ,2006.
4. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 2004
5. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.

Web References

1. https://examupdates.in/digital-logic-design-books/
2. http://american.cs.ucdavis.edu/academic/ecs154a.sum14/postscript/cosc205.pdf
3. https://nptel.ac.in/courses/117106086/
4. https://nptel.ac.in/content/syllabus_pdf/108105113.pdf

Semester-III

21BEEC303 **SIGNALS AND SYSTEMS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To understand Linear Shift-Invariant Systems and its properties
- To learn the concepts of Fourier Transform in signal analysis.
- To inculcate the characteristics of various signals.
- To study Laplace Transform
- To familiarize with Z Transform and its application on signals
- To get familiarize of sampling of signals

Course Outcomes

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

- Analyze different types of signals
- Represent continuous systems in time and frequency domain using different transforms
- Depict discrete systems in different domain using Fourier Transform
- Investigate stability of the system
- Carry on state-space analysis of signals and its multi-input, multi-output representation
- Sample and reconstruct a signal

UNIT I INTRODUCTION TO SIGNALS AND LSI SYSTEMS

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. Impulse response and step response, convolution, input-output behavior with a periodic convergent inputs. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations and difference equations.

UNIT II FOURIER TRANSFORM

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

UNIT III SAMPLING

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

UNIT IV LAPLACE TRANSFORM ANALYSIS

The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.

UNIT V Z TRANFORM

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis. State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role.

SUGGESTED READINGS

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 2007.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.
4. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 2003.
5. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
6. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
7. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
8. Dr.J.S.Chitode, Signals And Systems.. Publisher, Technical Publications, 2009.

Web Links

1. https://swayam.gov.in/nd1_noc20_ee15/preview
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
3. https://nptel.ac.in/courses/117101055/
4. https://nptel.ac.in/courses/108104100/

Semester-III

21BEEC304 **ELECTROMAGNETIC FIELD** **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course objectives:

The goal of this course for students is :

- To impart knowledge on static electric field with its associated laws.
- To familiarize the concepts of electrostatics, electric potential, energy density.
- To gain knowledge on the application of Poisson's and Laplace's equations.
- To study the various law in static magnetic fields
- To understand magnetic field concepts
- To learn the concept of Maxwell's equations

Course Outcomes:

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

- Analyze field potentials due to static changes and static magnetic fields.
- Explain how properties of materials affect electric and magnetic fields.
- Analyze time varying conditions using various laws
- Apply Magnetic boundary conditions in evolving magnetic fields.
- Understand Faraday's law for Electromagnetic induction
- Apply Maxwell's equations to evaluate the boundary conditions

UNIT I STATIC ELECTRICFIELD

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charged distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electro static Energy and Energy density.

UNIT II CONDUCTORS AND DIELECTRICS

Conductors and dielectrics in Static Electric Field, Current and current density, Continuity equation, Polarization, Method of images, Resistance of a conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundary conditions for perfect dielectric materials, Poisson's

equation, Laplace's equation, Solution of Laplace equation, Application of Poisson's and Laplace's equations.

UNIT III STATIC MAGNETIC FIELDS

Biot- Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere's Circuital Law, Point form of Ampere's Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

UNIT IV MAGNETIC FORCES AND MATERIALS

Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature magnetic materials, Magnetization and permeability, Magnetic boundary conditions in evolving magnetic fields, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance, Basic expressions for self and mutual inductances, Inductance evaluation for solenoid, toroid, coaxial cables and transmission lines, Energy stored in Magnetic fields.

UNIT V TIME VARYING FIELDS AND MAXWELL'S EQUATIONS

Fundamental relations for Electro static and Magneto static fields, Faraday's law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form of Maxwell's equations, Integral form of Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Electromagnetic Spectrum.

Suggested Readings:

1. WilliamH Haytand Jr.JohnA Buck Engineering Electromagnetic Tata McGraw-Hill Publishing Company Ltd New Delhi 2008
2. Sadiku M H Principles of Electro magnetics Oxford University Press Inc, New Delhi 2009
3. DavidK Cheng Field and Wave Electromagnetic Pearson Education Inc, Delhi 2004
4. John D Kraus and DanielAFleisch," Electromagnetic with Applications McGraw Hill Book 2005.
5. Karl E Longman and Sava V Savov Fundamentals of Electromagnetic Prentice Hall of India New Delhi 2006
6. Ashutosh Pramanic Electromagnetism Prentice Hall of India, New Delhi 2006

Web links

1. https://swayam.gov.in/nd1_noc20_ph08/

Semester-III

21BEEC305 **NETWORK THEORY** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To introduce various laws for DC circuit analysis
- To understand various network theorems for DC circuits
- To be familiar with Tallegen's theorem for AC circuits
- To study the transient behavior of RL,RC and RLC circuits using initial and final conditions
- To learn series and parallel resonance circuits
- To make them aware of various network parameters in two port network.

Course Outcomes

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

- Analyze electrical circuits using nodal and mesh analysis.
- Apply various theorems to solve complex circuits.
- Solve complex RL,RC and RLC circuits using Laplace transforms
- Resolve different network behavior.
- Explain resonance behavior of series and parallel network.
- Analyze various two port network parameters.

UNIT I BASIC CONCEPTS AND NETWORK THEOREMS

Practical sources, Source transformations, Network reduction using Star – Delta transformation, – Voltage and Current laws -Loop and node analysis with linearly dependent and independent sources for DC and AC networks. Superposition, Millman‘s theorems, Thevinin‘s and Norton‘s theorems, Maximum Power transfer theorem.

UNIT II Graph theory

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits –Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – Trees – Properties of trees – Distance and centers in tree – Rooted and binary trees.

UNIT III TRANSIENT BEHAVIOR AND INITIAL CONDITIONS

Transient Behavior and Initial Conditions Behavior of circuit elements under switching condition and their Representation, evaluation of initial conditions in RL, RC and RLC circuits for AC and DC excitations

UNIT IV LAPLACE TRANSFORMS AND RLC ANALYSIS

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without Final conditions with Laplace transforms evaluation of Final conditions.

UNIT V RESONANT CIRCUITS AND TWO PORT NETWORK PARAMETERS

Resonant Circuits :Series and parallel resonance, frequency- response of series and Parallel circuits, Q–Factor, Bandwidth .Two Port Network Parameters: Definition of z, y, h parameters, modeling with these parameters, relationship between parameters sets.

Suggested Readings

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2019.
2. A Sudhakar., Shyammohan Palli.; "Network analysis"; Prentice hall of India, 2006.
3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 2002.
4. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education 2018.
5. Roy Choudhury, ―Networks and systems‖, 2nd edition, New Age International Publications, 2006

Web Links

1. https://nptel.ac.in/courses/108102042/
2. https://nptel.ac.in/courses/117102059/
3. https://nptel.ac.in/courses/108105065/
4. https://nptel.ac.in/courses/117101053/
5. https://swayam.gov.in/nd1_noc20_ee46/preview
6. https://nptel.ac.in/courses/117/106/117106108/

SEMESTER III

21BEEC341 DATASTRUCTURE&ALGORITHMS 7H-5C

(THEORY & LAB)

Instruction Hours/week: L: 3 T:0 P:4 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) Theory

Course Objectives:

The goal of this course is for the students to

- Impart the basic concepts and the operations of data structures like Stacks, queues, lists.
- Understand concepts about searching and sorting techniques
- Understand basic concepts of nonlinear data structures like stacks, trees and graphs.
- Analyze the given algorithms.
- Enable the motto write algorithms for solving problems with the help of fundamental data structures
- Analyze Graph search and traversal algorithms

Course outcome:

Upon Completion of this course the student will be able:

- To analyze the algorithms to determine the time and computation complexity and justify the correctness.
- To implement Linear Search and Binary Search.
- To construct the Stacks, Queues and linked list student, perform relevant operations and to analyze and determine the time and computation complexity.
- To write algorithms for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in terms of Space and Time complexity.
- To implement Graph search and traversal algorithms and determine the time and space complexities.
- To analyze a given problem, write an algorithm and implement it using a programming language

UNIT I INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS

Arrays, Structures, Pointers to structures and Strings- Algorithm Development- Complexity Analysis-Recursion.

UNIT II LINEAR DATA STRUCTURES

Abstract Data Type(ADT)-Definition- List ADT – Linked List- Operations-Creation-Insertion-Deletion- Doubly Linked List- Stack ADT-Definition-Implementation - Operations and Applications-Queue ADT- Definition-Implementation, Operations and Applications

UNIT III TREES

Basic Tree Terminologies- Different types of Trees: Binary Tree- Threaded Binary Tree-Binary Search Tree-AVL Tree- Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree- B+ Tree: definitions- algorithms and analysis.

UNIT IV SORTING AND HASHING

Objective and properties of differentsorting algorithms:Selection Sort, Bubble Sort, InsertionSort, Quick Sort, Merge Sort, Heap Sort; PerformanceandComparison among all the methods, Hashing.

UNIT V GRAPH

Graph-Definition-Terminologies- Graph Representations- Graph Traversals- Basic Algorithms-Shortest Path Algorithm- Minimum Spanning Tree Construction Algorithms-Prim‟s and Kruskal‟s-Bi- connectivity- Graph Applications.

Total Hours:45

Suggested Readings

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2nd, Edition,2015.
2. ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2011.
3. Thomas H. Cormen , Charles E. Leiserson, Ronald L. Rivest,Introduction to Algorithms, 3rd Edition by Clifford Stein, 2015.
4. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
5. Richard.F, Gilberg A, Behrouz A., Forouzan, "Data Structures- A Pseudocode Approach with C", Thomson Brooks, 2nd, Edition,2008.
6. AhoHopcroft and Ullman, " Data Structures and Algorithms, Pearson Education, 4th Edition,2009.

Websites:

1. https://nptel.ac.in/courses/106102064/
2. https://nptel.ac.in/courses/106/106/106106127/
3. http://www.cs.auckland.ac.nz/software/AlgAnim/trees.html
4. http://www.itl.nist.gov/div897/sqg/dads/HTML/graph.htmlhttp://www.cmpe.boune du.tr/~akin/cmpe223/chap2.htm

(ii) Laboratory

Course Objectives:

The goal of this course is for the students to

- To understand the basic concepts of different data structures
- To choose the appropriate data structure to design a specified application.
- To Determine which algorithm or data structure to be used in different scenarios
- To analyze the performance of algorithms.
- To demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and understanding of various sorting algorithms, including bubble sort, selection sort, heap sort and quick sort.
- To Understand and apply fundamental algorithmic problems including Tree traversals, Graph traversals, and shortest paths.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

- Understand the importance of data structures and abstract data types, and their basic usability in different applications through programming languages.
- Analyze and differentiate different algorithms based on their time complexity.
- Be capable to identity the appropriate data structure for given problem
- Implement both linear and non-linear data structures and their operations
- Able to understand various data structure such as stacks, queues, trees, graphs, etc. to solve various computing problems.
- Have practical knowledge on the applications of data structures.

List of Experiments

1. Implementation of List using Arrays
2. Implementation of Singly Linked List
3. Implementation of Linked Stack
4. Implementation of Linked Queue
5. Implementation of any two stack applications
6. Implementation of Insertion Sort
7. Implementation of Merge Sort
8. Implementation of Quick Sort
9. Implementation of Insertion operation in Binary Search Tree
10. Implementation of Tree Traversals
11. Implementation of Dijkstra's Shortest Path Algorithm

Total Hours: 30

Semester-III

21BEEC311 DIGITAL SYSTEM DESIGN LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To learn various logic gates and flip-flops
- To study different combinational circuits
- To implement combinational function using multiplier
- To design synchronous sequential circuits.
- To simulate simple combinational and sequential circuits
- To learn about asynchronous sequential circuits design.

Course Outcomes

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

- Design various combinational circuits for different application
- Distinguish various ICs by their pin configuration
- Implement combinational functions using Large Scale Integration (LSI) devices
- Construct counter circuits for different application
- Simulate a design using VHDL/Verilog
- Design a two bit magnitude comparator

List of Experiments

1. Study of Gates & Flip-flops.
2. Design and implementation of arbitrary functions and Code Converters using logic gates
3. Design and implementation of four bit adder/subtractor
4. Implementation of combinational logic function using multiplexers
5. Design and Implementation of Shift Registers.
6. Design and implementation Synchronous Counters.
7. Design and implementation Asynchronous sequential circuits
8. Simulation of combinational and sequential circuits using VHDL/Verilog
9. Design and implementation of Magnitude Comparator (2-Bit).

Semester-III

21BEEC351 CONSTITUTION OF INDIA 1H-0C

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:100** External**:-**Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To know about Indian constitution.
- To study about central and state government functionalities in India.
- To understand about Indian society.
- To understand the functions of Governor and Chief Minister
- To know about the culture among the people.
- To acquire knowledge on constitutional remedies for citizens

Course Outcomes

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

- Identify functions of the state and central government.
- Understand and abide the rules of the Indian constitution.
- Appreciate different culture among the people.
- Understand the functions of Governor and Chief Minister
- Appreciate the working of Parliamentary System in India.
- Gain knowledge on right for women, children, scheduled castes, scheduled tribes and other Weaker Sections.

UNIT I INTRODUCTION

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Suggested Readings

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India, New Delhi 2008
2. R.C.Agarwal, (1997).Indian Political System ,S.Chand and Company, New Delhi,
3. Maciver and Page, Society: An Introduction Analysis, Mac Milan India Ltd, New Delhi
4. K.L.Sharma(1997)., Social Stratification in India: Issues and Themes , Jawaharlal Nehru University, New Delhi,
5. Sharma, Brij Kishore,(2011)., Introduction to the Constitution of India, Prentice Hall of India, New Delhi,
6. U.R.Gahai, (1998).Indian Political System, New Academic Publishing House, New Delhi,.

Web links:

1. https://en.wikipedia.org/wiki/Constitution_of_India

Semester-IV

21BEEC401 **MATHEMATICS – IV** **4H-4C**

(PROBABILITY AND STATISTICS)

Instruction Hours/week: L:4 T:0 P:0 **Marks:** Internal**:40** External**: 60** Total**:100**

End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for the students

- This course aims at providing the required skill to apply the statistical tools in Engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two-dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

Course Outcomes:

Upon Completion of this course the students will be able to:

- Explain the fundamental concepts of probability and standard distributions which can describe real life phenomenon.
- Explain the basic concepts of one- and two-dimensional random variables and their applications in engineering.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Discuss the notion of sampling distributions and statistical techniques used in engineering and management problems.
- Discuss about the techniques in quality control that model engineering problems.

UNIT I PROBABILITY AND RANDOM VARIABLES

Probability – The axioms of probability – Conditional probability – Baye‘s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression using SPSS tool– Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chisquare and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design using SPSS tool.

UNIT V STATISTICAL QUALITY CONTROL

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

Total: 60

Suggested Readings:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.
4. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
5. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
6. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum‘s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
7. Walpole. R.E., Myers. R.H., Myers.S.L. and Ye.K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
8. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
9. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
10. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Websites:

1. www.cut-theknot.org/probability.shtml
2. www.mathworld. Wolfram.com
3. www.mathcentre.ac.uk

Semester-IV

21BEEC402 **ANALOG CIRCUITS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To learn various biasing arrangements for BJT and FET
- To know about various high frequency models for BJT & its feedback configurations
- To be familiar with construction of oscillators
- To study Op-amp configurations with its applications
- To design simple circuits using OPAMPs
- To understand various data convertors

Course Outcomes

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

- Understand the characteristics of transistors of BJT.
- Devise a stable circuits with necessary configuration.
- Familiarize with the multi stage amplifiers.
- Design an oscillator for any given frequency
- Construct OP-AMP and OP-AMP based circuits.
- Design Analog-to digital converters (ADC) and digital to Analog-to converters

UNIT I BIASING CIRCUITS AND SMALL SIGNAL MODELS

Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

UNIT II HIGH FREQUENCY MODELS

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues.

UNIT III FEEDBACK AND OSCILLATOR CIRCUITS

Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin. Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators, Current mirror.

UNIT IV OP-AMP AND 555 TIMER

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. Linear and non linear applicatoin of opamp and its applications. Active filters: Low pass, high pass, band pass and band stop. Study of LM324 with its applications. 555 timers and its applications

UNIT V DATA CONVERTORS

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, etc. Analog-to digital converters (ADC): Single slope, dual slope, successive approximation. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Suggested Readings

1. J. Millman and A. Grabel, “Microelectronics”, 2nd edition, McGraw Hill**,** 2009.
2. P. Horowitz and W. Hill, “The Art of Electronics”, 2nd edition, Cambridge University Press,2006.
3. A.S. Sedra and K.C. Smith, “Microelectronic Circuits”, Oxford University Press, Incorporated, Edition IV, 2019
4. Paul R. Gray and Robert G.Meyer, “Analysis and Design of Analog Integrated Circuits”, John Wiley, 3rd Edition, 2001

Web links:

1. https://archive.org/details/ApplicationsOfOperationalAmplifiers3rdGenerationTechniques
2. http://ocw.mit.edu/resources/res-6-010-electronic-feedbacksystems-spring-2013/textbook/
3. http://www.nptel.ac.in/courses/117106088/1
4. http://analogcorner.net/
   https://nptel.ac.in/courses/117101106/
5. http://www.owlnet.rice.edu/~dodds/Files331/analog_notes.pdf
6. http://www.ee.iitm.ac.in/~ani/2012/ec5135/lectures.html

Semester-IV

21BEEC403 ANALOG AND DIGITAL COMMUNICATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study different analog modulation techniques
- To expose various digital modulation techniques
- To understand Pulse Code Modulation (PCM) techniques
- To provide knowledge on inter symbol interference and nyquist criterion.
- To learn about pass band digital modulation
- To understand the concept of various error correcting codes.

Course Outcomes:

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

- Tabulate different analog modulation schemes in terms of efficiency and bandwidth.
- Understand different digital modulation schemes
- Calculate the bit error performance
- Demonstrate base band pulse transmission concepts
- Analyze Gaussian and white noise characteristics
- Apply suitable error correcting codes.

UNIT I ANALOG MODULATION SYSTEMS

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT II DIGITAL MODULATION SYSTEMS

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

UNIT III BASE BAND PULSE TRANSMISSION

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion.

UNIT IV PASS BAND DIGITAL MODULATION

Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

UNIT V NOISE CHARACTERIZATION AND ERROR CONTROL CODING

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, channel capacity, Error Control Coding, linear block codes, cyclic codes - ARQ Techniques.

Suggested Readings

1. Haykin S., "Communications Systems", John Wiley and Sons, 2008.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2008.
4. Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication", Kluwer Academic Publishers, 2004.
5. Proakis J.G., "Digital Communications", 4th Edition, McGraw Hill, 2001.

Web links:

1. 1.https://www.youtube.com/watch?v=PygLdNMDr_E&list=PLNEqvET0cb64T1v3SrANLP5zC8OQpjXB I&index=1
2. 2.https://www.youtube.com/watch?v=_YahdHyZLL4&index=10&list=PLqGm0yRYwTgX2FkPVcY 6io003-tZd8Ru
3. 3.https://www.youtube.com/ watch?v=6028j9VLlXA& list=PLqGm0yRYwTgX2FkPVcY 6io003-tZd8Ru&index=14
4. 4.https://www.youtube.com/watch?v=HCltbJapAf8&index=38&list=PLqGm0yRYwTgX2FkPVcY 6io003-tZd8Ru

21BEEC404 MICROPROCESSOR & MICROCONTROLLER 3H-3C

Instruction Hours/week: L:3 T: 0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study various processor architecture
- To expose them to programming concepts
- To learn the concepts of Interfacing with Peripherals
- To outline advanced processor architecture
- To understand the concepts of Reduced Instruction Set Computer (RISC) architecture
- To provide knowledge on Advanced RISC Machine (ARM) architecture

Course Outcomes

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

- Write assembly language program (ALP) for different applications for 8085 and 8086
- Identify interrupt concepts of various Microprocessor.
- Gain knowledge on advanced Pentium processors
- Interface memory and I/O device with controllers
- Choose suitable processor for various applications
- Distinguish and analyze the properties of Microprocessors & Microcontrollers.

UNIT I MICROPROCESSOR

Introduction to 8085-Instruction sets and addressing modes-Assembly language programs in 8085, Introduction to 8086 -Architecture- Memory Organization-Bus Operation-I/O Addressing-Minimum Mode-Maximum Mode-Timing Diagram- Interrupts - Service Routines – I/O and Memory Interfacing concepts.

UNIT II PROGRAMMING OF 8086

Instruction Format - Instruction set - Addressing Modes- -Assembly language programs in 8086, Strings, Procedures, Macros, Assembler Directives- Interrupts and Interrupt Applications

UNIT III ADVANCED PROCESSOR AND MICROCONTROLLER

Advanced coprocessor Architectures- 286, 486, - Architecture of 8051 microcontroller, Register Set - I/O and memory addressing- Interrupts- Instruction set- Addressing modes.- Latest Pentium architectures- Core i7

UNIT IV INTERFACING WITH PERIPHERALS

Timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design, Concepts of virtual memory, Cache memory

UNIT V INTRODUCTION TO RISC AND ARM

Introduction to RISC processors; RISC architecture – Review of ARMv7 core and its architecture, introduction to ARM Programming-register configuration and instruction set – sample program. ARM microcontrollers interface designs.

Suggested Readings

1. R. S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085/8080A", Penram International Publishing, 2002.
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface". Morgan Kaufman Publishers 2018
3. Douglas Hall, "Microprocessors Interfacing", Tata McGraw Hill, 2005.
4. Kenneth J. Ayala, "The 8051 Microcontroller", Clifton Park, NY : Thomson Delmar Learning, 2005.
5. Jonathan W Valvano "Introduction to Arm(r) Cortex-M Microcontrollers"Createspace Independent Publisher 2012

Web links

1. http://www.engineersgarage.com
2. www.comtechdoc.org
3. www.emu8086.com
4. www.microcontroller.com

5.www.newelectronics.co.uk/electronics

6.http://nptel.ac.in/courses/108107029

Semester-IV

21BEEC405 **CONTROL SYSTEMS** **4H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To study the control system components
- To learn feedback concepts
- To understand the use of transfer function models for analysis of physical systems
- To provide adequate knowledge in time response of systems and steady state error analysis.
- To gain basic knowledge on open loop and closed–loop frequency response of systems.
- To outline state variable representation of physical systems

Course Outcomes

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

- Characterize a system and analyze its steady state behavior
- Summarize stability concepts
- Investigate stability of a system using different tests
- Analyze frequency and time response for any given system
- Design various controllers
- Describe the necessity of controllability and observability

UNIT I INTRODUCTION TO CONTROL PROBLEM

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

UNIT II TIME RESPONSE ANALYSIS

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

UNIT III FREQUENCY-RESPONSE ANALYSIS

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT IV INTRODUCTION TO CONTROLLER DESIGN

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

UNIT V STATE VARIABLE ANALYSIS AND NON LINEAR CONTROL

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-times systems. Stability of linear discrete-time systems. Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis.

Suggested Readings

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 2010
4. Nagrath&Gopal, "Modern Control Engineering", New Age International, New Delhi 2009

Web links:

1. http://gtu-info.com/Subject/2150909/CSE/Control_System_Engineering/Syllabus
2. https://swayam.gov.in/nd1_noc19_de04/preview

Semester-IV

21BEEC411 ANALOG CIRCUITS LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To gain knowledge on various feedback configurations
- To learn different RC and LC oscillators
- To understand various non-linear application of Op-amp
- To know about filter design
- To learn multivibrator circuits using op-amp
- To study various linear application of Op-amps

Course Outcomes

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

- Analyze the various linear application of op-amp
- Design various non-linear application of op-amp
- Design filters to a given frequency
- Analyze multivibrator circuits using op-amp
- Construct an Instrumentation amplifier for a given gain
- Simulate various circuits using simulation software

List of Experiments

1. Series and Shunt feedback amplifiers
2. Design of transistor RC phase shift oscillator
3. Design of LC–Hartley and Colpitt oscillator
4. Inverting, Non-inverting and differential amplifiers.
5. Integrator and Differentiator.
6. Astable, Monostable multivibrators and Schmitt Trigger using op-amp.
7. Instrumentation amplifier.
8. Active lowpass, highpass and Bandpass filter.
9. Simulation of Experiments1,2,3,4,5 using PSpice / MultiSim
10. Trouble shooting of Mobile phone

Semester-IV

21BEEC412 ANALOG AND DIGITAL COMMUNICATION LABORATORY **2H-1C**

Instruction Hours/week: L: 0 T: 0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To understand the building blocks of digital communication system.
- To impart knowledge on sampling of signals
- To study different coding techniques
- To study about multiplexing mechanisms
- To understand different modulation scheme
- To learn about analog and digital modulation technique

Course Outcomes:

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

- Familiarize with sampling and signal reconstruction
- Demonstrate the working of analog modulation techniques.
- Gain knowledge on multiplexing mechanisms
- Construct Pulse width modulation and demodulation circuits
- Simulate analog modulation using simulation software
- Simulate digital modulation using simulation software

List of Experiments

1. Signal Sampling and its reconstruction.
2. Time division multiplexing and Demultiplexing.
3. Pulse modulation and demodulation-PAM/PWM/PPM
4. Pulse code modulation & demodulation.
5. Line Coding & Decoding
6. Digital modulation & demodulation–ASK,PSK,FSK
7. Software simulation of Signal Sampling and its reconstruction using Multisim
8. Software simulation of AM,FM,PM using Multisim
9. Software simulation of ASK,PSK,FSK using Multisim

21BEEC413 MICROPROCESSOR & MICROCONTROLLER LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To introduce students to basic Assembly Language Programming (ALP) in 8086 and 8085
- To infuse practical training on interfacing peripheral devices with 8086 microprocessor
- To inculcate basic programming on advanced controller
- To know about ADC and DAC programming concepts
- To understand interfacing concepts
- To enhance their practical knowledge on microcontroller programming

Course Outcomes

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

- Write program on subroutine
- Interface data converters with microcontrollers
- Design speed control applications using advanced controller
- Program advanced processors
- Write program for design of simple system
- Understand interfacing concepts

List of Experiments

1. Programs for 8/16 bit Arithmetic operations (Using 8085 and 8086).
2. Programs for Sorting and Searching (Using 8086).
3. Programs on Subroutines (Using 8051).
4. Interfacing ADC and DAC (Using MSP 430 Controllers/8051).
5. Interfacing with 8255.
6. Interfacing with 8279.
7. Interfacing LCD and switch using MSP 430
8. Interfacing and Programming of Stepper mmotor, DC motor using MSP 430.
9. Programming using Arithmetic, Logical & Bit Manipulation instructions of 8051 microcontroller.

Semester-IV

21BEEC451	**INTERNSHIP**	**0H-0C**

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**:-** Total**:100**

Course Objective

The goal of this course for students is :

- To bridge the gap between academia and industry in providing a industry exposure for satisfying local industrial needs .

Course Outcomes

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

- Gain knowledge on various tools used in industry
- Know recent technological advancement happening in industry

Semester-V

21BEEC501 ANTENNAS AND WAVE PROPAGATION 4H-4C

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To provide insight on antennas fundamentals
- To study electromagnetic field (EM) around an antenna
- To introduce various antenna arrays and its radiation characteristics
- To have an exposure on special purpose antennas
- To understand the concept of beam forming in smart antennas
- To learn the mechanism of ionosphere propagation

Course Outcomes

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

- Understand the properties and various types of antennas.
- Differentiate antenna array concepts
- Gain knowledge on special purpose antennas
- Demonstrate the working of smart antennas
- Explain radio wave propagation in ionosphere
- Choose appropriate antennas based on applications .

UNIT I FUNDAMENTAL CONCEPTS

Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions, Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication

UNIT II ANTENNA ARRAYS

Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, and synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

UNIT III SPECIAL PURPOSE ANTENNA

Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

UNIT IV SMART ANTENNAS

Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

UNIT V RADIO WAVE PROPAGATION

Basics of propagation-Ground wave propagation – Space wave propagation- Considerations in space wave propagation – Super refraction – Ionospheric wave propagation – Structure of ionosphere – Mechanism of ionospheric propagation – Effect of earth's Magnetic field on Radio wave propagation– Virtual height – MUF – Skip distance – OWF – Ionosphere abnormalities.

Suggested Readings

1. D. Kraus, Antennas, McGraw Hill, 2008.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 2007
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw hill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Web link

1. https://swayam.gov.in/nd1_noc20_ee20/preview
2. http://www.gvpcew.ac.in/Material%203%20Units/3%20ECE%20AWP.pdf

Semester-V

21BEEC502 **INTERNET OF THINGS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is:

- To understand the definition and significance of the Internet of Things (IoT).
- To learn IoT protocol.
- To identify the middleware for IoT application
- To impart knowledge on Web of Things.
- To introduce the concept of Cloud of Things
- To get an idea of various application areas where IoT can be applied

Course Outcomes

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

- Apply IOT to different applications
- Analyze various protocols for IoT
- Distinguish IoT and cloud computing
- Understand and apply the concepts of Web of things
- Gain knowledge on Integrated billing solutions in IoT
- Design of embedded system for IoT application

UNIT I INTRODUCTION

Overview, technology of the internet of things Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT – IoT Information Security

UNIT II IOT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4,802.15.4g, 802.15.4e – BACNet Protocol – Modbus – KNX – Zigbee Architecture

UNIT III WEB OF THINGS

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Mobile Cloud Computing – The Cloud of Things Architecture Integrated

Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects

UNIT IV BUILDING IoT WITH RASPBERRY PI

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python

UNIT V APPLICATIONS

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Commercial building automation, Smart and Connected Cities- Smart Lighting –Agriculture

Suggested Readings

1. Honbo Zhou The Internet of Things in the Cloud: A Middleware Perspective CRC Press 2012
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of things pringer 2011
3. David Easley and Jon Kleinberg Networks, Crowds, and Markets: Reasoning About a Highly Connected World Cambridge University Press 2010
4. Olivier Hersent, Omar Elloumi and David Boswarthick The Internet of Things: Applications to the Smart Grid and Building Automation Wiley 2012.
5. The Internet of Things: Applications to the Smart Grid and Building Automation by - Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012

Web link

1. https://nptel.ac.in/courses/106105166/
2. https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/ SiteAssets/Pages/ Events/ 2017/ Nov_IOT/NBTC%E2%80%93ITU-IoT/Session%201%20IntroIoTMZ-new%20template.pdf

Semester-V

21BEEC503 **DIGITAL SIGNAL PROCESSING** **3H-4C**

Instruction Hours/week: L:3 T:1 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To impart knowledge on processing of discrete signals
- To study discrete fourier transform and its applications.
- To design Finite Impulse Response (FIR) filter using window function
- To introduce the concept of Infinite Impulse Response (IIR) filters for different frequencies
- To learn the effect of finite word length in FIR filter design.
- To understand DSP architecture and its algorithms

Course Outcomes:

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

- Interpret, represent and process discrete signals
- Apply discrete Fourier transforms for LSI system
- Design FIR Filter using window functions
- Analyze IIR filter for different applications
- Identify the effects of finite word length while designing filters
- Choose different DSP architecture for various applications

UNIT I DISCRETE FOURIER TRANSFORM

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

UNIT II FIR FILTER DESIGN

Design characteristics of FIR filters with linear- phase – Frequency response of linear phase FIR filters – Design of FIR filters using window functions (Rectangular, Hamming, Hanning, Blackmann, and Kaiser)- Comparison of design methods of FIR filters

UNIT III FINITE WORD LENGTH EFFECTS

Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP.

UNIT IV IIR FILTER DESIGN

Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, High pass, Bandpass and Bandstop filters, Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT V DIGITAL SIGNAL PROCESSORS

Introduction to DSP architecture - Fixed and Floating point architecture, Dedicated MAC unit - Multiple ALUs, Advanced addressing modes, filter operation in different DSP architecture-typical implementation of DSP algorithms

Suggested Readings

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH,2011
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, 3rd edition, Prentice Hall, 2009.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Pearson Education, 4/e, 2007.
4. Emmanuel C.Ifeachor, "Digital Signal Processing A Practical Approach" 2nd edition, Pearson Education, 2011
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall,2009

Web links

1. https://www.coursera.org/learn/dsp
2. https://www.tutorialspoint.com/digital_signal_processing/index.htm

Semester-V

21BEEC504 MEASUREMENT AND INSTRUMENTATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To introduce characteristics of instruments and concepts of errors
- To study various standards used for measuring instruments
- To provide knowledge on electrical and electronic instruments
- To impart knowledge on bridge measurement techniques
- To outline the concept of storage and display devices
- To introduce data acquisition elements and transducers

Course Outcomes

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

- Identify the various errors in electronic instruments
- Appreciate the need for standards and calibration
- Demonstrate the working of electrical and electronic measuring instruments
- Choose correct bridge arrangement for measurement of resistance
- Demonstrate the working of various storage devices
- Pick different transducers for different applications

UNIT I INTRODUCTION

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops – Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

Suggested Readings

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007
4. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
5. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
6. David Bell, ' Electronic Instrumentation & Measurements', Oxford University Press,2013.
7. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
8. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

Web link

1. https://swayam.gov.in/nd1_noc19_ee44/preview
2. https://www.classcentral.com/course/swayam-electrical-measurement-and-electronic-instruments-14032

Semester-V

21BEEC505 LONG TERM EVOLUTION (LTE) AND 4G COMMUNICATION

3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To study the fundamentals of wireless communications
- To introduce the concept of diversity for reception
- To impart the basics of LTE and its specifications.
- To provide overview on LTE channel structure
- To familiarize the system architecture of LTE
- To learn the main factors affecting LTE performance

Course Outcomes

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

- Understand the basics of wireless communications
- Apply the concept of fading to improve the quality of reception
- Identify the importance of multiplexing techniques
- Describe the system architecture and the functional standard specified in LTE 4G.
- Allocate resources for Multiple Input Multiple Output (MIMO) systems
- Identify the role of LTE radio interface concepts

UNIT I WIRELESS FUNDAMENTALS

Cellular concept, Broadband wireless channel (BWC), Fading in BWC, Modeling BWC – Empirical and Statistical models, Mitigation of Narrow band and Broadband Fading. Spatial Diversity overview, Receive Diversity, Transmit Diversity, Interference cancellation and signal enhancement, Choice between Diversity

UNIT II MULTICARRIER MODULATION AND MULTIPLE ANTENNAS

OFDM, Single carrier FDMA, Single carrier FDE, Channel Dependent Multiuser Resource Scheduling, Multi antenna Techniques, LTE Network Architecture. OFDM basics, OFDM in LTE, Timing and Frequency Synchronization, PAR, SC-FDE. OFDMA and SC-FDMA:OFDM with FDMA,TDMA,CDMA

UNIT III OVERVIEW AND CHANNEL STRUCTURE OF LTE

Introduction to LTE, Channel Structure of LTE, Downlink OFDMA Radio Resource, Uplink L1, L2 146 SC-FDMA Radio Resource. Downlink Transport Channel Processing: Overview, Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink physical channels, H-ARQ on Downlink

UNIT IV UPLINK CHANNEL TRANSPORT PROCESSING

Overview, Uplink shared channels, Uplink Control Information, Uplink Reference signals, Random Access Channels. Physical Layer Procedures: Channel Quality Indicator CQI feedback, Precoder for closed loop MIMO Operations, Uplink channel sounding, Buffer status Reporting in uplink, Scheduling and Resource Allocation, Cell Search, Random Access Procedures, Power Control in uplink

UNIT V RADIO RESOURCE MANAGEMENT AND MOBILITY MANAGEMENT

PDCP overview, MAC/RLC overview, RRC overview, Mobility Management, Inter-cell Interference Coordination

Suggested Readings

1. Simon Haykin and Michael Moher, Modern Wireless Communication, Pearson education, 2005.
2. LTE for UMTS Evolution to LTE-Advanced' Harri Holma and Antti Toskala, Second Edition - 2011, John Wiley & Sons, Ltd. Print
3. 'Evolved Packet System (EPS) ; the LTE and SAE evolution of 3G UMTS' by Pierre Lescuyer and Thierry Lucidarme, 2008, John Wiley & Sons, Ltd. Print
4. 'LTE – The UMTS Long Term Evolution ; From Theory to Practice' by Stefania Sesia, Issam Toufik, and Matthew Baker, 2009 John Wiley & Sons Ltd

Web Link

1. https://swayam.gov.in/nd1_noc19_ee48/preview

B.E Electronics and Communication Engineering **2021-2022**

Semester-V

21BEEC5E** **PROFESSIONAL ELECTIVE -I** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Electronics and Communication Engineering **2021-2022**

Semester-V

21BEEC511 **DIGITAL SIGNAL PROCESSING LABORATORY** **2H-1C**

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To implement the IIR and FIR filters
- To implement linear and circular convolution
- To study the architecture of DSP processor
- To study DFT and FFT operations
- To gain knowledge in effect of aliasing
- To implement adaptive filters for different applications of DSP

Course Outcomes

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

- Develop and write coding from basic mathematical operations
- Carry out complex operations like DFT and FFT
- Demonstrate the applications of FFT in DSP
- Understand the effect of aliasing
- Calculate the FFT of a signal
- Implement adaptive filters for various applications of DSP

List of Experiments Using Tms 320c5x

1. Study of various architecture and addressing modes of Digital Signal Processor
2. Waveform Generation
    - Sine Wave
    - Cosine Wave
3. Implementation of FIR filters.
4. Calculation of FFT.

Simulation Using Matlab/ Equivalent Software Package

5. Generation of Signals

6. Linear and circular convolution of two sequences
7. Sampling and effect of aliasing
8. Design of FIR filters
9. Design of IIR filters
10. Calculation of FFT of a signal

Semester-V

21BEEC512 **ANTENNA LABORATORY** **2H-1C**

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To understand the radiation patterns of antennas
- To design rectangular microstrip antenna
- To understand the types of antenna
- To measure radiation pattern in different types of antenna
- To design patch antennas using CADFEKO
- To simulate antenna patterns using MATLAB

Course Outcomes

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

- Design antenna for any application
- Understand radiation pattern of different antennas
- Select proper type of antenna, based on applications
- Design rectangular microstrip antenna
- Familiarize the use of tools to implement antenna prototypes.
- Design patch antennas using CADFEKO

List of Experiments:

1. Study of Antenna Parameters and antenna arrays.
2. Study of special purpose antennas.
3. Measurement of Radiation pattern of
    a. Monopole Antenna.
    b. Halfwave dipole Antenna
    c. Yagi Antenna
    d. Loop Antenna
    e. Parabolic reflector
    f. Log-periodic antenna
4. Analysis and design of rectangular microstrip patch antenna.
5. Software simulation of Monopole Antenna and half-wave dipole Antenna using Matlab
6. Measurement of radiation pattern of all wired and aperture antennas
7. Design of patch antennas (Square, Circular and Triangular) using CADFEKO.

Semester-V

21BEEC551	**IN PLANT TRAINING**	**0H-0C**

Instruction Hours/week: L:0 T:0 P:0 **Marks:** Internal**:100** External**:-** Total**:100**

Course Objective

The goal of this course for students is :

- To bridge the gap between academia and industry in providing a industry exposure for satisfying local industrial needs .

Course Outcomes

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

- Gain knowledge on various tools used in industry
- Know recent technological advancement happening in industry

Semester-VI

21BEEC601 VERY LARGE SCALE INTEGRATED (VLSI) DESIGN 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To impart knowledge on MOS process technology.
- To help them understand non-ideal behavior of the MOS device
- To learn the basic MOS working principles
- To study concept of various logic design.
- To provide overview on Field Programmable Gate Array (FPGA)
- To introduce the concept of VLSI implementation strategies.

Course Outcomes

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

- Identify the processing technologies used for CMOS fabrication
- Draw physical layout for simple circuit
- Design different circuits using various logic design
- Model the digital system using Hardware Description Language (HDL).
- Explore high speed adders and multipliers
- Gain exposure on clocking Strategies

UNIT I MOS TECHNOLOGY

Chip Design Hierarchy – IC Layers – Photolithography – Basic MOS Transistors – CMOS Fabrication: n-well – p-well –SOI. Latch up and prevention- Layout design rules, physical design-basic concepts, CAD tool sets, physical design of logic gates- Inverter, NAND, NOR.- MOS Parasitic & SPICE Model

UNIT II MOS TRANSISTOR PRINCIPLE

Introduction to MOSFET: Symbols, Enhancement Mode-Depletion mode transistor operation – Threshold voltage derivation – Drain current derivation – Non-ideal behavior of the MOS Transistor. NMOS and CMOS inverter – Determination of pull up to pull down ratio - scaling of the MOS device

UNIT III CMOS LOGIC GATES & OTHER COMPLEX GATES

Gate delays – Logical Effort - CMOS Static Logic – Transmission Gate Logic – Tri-State Logic – Pass Transistor Logic – Dynamic CMOS Logic – Domino CMOS Logic, NORA CMOS Logic-Clocking Strategies

UNIT IV VERILOG HDL

Hierarchical modeling concepts – Basic concepts: Lexical conventions – Data types – Modules and ports. Gate level modeling – Dataflow modeling – Behavioral modeling – Design examples of Combinational and Sequential circuits – Switch level modeling – Functions – UDP concepts.

UNIT V VLSI IMPLEMENTATION STRATEGIES

Introduction – Design of Adders: carry look ahead-carry select-carry save. Design of multipliers: Array – Braun array – Baugh-Wooley Array. Introduction to FPGA – Full custom and Semi custom design- Xilinx 4000. Concept of Memory & its Designing

Suggested Readings

1. Douglas A. Pucknell Basic VLSI Systems and Circuits 3rd Edition reprint Prentice Hall of India 2008
2. John P. Uyemura, Introduction to VLSI Circuits and Systems John Wiley&Sons, Reprint 2009
3. Smith.M.J. S Application Specific integrated circuits Pearson Education, New York 2008
4. Weste & Eshraghian, Principles of CMOS VLSI Design 2nd Edition Addison Wesley, 2011
5. John P Uyemura Chip Design for Submicron VLSI: CMOS layout and simulation Thomson India Edition 2010
6. Samir Palnitkar, VerilogHDL– Guide to Digital Design and Synthesis-3rd Edition Pearson Education 2003

Web link

1. https://swayam.gov.in/nd1_noc20_ee29/preview

Semester-VI

21BEEC602 **EMBEDDED SYSTEM** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To impart basic knowledge on Soc
- To understand various bus configurations used in embedded systems
- To impart knowledge on embedded programming in C, C++
- To Inculcate the understanding of PCI bus architecture.
- To study PIC microcontroller architecture and programming
- To learn ARM architecture

Course Outcomes

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

- Classify different hardware units in embedded systems
- Choose various bus architecture for various networks
- Suggest design approach using advanced controllers for real-life situations.
- Write simple programs using Embedded C,C++.
- Interface the microcontroller with other data handling / processing systems.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

UNIT II BUSES FOR DEVICES NETWORK

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports-Timer and Counting Devices - '13C', 'USB', 'CAN' and advanced I/O Serial high speed buses-ISA, PCI, PCI-X, cPCI and advanced buses.

UNIT III PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service

Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

UNIT IV PIC 16F877A MICROCONTROLLERS

Device Overview - Memory Organization - I/O Ports - Data EEPROM and FLASH Program Memory, LCD Interfacing using I^2C - Timer Module - Capture/Compare/PWM Modules - Master Synchronous Serial Port (MSSP) Module - Addressable Universal Synchronous Asynchronous Receiver Transmitter (USART) - Analog-to-Digital Converter (A/D) Module - Instruction Set.

UNIT V ARM ASSEMBLY LANGUAGE PROGRAMMING

Assembly basics, Instruction set development, Thumb-2 Technology, Unified Assembler, Architecture, Instruction Set, Instruction list and descriptions, Processing data, Bit Fields, Useful and new instructions

Suggested Readings

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.
6. Joseph Yiu, ―The Definitive Guide to ARM Cortex M3‖, Second Edition, Newnes 2010.

Web links

1. https://swayam.gov.in/nd1_noc20_cs15/preview
2. https://swayam.gov.in/nd1_noc20_ee42/preview

Semester-VI

21BEEC603 **MICROWAVE ENGINEERING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study the two port RF network parameters
- To learn various microwave oscillators
- To expose various active microwave devices
- To understand the design of microwave amplifiers
- To impart knowledge on microwave antenna parameters
- To deal with the microwave generation and microwave measurement techniques.

Course Outcomes

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

- Distinguish various band in microwave frequency
- Describe properties of networks with s parameters
- Identify the working of various microwave active devices
- Design microwave systems for different practical application
- Understand concepts of microwave measurements
- Appreciate various fields of application of microwave

UNIT I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION

Microwave frequency band and advantages – Review of Transmission Lines and Waveguides – Low frequency parameters: impedance, admittance, hybrid and ABCD – High Frequency Parameter: S-matrix –Representation of networks- properties of S-matrix-Reciprocal and lossless networks, transmission matrix, flow graphs

UNIT II PASSIVE AND ACTIVE MICROWAVE DEVICES

High frequency effects in Tubes, Two-cavity klystron amplifier; Reflex klystron oscillator; TWT amplifier, Backwards wave oscillator; Magnetron oscillator: Theory and applications - Tunnel Diodes - Transferred electron and Avalanche transit-time devices: Gunn diode, Gunn diode as an oscillator. IMPATT, TRAPATT and BARITT – Parametric Devices and Amplifiers – Noise in Microwave Amplifiers

UNIT III MICROWAVE DESIGN PRINCIPLES

Impedance transformation, Impedance Matching, Microwave Filter Design, RF & Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas -Antenna parameters, Antenna for ground based systems, Antennas for airborne & satellite borne systems Planar Antennas. Measurement of Microwave antenna parameters.

UNIT IV MICROWAVE MEASUREMENTS

Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency & measurement of noise figure.

UNIT V MICROWAVE SYSTEMS

Radar, Terrestrial and Satellite Communication, Radio Aids to Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Suggested Readings

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house
3. David, M. Pozar, Microwave Engineering, Wiley India, (2012).
4. Ramo, S., Whinnery, J.R., and Duzer, T.V., Fields and Waves in Communication Electronics, Wiley India
5. Collin, R.E., Foundations for Microwave Engineering, IEEE Press 2009

Web links

1. https://swayam.gov.in/nd1_noc19_ee68/preview

B.E Electronics and Communication Engineering **2021-2022**

Semester-VI

21BEEC6E**	**PROFESSIONAL ELECTIVE -II**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Electronics and Communication Engineering **2021-2022**

Semester-VI

21BECSOE**/ 21BEEEOE****/ 21BEBMEOE****	**OPEN ELECTIVE-I**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VI

21BEEC611 VLSI DESIGN LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To study CADENCE EDA tools
- To explore various style in Hardware Description Language (HDL)
- To understand Finite State Machine concepts using HDL
- To learn coding concepts for simulating real time clock
- To learn the concept of analog circuit design
- To understand clocking system in HDL

Course Outcomes

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

- Exposed to Electronic Design Automation (EDA tool), Cadence
- Simulate programs in CADENCE software
- Define simple system using hard ware description language
- Simulate real time clock using HDL.
- Design simple analog circuits.
- Simulate Finite State Machine using HDL.

List of Experiments

1. Study of CADENCE EDA tool
2. Design and Simulate carry look ahead Adder (Min 8 Bit) using HDL.
3. Design and simulate a Universal Shift Register using HDL
4. Design and simulate an ALU using HDL.
5. Design and simulate Finite State Machine (Moore/Mealy) using HDL.
6. Design and simulate real time clock using HDL
7. Design and simulate a CMOS inverter using digital flow
8. Design and simulate a CMOS Basic Gates and Flip-Flops
9. Design and Simulate a CMOS Inverting Amplifier.

Semester-VI

21BEEC612 EMBEDDED SYSTEM LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To learn the working of ARM processor.
- To understand PIC microcontroller programming.
- To explore various interfacing boards using ARM
- To gain knowledge on PIC microcontroller interfacing
- To expose them to the concept of memory
- To gain inputs on stepper motor interface.

Course Outcomes

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

- Write programs in ARM for a specific application.
- Enhance programming skill using PIC microcontroller
- Interface memory, A/D and D/A convertors with ARM system.
- Write programs to understand memory concepts
- Enhance programming skill using EPROM and interrupt.
- Write programs for various interfacing boards.

List of Experiments

1. Interfacing of LED, seven segment display with 8051
2. Study of ARM evaluation system.
3. Flashing of LEDS using ARM
4. Interfacing LED and PWM using ARM
5. Interfacing stepper motor and temperature sensor using ARM controller
6. Interfacing of ADC and DAC with ARM controller.
7. Interfacing EPROM and interrupt.
8. Implementing zigbee protocol with ARM.
9. Program for LCD Interfacing using PIC microcontroller.
10. Program for RS232C Serial port interfacing using PIC microcontroller.

Semester-VI

21BEEC613 MICROWAVE ENGINEERING LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To study the impedance measurement concept
- To understand the working of Gunn Diode oscillator
- To expose to magic tee coupler and its usage.
- To study the microwave power measurement.
- To understand the different attenuators.
- To learn the various components of microwave systems

Course Outcomes

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

- Measure the terminal impedance of microwave circuits
- Analyze the working of Gunn diode oscillators
- Gain knowledge on the usage of magic tee coupler
- Understand the concepts of couplers .
- Gain knowledge on implementation of couplers in specific areas
- Choose appropriate microwave circuits for different application

List of Experiments

1. VSWR Measurements–Determination of terminated impedance
2. Determination of guide wavelength, frequency measurement.
3. Radiation Pattern of Horns, Paraboloids.
4. Microwave Power Measurement.
5. Characteristics of Gunn diode Oscillator
6. Study of MagicTee
7. Study of attenuators (fixed and variable)
8. Conduct an experiment using microwave test bench.
9. Study of resonant cavity

Semester-VI

21EEC614	**MINI PROJECT**	**4H-2C**

Instruction Hours/week: L:0 T:0 P:4 **Marks:** Internal**:100** External**:0** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To make students to understand a problem statement
- To make students to design an electronic circuit

Course Outcomes

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

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on mini project work.

Semester-VII

21BEEC701 UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY

3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To develop the holistic perspective based on self exploration about themselves ,family, society and nature/existence
- To understand harmony in themselves ,family, society and nature/existence
- To Strengthen the self-reflection
- To develop the commitment and courage to act

Course Outcomes

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

- Become more aware of themselves and their surroundings (family, society, nature)
- Be more responsible in life
- Deal with problems with sustainable solutions, while keeping human relationship and human nature in mind.
- Develop consciousness of themselves through the control of mind.

UNIT I INTRODUCTION

Purpose and motivation for the course, recapitulation from universal human values I . Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as a process for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and

helth; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and health.

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMANHUMAN RELATIONSHIP

Understanding values in human-human relationship; meaning of justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of trust; Difference between intention and competence Understanding the meaning of respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, prosperity, fearlessness and coexistence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS CO-EXISTENCE

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

Suggested Readings

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010
2. Small is Beautiful: Economics as If People Mattered, E.F.Schumacher, Perennial Library, 1989
3. Slow is Beautiful , Cecile Andrews , New Society Publishers, 2006
4. The Economy of Permanence, Joseph Cornelius Kumarappa , Digitized 30 Oct 2019

5. The Story of My Experiments with Truth, Mahatma Gandhi, 1983
6. India Wins Freedom, Maulana Abul Kalam Azad, Create Space Independent Publishing Platform,2017
7. The Life of Vivekananda and the Universal Gospel Romain Rolland, Advaita ashrama, 1953 - Hindu philosophers

Web link

1. http://www.arvindguptatoys.com/arvindgupta/gandhiexperiments.pdf
2. http://www.sanipanhwar.com/India%20Wins%20Freedom%20-%20Maulana%20Abul%20Kalam%20Azad.pdf
3. https://estudantedavedanta.net/The-Life-Of-Vivekananda-And-The-Universal-Gospel.pdf

Semester-VII

21BEEC702 ARTIFICIAL INTELLIGENCE (AI) 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study the different search strategies in AI
- To depict the full picture of AI easily.
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.
- To make students to understand a problem statement

Course Outcomes

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

- Acquire knowledge on Artificial Intelligence concepts
- Gain knowledge on problem solving methods
- Analyze different problem solving methods
- Understand the importance of Ontology engineering
- Gain knowledge on software agents
- Find the application of Artificial intelligence

UNIT I INTRODUCTION

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games

UNIT III KNOWLEDGE REPRESENTATION

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and

Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information

UNIT IV SOFTWARE AGENTS

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware Perception – Planning – Moving

Suggested Readings

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
3. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.
4. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2008.
5. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.

Web link

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://www.dcpehvpm.org/E-Content/BCA/BCA-III/artificial_intelligence_tutorial.pdf
3. http://zsi.tech.us.edu.pl/~nowak/bien/BIEN_introduction.pdf

Semester-VII

21BEEC703 **DIGITAL IMAGE PROCESSING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To learn digital image fundamentals.
- To expose to simple image processing techniques.
- To impart the necessity of image enhancement techniques
- To be familiar with restoration techniques.
- To understand image segmentation
- To study about image compression concepts**.**

Course Outcomes

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

- Understand digital image fundamentals.
- Apply image enhancement techniques.
- Use image restoration techniques for retrieval of various images.
- Acquire knowledge on l**ine, and edge detection in image segmentation.**
- Use image compression techniques of various images for analysis.
- Do error free compression

UNIT I DIGITAL IMAGE FUNDAMENTALS

Introduction – Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, steps in image processing, Image acquisition, representation, sampling and quantization, relationship between pixels. – color models – basics of color image processing.

UNIT II IMAGE ENHANCEMENT

Image enhancement in– some basic gray level transformations – histogram processing – enhancement using arithmetic , logic operations – basics of spatial filtering Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.1- D, 2 –D DFT and its inverse transform, smoothing and sharpening filters.

UNIT III IMAGE RESTORATION

Image restoration: Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering. Model of degradation and restoration process – noise models – restoration in the presence of noise- periodic noise reduction.

UNIT IV IMAGE SEGMENTATION

Thresholding and region based segmentation. Fundamentals – models – information theory – Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation, Segmentation Using Morphological Watersheds.

UNIT V IMAGE COMPRESSION

Compression Ratio, Compression Algorithm, Compression Technique. Lossy compression: predictive and transform coding. JPEG standard. error free compression,

Suggested Reading:

1. R.C. Gonzalez, R.E.Woods, 2009, Digital Image processing, 2nd Edition, Pearson Education.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002, Digital Picture Processing, vol .I & II, Academic Press.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

Web links:

1. http://www.imageprocesssingplace.com/DIP/dip-downloads/
2. https://nptel.ac.in/courses/117105079/
3. http://eeweb.poly.edu/~onur/lectures/lectures.html.
4. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html

Semester-VII

21BEEC7E**	**PROFESSIONAL ELECTIVE -III**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Electronics and Communication Engineering **2021-2022**

Semester-VII

21BECSOE/ 21BEEEOE**/ 21BEBMEOE****	**OPEN ELECTIVE-II**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VII

21BEEC711 DIGITAL IMAGE PROCESSING LABORATORY 2H-1C

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To familiarize the undergraduate level students in the regular image processing formats
- To understand the different modification involved while processing an image.
- To study the necessity of histogram in displaying images**.**
- To be familiar with image enhancement of images.
- To understand image restoration principles.
- To understand the image compression techniques.

Course Outcomes

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

- Gain knowledge in various formats and organization of image file
- Understand the graphical representation of images
- Gain knowledge on image processing.
- Acquire knowledge on image enhancement techniques
- Restore image with maximum accuracy
- Gain inputs on compression technique of images

List of Experiments:

1. Study of image file formats and organization
2. Display of an image, negative of an image.
3. Contrast stretching of a low contrast image.
4. Display of a histogram, and histogram equalization.
5. Image enhancement by Intensity/Gray level slicing.
6. Implementation of FT for an image.
7. Implementation of High pass, Low pass filtering.
8. Mean and Median filtering of an image.
9. Image compression by DCT.

Semester-VII

21BEEC712	**TECHNICAL SEMINAR**	**2H-1C**

Instruction Hours/week: L:0 T:0 P:2 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To make students aware of recent technical advancements in electronics
- To enable students to overcome stage fear

Course Outcomes

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

- Gain knowledge on recent trends in electronics
- Acquire fluency and confidence for conference presentation

B.E Electronics and Communication Engineering **2021-2022**

Semester-VII

21BEEC791 **PROJECT WORK PHASE-I** **8H-4C**

Instruction Hours/week: L:0 T:0 P:8 **Marks:** Internal**:100** External**:-** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To make students to understand a problem statement
- To enable students to design an electronic circuit useful to the society

Course Outcomes

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

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from industries.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on project work.

B.E Electronics and Communication Engineering **2021-2022**

Semester-VIII

21BEEC8E** **PROFESSIONAL ELECTIVE -VI** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

B.E Electronics and Communication Engineering **2021-2022**

Semester-VIII

21BEEC8E** **PROFESSIONAL ELECTIVE -V** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Semester-VIII

21BEEC891 **PROJECT WORK PHASE-II &VIVA-VOCE** **16H-8C**

Instruction Hours/week: L:0 T:0 P:16 **Marks:** Internal**:120** External**:180-** Total**:300**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To make students to understand a problem statement
- To enable students to design an electronic circuit useful to the society

Course Outcomes

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

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from industries.
- Design, implement and test the prototype/algorithm in order to solve the conceived problem.
- Write comprehensive report on project work.

Semester-V

21BEEC5E01 SENSORS AND TRANSDUCERS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To understand the characteristics of sensors and errors occurring in it.
- To study basic concepts of mechanical sensors.
- To learn about electro mechanical sensors.
- To develop knowledge in selection of suitable sensor based on requirement.
- To know about Superconducting Quantum Interference Device (SQUID) and its ability to measure extremely subtle magnetic field.
- To study basic concepts of magnetic sensors.

Course Outcomes

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

- Characterize and classify errors.
- Demonstrate basic concepts of mechanical sensors.
- Gain knowledge about electro analytical sensors.
- Handle various radiation sensors.
- Use SQUID to measure immensely subtle magnetic field.
- Acquire knowledge in selection of suitable sensor based on requirement and application.

UNIT I INTRODUCTION

Definition, classification, static and dynamic parameters, Characterization–Electrical, mechanical, thermal, optical, biological and chemical, Classification of errors–Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors.

UNIT II MECHANICAL AND ELECTRO MECHANICAL SENSORS

Resistive Potentiometer, strain gauge, Inductive sensors and transducer, capacitive sensors, ultrasonic sensors.

UNIT III THERMAL AND RADIATION SENSOR

Thermal Sensors: Gas thermometric sensors, acoustic temperature sensors, magnetic thermometer, resistance change-type thermometric sensors, thermos emf sensors, junction semiconductor types, Thermal radiation sensors, spectroscopic thermometry

Radiation Sensors: Photo detectors, photovoltaic and photo junction cells, photo sensitive cell, photo FET sand other devices.

UNIT IV MAGNETIC AND ELECTRO ANALYTICAL SENSOR

Magnetic Sensors: Force and displacement measurement, magneto resistive sensors, Hall Effect sensor, Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flow meter, squid sensor.

Electro analytical Sensors: Electro chemical cell, cell potential, sensor electrodes, electro ceramics in gas media, chem FET.

UNIT V SENSORS AND THEIR APPLICATIONS

Auto mobile sensor, Home appliance sensor, Aero space sensors, sensors for manufacturing, medical diagnostic sensors, environmental monitoring.

Suggested Readings

1. Patranabis D Sensor and Actuators Prentice Hall of India (Pvt) Ltd 2006
2. Ian Sinclair Sensor and Transducers 3rd Edition Elsevier India Pvt Ltd, 2011
3. A.K. Sawhney, Puneethsawhney A Course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai Publications 2012
4. Ernest O. Doeblin Measurement System, Application and Design 5th Edition Tata McGraw Hill Publishing Company Ltd. 2008

Web links

1. https://swayam.gov.in/nd1_noc19_ee41/preview

Semester-V

21BEEC5E02 **BIOMEDICAL ELECTRONICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study the methods of recording various biopotentials
- To learn the working various medical devices
- To study about various Prosthetic aids
- To understand the use of radiation for diagnostic and therapy
- To acquire skills on deploying various diagnostic equipment.
- To study the need of electrical safety in Hospitals

Course Outcomes

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

- Gain knowledge on Biomedical transducers
- Understand the application of the measuring devices in medical applications.
- Acquire knowledge about different assist devices
- Identify the need of assist devices and the need of electrical safety in Hospitals
- Arrange various diagnostic equipment based on the need.
- Demonstrate the practical limitations on the electronic components while handling medical equipments

UNIT I TRANSDUCERS AND ELECTRODES

Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

UNIT II MEASURING DEVICES

Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, Xray and nuclear imaging.

UNIT III ASSIST DEVICES

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects and Bio-telemetry

UNIT-IV RADIO LOGICAL EQUIPMENTS

Ionizing radiation, Diagnostic x-ray equipments, use of Radio Isotope in diagnosis, Radiation Therapy, Laser in medicine, Positron emission tomography, Computed Tomography scan

UNIT-V RECENT TRENDS IN MEDICAL INSTRUMENTATION

Thermograph, endoscopy unit, Laser in medicine, Diathermy units, Electrical safety in medical equipment.

Suggested Readings

1. Leislie Cromwell, Biomedical instrumentation and measurement, Prentice Hall of India, New Delhi.2002
2. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
3. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
4. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Web links

1. https://freevideolectures.com/course/3318/ece5030-biomedical-electronics

Semester-V

21BEEC5E03 FIBER OPTIC COMMUNICATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To provide knowledge on principles of fiber optic communication
- To understand the different modes of communication in optical fibers
- To learn about optical detectors and receivers
- To acquire knowledge on multichannel transmission techniques.
- To know about power penalties and nodal noise
- To understand the concept of analog and digital links

Course Outcomes

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

- Understand the principles of fiber-optic communication and bandwidth advantages.
- Know about optical sources and detectors.
- Acquire familiarity on multichannel transmission techniques.
- Understand the concept of power penalties and nodal noise
- Learn the properties of the optical fibers and connectors.
- Understand the application of analog and digital links in optical communication systems.

UNIT I OVERVIEW OF OPTICAL FIBER COMMUNICATION

Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber, single mode fiber, cutoff wave length, mode filed diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers. Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra model dispersion, Inter model dispersion.

UNIT II OPTICAL SOURCES DETECTORS AND RECEIVERS

Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors .Introduction to Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, burst mode receiver, operation, Analog receivers.

UNIT III FIBER COUPLERS AND CONNECTORS

Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

UNIT IV ANALOG AND DIGITAL LINKS

Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point–to–point links, System considerations, link power budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

UNIT V OPTICAL AMPLIFIERS AND NETWORKS

Optical Amplifiers and Networks – optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. OPTICAL NETWORKS: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

Suggested Readings

1. St 1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press,1979.
5. P Chakrabarti, "Optical Fiber Communication‖, McGraw Hill Education (India)Private Limited, 2016
6. GredKeiser,"Optical Fiber Communication‖, McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.
7. John M.Senior, Optical fiber communication‖, Pearson Education, second edition.2007.
8. Rajiv Ramaswami, Optical Networks , Second Edition, Elsevier , 2004

Web links

1. https://nptel.ac.in/courses/117104127/
2. https://nptel.ac.in/courses/117101002/
3. https://nptel.ac.in/courses/108104113/
4. https://nptel.ac.in/courses/115107095/
5. https://www.slac.stanford.edu/slac/sass/talks/opticalfiber.pdf

Semester-V

21BEEC5E04 RADAR COMMUNICATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To understand the basics of radar along with radar equation
- To define about bearing and altitude in radar communication
- To study the moving target indication (MTI) and pulse Doppler radar with its line canceller.
- To understand the use of Conical scanning in radar units.
- To learn about radar tracking methologies and sequential lobing
- To understand antennas systems and communication equipment required for the operation of RADAR.

Course Outcomes

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

- Acquire the knowledge to apply and design required parameters for a RADAR system.
- Gain the knowledge about basic concepts like bearing and altitude in radar communication.
- Obtain information on various parameters involved in forming the RADAR equation.
- Understand the necessity of conical scanning in tracking radar.
- Detect the radar using the tracking techniques and sequential lobing.
- Gain knowledge on radar antennas and its parameters

UNIT I BASICS OF RADAR

Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems.

UNIT II THE RADAR EQUATION

Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Radar Cross Section of Targets: simple targets – sphere, cone-sphere, transmitter Power, PRF and Range Ambiguities, System Losses

UNIT III MTI AND PULSE DOPPLER RADAR

Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler,

UNIT IV TRACKING RADAR AND SEQUENTIAL LOBING

Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse, Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range, Comparison of Trackers

UNIT V THE RADAR ANTENNA

Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas, The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays.

Suggested Reading

1. Radar Engineering and fundamentals of Navigational Aids-G.S.N.Raju, I.K International, 2008.
2. Introduction to Radar Systems – Merrill I. Skolnik, THIRD EDITION, Tata McGraw –Hill, 2001.
3. Radar: Principles, Technologies, Applications- Byron Edde, Pearson Education.2009
4. Introduction to Radar Systems – Merrill I. Skolnik, SECOND EDITION, McGraw – Hill, 2001.

Web links

1. https://nptel.ac.in/courses/108105154/
2. https://nptel.ac.in/courses/101108056/
3. https://www.tutorialspoint.com/radar_systems/radar_systems_tutorial.pdf
4. https://swayam.gov.in/nd1_noc19_ee58/preview

Semester-VI

21BEEC6E01 MULTIMEDIA COMPRESSION TECHNIQUES 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To understand multimedia–graphics and compression fundamentals
- To study various text compression coding schemes
- To learn audio compression techniques
- To understand various predictive image compression techniques
- To study of video compression techniques and standards
- To acquire knowledge on Digital Video Interactive (DVI) data compression technique.

Course Outcomes

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

- Gain knowledge of multimedia-graphics and various compression techniques
- Demonstrate different compaction techniques
- Explain sub-band and audio coding techniques
- Describe various laws used in audio compression techniques
- Acquire knowledge on DVI data compression technique
- Understand motion estimation and compensation techniques

UNIT I INTRODUCTION

Special features of Multimedia–Graphics and Image Data Representations -Fundamental concepts in Video and Digital Audio– Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques –Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques–Error analysis and methodologies

UNIT II TEXT COMPRESSION

Compaction techniques –Huffmanncoding–Adaptive HuffmannCoding–Arithmetic coding–Shannon-Fanon coding–Dictionary techniques–LZW family algorithms.

UNIT III AUDIO COMPRESSION

Audio compression techniques-μ-LawandA-Law companding. Frequency domain and filtering–Basic sub-band coding–Application to speech coding–G.722–Application to audio coding–

MPEG audio, progressive encoding for audio–Silence compression, speech compression techniques–Formant and CELP Vocoders

UNIT IV IMAGE COMPRESSION

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression– Transform Coding–JPEG Standard–Sub- band coding algorithms :Design of Filter banks– Wavelet based compression: Implementation using filters –EZW, SPIHT coders –JPEG 2000standards -JBIG, JBIG2 standards.

UNIT V VIDEO COMPRESSION

Video compression techniques and standards – MPEG Video Coding I:MPEG–1 and 2–MPEG Video Coding II: MPEG–4 and 7– Motion estimation andcompensation techniques – H.261Standard –DVI technology –PLV performance–DVI real time compression–Packet Video.

Suggested Readings

1. Khalid Sayood Introduction to Data Compression Morgan Kauffman Harcourt India, San Francisco, California -2000
2. David Salomon Data Compression–The Complete Reference Springer Verlag, NewYork 2001
3. YunQ. ShiandHuifangSunImageand Video Compression for Multimedia Engineering-Fundamentals, Algorithms & Standards CRC press, USA 2003
4. Sads Peter Symes Digital Video Compression McGraw Hill Pub, New Yark 2004

Web links

1. https://www.cosy.sbg.ac.at/~uhl/ctmdf.pdf
2. https://www.youtube.com/watch?v=rC16fhvXZOo

Semester-VI

21BEEC6E02 **PATTERN RECOGNITION** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To provide basic insight on pattern recognition
- To make aware of various classifiers for pattern recognition
- To study of parameter estimation methods
- To introduce nonparametric techniques
- To impart knowledge on unsupervised learning
- To learn about clustering in pattern recognition

Course Outcomes

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

- Understand the basic concepts of pattern recognition
- Choose different classifiers based on applications
- Acquire knowledge on parameter estimation methods
- Identify various estimation techniques for different models
- Gain knowledge on unsupervised learning
- Apply K-means for pattern clustering

UNIT I INTRODUCTION

Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.

UNIT II STATISTICAL PATTEN RECOGNITION

Bayesian Decision Theory, Minimum error rate classification, Classifiers, Discriminant function, Decision surfaces, Discriminant functions for normal density, Error bounds for normal density, Missing and noisy features, Bayesian belief networks.

UNIT III PARAMETER ESTIMATION METHODS

Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminate analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

UNIT IV NON PARAMETRIC TECHNIQUES

Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.

UNIT V UNSUPERVISED LEARNING & CLUSTERING

Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.

Suggested Readings

1. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, John Wiley, 2006.
2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2009.
3. Theodoridis and K. Koutroumbas, “Pattern Recognition”, 4th Edition, Academic Press, 2009.

Web links

1. https://swayam.gov.in/nd1_noc19_ee56/preview

Semester-VI

21BEEC6E03 **NANO ELECTRONICS** **3H-3C**

Instruction Hours/week: L:3 T:0P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To learn the basics of quantum mechanics
- To study about resonant tunneling diode
- To understand various aspects of carbon nano structures
- To know scaling limits
- To gain knowledge on nano-materials
- To acquire knowledge on various nano sensors

Course Outcomes

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

- Understand the basics of Quantum Mechanics
- Acquire knowledge on resonant tunneling diode
- Demonstrate the advantages of the carbon nano sensors
- Identify the advantages of the nano-materials and use in solving practical problems
- Acquire knowledge about nanosensors based on quantum size effects
- Describe the working of nano sensor for different application

UNIT I BASICS OF QUANTUM MECHANICS:

Introduction to nanotechnology, meso structures, Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. KronigPenny Model. Brillouin Zones.

UNIT II SHRINK-DOWN APPROACHES

Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

UNIT III CHARACTERIZATION

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors ,Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

UNIT IV CARBON NANOSTRUCTURES

Carbon molecules, Carbon Clusters, Carbon Nanotubes, Carbon Nano interconnects, carbon nano antennas, application of Carbon Nanotubes.

UNIT V NANOSENSORS

Introduction, What is Sensor and Nanosensors?, What makes them Possible?, Order From Chaos, Characterization, Perception, Nanosensors Based On Quantum Size Effects, Electrochemical Sensors, Sensors Based On Physical Properties, Nanobiosensors, Smartdust-Sensor for the future. Applications: Injection lasers, quantum cascade lasers, single-photon sources,biological tagging, NEMS, MEMS

SuggestedReadings

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press,1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003
6. Antonio Maffucci, Sergey Maksimenko, Yuri Svirko by Carbon-Based Nanoelectromagnetics 2019

Web link

1. https://swayam.gov.in/nd1_noc19_mm21/preview

Semester-VI

21BEEC6E04 MICRO ELECTRONIC MECHANICAL SYSTEM (MEMS) 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is:

- To study the materials used for MEMS and its working principle
- To understand the micro sensors and actuators
- To study about micro grippers
- To learn the fabrication process used for MEMS
- To know about microsystems design
- To study the packaging steps involved for MEMS

Course Outcomes

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

- Identify the underlying working principles of MEMS
- Explain the IC fabrication processes
- Understand the design of micro systems
- Describe packaging steps involved for MEMS
- Demonstrate the working of micro sensors
- Have a good knowledge of the future of micro system

UNIT I INTRODUCTION TO MICROSYSTEMS

Overview of microelectronics manufacture and Microsystems technology. Definition - MEMS materials. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

UNIT II MICRO SENSORS AND ACTUATORS

Working principle of Microsystems - micro actuation techniques - micro sensors – types – Micro actuators – types – micropump – micromotors – micro – valves – micro grippers – micro accelerometers.

UNIT III FABRICATION PROCESS

Substrates - single crystal silicon wafer formation – Photolithography – Ion implantation – Diffusion – Oxidation – CVD - Physical vapor deposition - Deposition epitaxy - etching process.

UNIT IV MICRO SYSTEM MANUFACTURING

Bulk Micro manufacturing - surface micro machining – LIGA – SLIGA - Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation – surface bonding - wire bonding - sealing.

UNIT V MICROSYSTEMS DESIGN AND PACKAGING

Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

Suggested Readings

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. Mems & Microsystems Design & Manufacture by Tai-Ran Hsu. Tata McGraw-Hill Publishing Company Ltd 2002.
4. Foundation of MEMS" by Chang Liu. Pearson Education. 2012

Web link

1. https://swayam.gov.in/nd1_noc20_ee52/preview
2. https://nptel.ac.in/courses/117105082/

Semester-VII

21BEEC7E01 APPLICATION SPECIFIC INTEGRATED CIRCUIT (ASIC) DESIGN 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To focus on the IC Design and the various library design
- To understand the principles of design logic cells, I/O cells
- To study about interconnect architecture
- To explore the Application Specific Integrated Circuits (ASIC) design flow from the circuit and layout design point of view.
- To study about logic synthesis and placement
- To understand routing concepts.

Course Outcomes

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

- Gain knowledge on various types of ASIC design
- Acquire knowledge in the circuit design aspects at various levels of abstractions.
- Understand architecture of Spartan and Virtex
- Distinguish various architecture and its purpose in different application
- Gain knowledge on logic synthesis and placement
- Understand routing concepts in optimized IC design

UNIT I INTRODUCTION TO ASIC, CMOS LOGIC AND ASIC LIBRARY DESIGN

Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.

UNIT II PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS

Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC ARCHITECTURE

Architecture and configuration of Spartan / Cyclone and Virtex / Stratix FPGAs – Micro-Blaze / Nios based embedded systems – Signal probing techniques.

UNIT IV LOGIC SYNTHESIS, PLACEMENT AND ROUTING

Logic synthesis - ASIC floor planning- placement and routing – power and clocking strategies.

UNIT V HIGH PERFORMANCE ALGORITHMS FOR ASIC / SOCS

DAA and computation of FFT and DCT. High performance filters using delta-sigma modulators. Case Studies: Digital camera, SDRAM, High speed data standards.

Suggested Readings

1. Douglas J. Smith, HDL Chip Design, Madison, AL, USA: Doone Publications, 1996.
2. M.J.S.Smith, " Application - Specific Integrated Circuits", Pearson,2003
3. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw Hill, Digitized 2007
4. Roger Woods, John McAllister, Dr. Ying Yi, Gaye Lightbod, “FPGA-based Implementation of Signal Processing Systems”, Wiley, 2008
5. Steve Kilts, “Advanced FPGA Design,” Wiley Inter-Science 2007

Web links:

1. https://www.electronics-notes.com/articles/electronic_components/programmable-logic/what-is-an-asic-application-specific-integrated-circuit.php
2. https://www.tce.edu/sites/default/files/PDF/14EC770-ASIC-DESIGN-K.Kalyani.pdf

Semester-VII

21BEEC7E02 **WIRELESS SENSOR NETWORKS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study about Wireless networks architecture and standards.
- To understand localization techniques
- To introduce concept of nesC
- To acquire knowledge on various protocols
- To learn various hopping techniques
- To know about network and routing protocols

Course Outcomes

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

- Gain knowledge on network architecture
- Deploy resources and configure any network
- Gain knowledge on various protocols
- Understand MAC protocols used for different communication standards used in WSN
- Explore new protocols for wireless sensor network
- Deploy appropriate routing protocols

UNIT I INTRODUCTION

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks

UNIT II NETWORK ARCHITECTURE

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to Tiny OS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.

UNIT III DEPLOYMENT AND CONFIGURATION

Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management.

UNIT IV NETWORK AND ROUTING PROTOCOLS

Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

UNIT V DATA STORAGE AND MANIPULATION

Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.

Suggested Readings

1. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Network",Elsevier, 1st Ed. 2004 (ISBN: 13- 978- 1-55860-914-3)
4. Kazem, Sohraby, Daniel Minoli, TaiebZanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).
5. B. Krishnamachari, " Networking Wireless Sensors", Cambridge University Press.2005

Web link

1. https://nptel.ac.in/courses/106105160/

Semester-VII

21BEEC7E03 SPEECH AND AUDIO PROCESSING 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To introduce the concept of speech coding
- To familiarize the mathematical model of speech signal
- To learn speech prediction and quantization
- To understand about linear prediction models
- To inculcate the knowledge on CELP speech production model
- To learn various speech coding standards

Course Outcomes

At the end of this course students will demonstrate the ability to

- Mathematically model the speech signal
- Analyze the quality and properties of speech signal.
- Gain knowledge on speech quantization techniques.
- Understand about speech coding standards.
- Analysis and synthesis of CELP speech production model
- Modify and enhance the speech and audio signals.

UNIT I INTRODUCTION

Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid,Requirements of speech codecs –quality, coding delays, robustness.Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT II LINEAR PREDICTION OF SPEECH

Basic concepts of linear prediction; Linear Prediction Analysis of non stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

UNIT III SPEECH QUANTIZATION

Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design,

codebook types. Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

UNIT IV LINEAR PREDICTION CODING & SPEECH CODING STANDARDS

LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model. -An overview of ITU-T G.726, G.728 and G.729standards

UNIT V CODE EXCITED LINEAR PREDICTION

CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Suggested Readings

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

Semester-VII

21BEEC7E04 **BIG DATA ANALYTICS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To give an insight to Big Data Concepts
- To provide inputs on various big data contents
- To illustrate file organization and concepts of stream
- To know about various analytical model
- To understand basic of R programming
- To study about different representation of data

Course Outcomes

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

- Work with big data platform and explore the big data analytics in business applications
- Apply linear and logistic regression models
- Acquire basic concepts involved in R programming
- Categorize data in to frames
- Organize and analyze data using R language
- Perform graphical data analysis using R language

UNIT I INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Challenges of Conventional Systems - Big Data vs Traditional Data - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.

UNIT II FILE ORGANIZATION AND STREAMS CONCEPTS

Distributed File Systems - Large-Scale File System Organization – The Hadoop Distributed File System (HDFS) concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication - Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream

UNIT III PREDICTIVE ANALYTICS

Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.

UNIT IV R PROGRAMMING BASICS

Basics, Numbers, Strings, Formulas, Data input and output- Loading & Writing data, Running a script, Manipulating data- Factors, Data Frames, Restructuring data, Sequential data. Statistical analysis, Scripts and functions

UNIT V REPRESENTATION OF DATA

Graphical Representation of Variables- visualizing your data, Advance analytics, K-mean clustering, Apriori algorithm, Logistic regression ,naïve Bayesian classifier, Decision tree.

Suggested Readings

1. Bill Franks - Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley and SAS Business Series, 2012.
2. R for Data Science – Hadley Wickham & Garrett Grolemund- O'Reilly Media; 1 edition January 10, 2017.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

Web links

1. https://r4ds.had.co.nz/
2. https://cmdlinetips.com/2018/01/free-online-resources-books-to-learn-r-and-data-science/

Semester-VIII

21BEEC8E01 FIELD PROGRAMMABLE GATE ARRAY(FPGA) BASED SYSTEM DESIGN 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To provide an understanding of FPGA lifecycle
- To impart knowledge on various FPGA technologies
- To learn implementation issues related to FPGA
- To understand the concept of selecting a FPGA based on project specifications
- To enable the student to understand the floor planning, place and route optimization techniques.
- To introduce the lower power reduction techniques for FPGA.

Course Outcomes

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

- Understand FPGA lifecycle and its architecture
- Gain knowledge on various FPGA technologies
- Select a FPGA, based on project specifications
- Identify and solve the FPGA implementation issues
- Familiarize with floor planning, place and route optimization techniques.
- Apply power optimization techniques for FPGA applications.

UNIT I INTRODUCTION TO GATE ARRAY AND CMOS LOGIC

Types of gate array–Design flow-CMOS Logic-Combinational–Sequential–Data path–Transistor as resistor–Capacitance-Hardware description language. System-level architecture design for FPGAs. Review VHDL programming basics.

UNIT II FIELD PROGRAMMABLE GATE ARRAY

FPGA Architecture- Altera FPGA technologies- Xilinx FPGA technologies – Lattice FPGA technologies-Actel FPGA technologies. Synthesizable VHDL, synchronous and asynchronous processes, finite state machines, and memory.

UNIT III FPGA IMPLEMENTATION ISSUES

Look-up-tables–Memory availability-Fixed coefficient design technique– Distributed arithmetic. FPGA synthesis and iterative performance optimizations.

UNIT IV FLOOR PLANNING, PLACE AND ROUTE OPTIMIZATION

Design Partitioning-Partitioning using simulated annealing- Optimal floor planning–Linear passive resistive network based placement techniques, Relationship between placement and routing–Logical Replications-I/O registers–Register Ordering-Placement seed

UNIT V LOW POWER FPGA IMPLEMENTATION

Sources of power Consumption-Power consumption reduction Techniques-Voltage scaling of FPGA's– Data reordering- Pipeline.

Suggested Readings

1. Steve Kilts Advanced FPGA Design Wiley Inter- Science,2003
2. Roger Woods, John McAllister, Ying Yi, Gaye Lightbody FPGA-based Implementation of Signal Processing SystemsWiley 2008.
3. M.J. S. Smith Application Specific Integrated Circuits Pearson 2003.

Web links

1. https://nptel.ac.in/content/storage2/courses/108105057/Pdf/Lesson-20.pdf
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105113/lec44.pdf

Semester-VIII

21BEEC8E02 ADVANCED EMBEDDED SYSTEMS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To explain the design procedures for developing complex system controllers using embedded system
- To understand various wired and wireless communication protocols
- To study the ARM processor fundamentals
- To outline the instruction set of ARM processor
- To learn about memory management unit
- To write assembly code for ARM processor

Course Outcomes

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

- Analyze and design an embedded system
- Use various instruction set for faster execution
- Familiarize with various ARM processors
- Understand cache and MMU configuration
- Explain the importance of cache memory
- Write assembly code for ARM processor

UNIT I PRINCIPLES OF EMBEDDED SYSTEM

Introduction- Embedded systems description, definition, design considerations & requirements - Overview of Embedded system Architecture- Categories of Embedded Systems-Product specifications - hardware/software partitioning - iterations and implementation - hardware software integration -product testing techniques. Wired Communication Protocols: UART – Inter Integrated Circuit(I2C)- Serial Peripheral Interface (SPI)- Controller Area Network (CAN).Wireless communication Protocols: Zigbee Protocols–Bluetooth Protocols-IrDA.

UNIT II ARM PROCESSOR FUNDAMENTALS

ARM core Introduction–Registers–Current Program Status Register–Pipeline–Exception– Interrupts – Vector Table–Core Extension–Architecture Revisions–ARM Processor Families –ARM Instruction Set–Thumb Instruction set–Thumb Register Usage–ARM–Thumb Interworking–Stack Instruction–Software Interrupt Instruction.

UNIT III CACHES AND MMU

The Memory Hierarchy and Cache Memory–Cache Architecture-Cache Policy–Co-Processor and Caches– Flushing and Cleaning Cache Memory– Cache Lock down–Caches and Software Performance. MMU: Moving from an MPU to an MMU–Virtual Memory–Details of ARM MMU–The Caches and Write Buffer–Co-Processor and MMU configuration.

UNIT IV OPTIMIZED PRIMITIVES

Double Precision Integer Multiplication–Integer Normalization and count Leading Zeros –Division – Square Roots –Transcendental Functions: Log, exp, sin, cos– Endian Reversal and Bit Operations– Saturated and Rounded Arithmetic– Random Number Generation

UNIT V WRITING AND OPTIMIZING ARM ASSEMBLY CODE

Writing Assembly Code–Profiling and Cycle Counting –Instruction Scheduling –Register Allocation–Conditional Execution–Looping Constructs–Bit Manipulation–Efficient Switches–Handling Unaligned Data.

Suggested Readings

1. Andrew N. Sloss, Dominic Symes, Chris Wright ARM System Developer's Guide Morgan Kaufmann 2008
2. Tammy Noergaard Embedded Systems Architecture Newnes 2008
3. Steve Furbe ARM System-on- Chip Architecture Addison-Wesley Professional 2000

Web links

1. https://nptel.ac.in/courses/106105193/

Semester-VIII

21BEEC8E03 **SMART ANTENNAS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To study about various types of smart antennas
- To outline various Direction Of Arrival (DOA) estimation fundamentals
- To familiarize with electromagnetic radiation direction finding algorithms
- To outline modulation mechanism for band-limited channels
- To learn about beam forming fundamentals
- To understand the different simulation concepts of smart antennas

Course Outcomes

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

- Gain knowledge of different smart antennas
- Estimate direction of arrival of signals
- Acquire knowledge on beam forming fundamentals
- Design smart antennas using Space–Time analysis
- Identify interference suppression techniques
- Appreciate the need of smart antennas for MIMO system

UNIT I SMART ANTENNAS

Introduction, Need for Smart Antennas, Overview, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Basic Principles, Mutual Coupling Effects.

UNIT II DIRECTION OF ARRIVAL ESTIMATION FUNDAMENTALS

Introduction, Array Response Vector, Received Signal Model, Subspace-Based Data Model, Signal Auto covariance, Conventional DOA Estimation Methods, Conventional Beam forming Method, Capon’s Minimum Variance Method, Subspace Approach to DOA Estimation, MUSIC Algorithm, ESPRIT Algorithm, Uniqueness of DOA Estimates.

UNIT III BEAM FORMING FUNDAMENTALS

Classical Beam former, Statistically Optimum Beam forming Weight Vectors, Maximum SNR Beam former, Multiple Side lobe Canceller and Maximum, SINR Beam former, Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beam forming

UNIT IV INTEGRATION AND SIMULATION OF SMART ANTENNAS

Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading Channel, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Adhoc Networks (MANETs), Protocol, Simulations, **Discussion.**

UNIT V SPACE–TIME PROCESSING

Introduction, Discrete Space–Time Channel and Signal Models, Space– Time Beam forming, Inter symbol and Co-Channel Suppression, Space–Time Processing for DSCDMA, Capacity, and Data Rates in MIMO Systems, **Discussion**.

Suggested Readings

1. Constantine A. Balanis & Panayiotis I. Ioannides, “Introduction to Smart Antennas”, Morgan & Claypool Publishers’ series-2007
2. Joseph C. Liberti Jr., Theodore S Rappaport, “Smart Antennas for Wireless Communications: IS-95 and Third Generation CDMA Applications”, Prentice Hall PTR,, 1999
3. T.S Rappaport, “Smart Antennas Adaptive Arrays Algorithms and Wireless Position Location”, IEEE press 1998, PTR – PH publishers 1999.
4. Thomas Kaiser Smart Antennas: State of the Art Hindawi publishing corporation 2005

Web links

1. https://nptel.ac.in/courses/117107035/

Semester-VIII

21BEEC8E04 COMPUTER NETWORKS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To introduce the concept of networking
- To familiarize the various OSI layers
- To introduce various types of switching in networks
- To learn about the transport layer protocol in detail
- To inculcate resource allocation techniques
- To study about various routing algorithm

Course Outcomes

At the end of this course students will demonstrate the ability to

- List out different OSI Layers
- Understand the concepts of networking thoroughly.
- Gain knowledge on Switching techniques for networks
- Understand the details of Transport layer protocols
- Gain knowledge to allocate appropriate resources
- Analyze the performance of the network.

UNIT I INTRODUCTION TO COMPUTER NETWORKS AND THE INTERNET

Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

UNIT II SWITCHING IN NETWORKS

Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call.

UNIT III TRANSPORT LAYER

Connectionless transport - User Datagram Protocol, Connection-oriented transport –Transmission Control Protocol, Remote Procedure Call.

UNIT IV CONGESTION CONTROL AND RESOURCE ALLOCATION

Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service. Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

UNIT V LINK LAYER

ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

Suggested Readings

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition
2. L. Peterson and B. Davie, "Computer Networks –A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. S. Keshav, "An Engineering Approach to Computer Networking" , Pearson Education
5. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, "Computer networks", Prentice Hall
7. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall
8. William Stallings, "Data and computer communications", Prentice Hall

21BEEC8E05 NATURAL LANGUAGE PROCESSING (NLP) 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To learn the fundamentals of natural language processing
- To understand the use of evaluating N-grams and various models
- To study process involved in NLP
- To impart knowledge on the role of semantics of sentences and pragmatics
- To learn discourse analysis and lexical resources
- To understand the importance of NLP in artificial intelligence

Course Outcomes

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

- Tag a given text with basic language features
- Understand how a meaningful sentence is formed in NLP
- Design an innovative application using NLP components
- Explain the working of algorithm for Context Free Grammar (CFG)
- Implement a rule based system to tackle morphology/syntax of a language
- Compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I INTRODUCTION

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III SYNTACTIC ANALYSIS

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow

parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV SEMANTICS AND PRAGMATICS

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brills Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC).

Suggested Readings

1. Daniel Jurafsky, James H. MartinSpeech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Pythonll, First Edition, OReilly Media, 2009
3. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
4. Richard M Reese, Natural Language Processing with Javall, OReilly Media, 2015.
5. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
6. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

Web links

1. https://swayam.gov.in/nd1_noc19_cs56/preview

21BEEC8E06 **ROBOTICS AND AUTOMATION** **3H-3C**

Instruction Hours/week: L:3 T:0P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To study the various generations of robots and related laws.
- To learn the various power sources used in robotics
- To identify the sensors for different fields of robotics.
- To understand the various parts of robots.
- To impart knowledge on path planning concepts for robots
- To know about robot programming languages.

Course Outcomes

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

- Explain the basic working of robot
- Analyze the function of sensors in the robot
- Write a program to use a robot for a typical application
- Design robots for different applications
- Choose appropriate end-of-arm tool for different application
- Value the importance of automation in various industries

UNIT I BASIC CONCEPTS

Definition and origin of robotics–different types of robotics–various generations of robots– degrees of freedom–Asimov's laws of robotics–dynamic stabilization of robots.

UNIT II POWER SOURCES AND SENSORS

Hydraulic, pneumatic and electric drives–determination of HP of motor and gearing ratio–variable speed arrangements–path determination – micro machines in robotics– machine vision – ranging–laser–acoustic –magnetic, fiber optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS

Construction of manipulators– manipulator dynamics and force control –electronic and pneumatic manipulator control circuits–end effectors–U various types of grippers –design considerations.

UNIT IV KINEMATICS AND PATH PLANNING

Solution of inverse kinematics problem–multiple solution jacobian work envelop–hill Climbing Techniques– robot programming languages

UNIT V CASESTUDIES

Multiple robots–machine interface–robots in manufacturing and non-manufacturing applications–robot cell design–selection of robot.

Suggested Readings

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 1999.
2. Bijoy K. Ghosh, T. J. Tarn, Ning X, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 2011.
3. Deb.S.R., Robotics technology and flexible Automation, John Wiley, 2010.
4. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
5. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
6. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
7. Issac Asimov I Robot, Ballantine Books, New York, 1986.

Web links

1. https://doc.lagout.org/science/0_Computer%20Science/8_Electronics%20%26%20Robotics/Robotics%20and%20Automation%20Handbook.pdf
2. https://swayam.gov.in/nd1_noc20_me03/preview

Semester-VIII

21BEEC8E07 MICRO AND SMART SYSTEM TECHNOLOGY 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To learn smart system concepts and application
- To explore various micro and smart device systems
- To introduce various packaging methods of micro materials
- To understand the various controlling methods for smart system
- To study micromachining techniques
- To expose the process flow for micro material manufacturing

Course Outcomes

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

- Identify the components and application areas of micro systems
- Choose micro transducers for particular application
- Distinguish various sensors, actuators used for micro systems
- Describe various packaging techniques
- Model micro electro mechanical system
- Understand the process flow for micro material manufacturing

UNIT I INTRODUCTION TO MICRO AND SMART SYSTEMS

Evolution of smart materials, structures and systems. Components of a smart system. Application areas. Commercial products. Feynman's vision. Micro machined transducers. Evolution of micro-manufacturing. Multi-disciplinary aspects.

UNIT II MICRO AND SMART DEVICES AND SYSTEMS

Salient features of sensors, actuators, and systems. Sensors: silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conducto metric gas sensor, fiber-optic gyroscope and surface-acoustic-wave based wireless strain sensor. Systems: micro gas turbine, portable clinical analyzer, active noise control in a helicopter cabin.

UNIT III MICRO MANUFACTURING AND MATERIAL PROCESSING

Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, and metallization. Silicon micromachining: surface, bulk, moulding, bonding based process flows. Thick-film processing, Smart material processing

UNIT IV ELECTRONICS, CIRCUITS AND CONTROL

Carrier concentrations, semiconductor diodes, transistors, MOSFET amplifiers, operational amplifiers. Basic Op-Amp circuits. Charge-measuring circuits. Examples from micro systems. Transfer function, state-space modeling, stability, PID controllers, and model order reduction. Examples from smart systems and micro machined accelerometer or a thermal cycler.

UNIT V INTEGRATION AND PACKAGING OF MICROELECTRO MECHANICAL SYSTEMS

Integration of microelectronics and micro devices at wafer and chip levels. Microelectronic packaging: wire and ball bonding, flip-chip. Low- temperature-cofired-ceramic (LTCC) multi-chip-module technology. Micro system packaging examples.

Suggested Readings

1. Micro and Smart Systems: G.K.Ananthasuresh, K.J.Vinoy, S.Gopalakrishnan, K.N.Bhat, V.K.Aatre,Wiley India 2010.
2. Micro and Smart Systems by V.K. Aatre G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat ,Wiley India Pvt Ltd,– 2010
3. Design and Development Methodogies, Smart Material Systems and MEMS: V. Varadan, K. J.Vinoy, S. Goplakrishnan, Wiley, October 2006
4. MEMS- Nitaigour Premch and Mahalik, McGraw-Hill Education (India) (January 9, 2009)

Web links

1. https://swayam.gov.in/nd1_noc20_ee52/preview

Semester-VIII

21BEEC8E08 CRYPTOGRAPHY AND NETWORK SECURITY 3H-3C

Instruction Hours/week: L:3 T: P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objective

The goal of this course for students is :

- To provide encryption techniques for symmetric ciphers
- To impart knowledge of public-key encryption and hash functions
- To study about authentication protocols
- To know the importance of firewall safety
- To learn about various network security practice
- To understand various concepts of system security and wireless security

Course Outcomes

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

- Understand the fundamental concepts in symmetric ciphers and encryption standard
- Acquire strong understanding of different encryption along with hash functions
- Explain the importance of firewall in a network
- Apply methods for authentication, network security and able to use them.
- Identify security vulnerabilities in existing systems
- Demonstrate IP security architecture
- Gain knowledge about different wireless security standards

UNIT I SYMMETRIC CIPHERS

Overview–classical Encryption Techniques–Block Ciphers and the Data Encryption standard – Introduction to Finite Fields –Advanced Encryption standard –Contemporary Symmetric Ciphers–Confidentiality using Symmetric Encryption.

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

Introduction to Number Theory–Public-Key Cryptography and RSA – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication and Hash Functions–Hash Algorithms – Digital Signatures and Authentication Protocols.

UNIT III NETWORK SECURITY PRACTICE

Authentication Applications – Kerbors – X.509 Authentication Service – Electronic mail

Security–Pretty Good Privacy–S/MIME–IP Security architecture– Authentication Header– Encapsulating Security Payload–Key Management.

UNIT IV SYSTEM SECURITY

Intruders –Intrusion Detection –Password Management –Malicious Software –Firewalls– Firewall Design Principles–Trusted Systems.

UNIT V WIRELESS SECURITY

Introduction to Wireless LAN Security Standards–Wireless LAN Security Factors and Issues-WLAN protection Enhancement-virtual private networking.

Suggested Readings

1. William Stallings Cryptography And Network Security– Principles and Practices Pearson Education, New Delhi 2003
2. Atul Kahate Cryptography and Network Security Tata McGraw Hill, New Delhi-2003
3. Bruce Schneier Applied Cryptography JohnWiley and Sons Inc, Singapore- 2001
4. Stewart S.Miller Wi-Fi Security McGraw Hill, New-York-2003
5. Charles B. Pfleeger, Shari Lawrence Pfleeger Security In Computing Pearson Education, New Delhi-2003
6. Cyrus Peikari, Seth Fogie Maximum Wireless Security Sams Publishing- 2003

Web links

1. https://swayam.gov.in/nd1_noc20_cs02/preview

OPEN ELECTIVE

B.E Electronics and Communication Engineering **2021-2022**

21BEECOE01 NEURAL NETWORKS AND ITS APPLICATIONS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To introduce the basic concepts of neural networks and its applications in various domain
- To educate about supervised and unsupervised learning process
- To gain a solid understanding of various neural network model
- To study about annealing technique
- To learn the concepts of Self-Organizing Map (SOM) algorithm
- To understand steps involved in ballistic arm movements.

Course Outcomes

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

- Understand the basic concepts of neural networks and its applications in various domains
- Gain knowledge about learning process in Neural Networks
- Design using Adaptive Resonance Theory (ART) technique
- Describe steps in annealing process
- Acquire knowledge on SOM concepts
- Explain ballistic arm movements.

UNIT I INTRODUCTION TO NEURAL NETWORKS

Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules-types of neural networks-single layer, multiple layer-feed forward, feedback networks

UNIT II LEARNING PROCESS

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCEPTION

Single layer Perception-Adaptive filtering-unconstrained Optimization-Least-mean square algorithm- Leaning Curve-Annealing Technique-perception convergence Theorem-Relationship between perception and Baye's Classifier-Back propagation algorithm

UNIT IV ATTRACTOR NEURAL NETWORK AND ART

Hopfield model-BAM model -BAM Stability-Adaptive BAM -Lyapunov function-effect of gain- Hopfield Design-Application to TSP problem-ART-layer 1-layer 2-orienting subsystem-ART algorithm-ARTMAP.

UNIT-V SELF ORGANIZATION

Self-organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical Vector Quantization. Applications of self-organizing maps: The Neural Phonetic Type Writer Learning Ballistic Arm Movements.

Suggested Readings

1. SimonHaykin Neural Networks and Learning Machines 3rd Edition Pearson/Prentice Hall 2009
2. SatishKumar Neural Networks: A Classroom Approach TMH 2008
3. Rajasekaran.S, Vijayalakshmi Pai.G.A Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and Applications PHI, New Delhi 2003.
4. LaureneFausett Fundamentals of Neural Networks: Architectures, Algorithms, and Applications Pearson/Prentice Hall 1994
5. Wasserman P.D Neural Computing Theory & Practice Van Nortrand Reinhold 1989.
6. Freeman J.A, S kapura D.M Neural networks, algorithms, applications, and programming techniques Addition Wesley 2005.

Web links

1. https://nptel.ac.in/courses/117105084/
2. https://www.geeksforgeeks.org/adaptive-resonance-theory-art/

21BEECOE02 PRINCIPLES OF MODERN COMMUNICATION SYSTEM 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To provide clear knowledge on evolution of communication systems
- To understand uplink and downlink concepts in mobile phone
- To make aware of mobile communication generations
- To deliver knowledge on wireless communication standards
- To enable students to have a better understanding on launching of satellite
- To study the concept of radar communication

Course Outcomes

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

- Understand past, present and future trends in mobile communication.
- Explain how uplink and downlink is done in mobile phone
- Distingiush various standards in use for wireless communication
- Demonstrate some basic application of GPS.
- Appreciate launching mechanism of satellite
- Gain knowledge about RADAR working and its applications

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION

From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II MOBILE CELLULAR COMMUNICATIONS

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

UNIT III WIRELESS COMMUNICATION

Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMaX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

UNIT IV SATELLITE COMMUNICATION

History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V RADAR & NAVIGATION

Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar. Navigation Systems: Introduction & methods of navigation, Instrument Landing System, Microwave landing system- Modern Navigation systems.

Suggested Readings

1. S.Haykin, ―Communication Systems, 4/e, John Wiley 2007
2. B.P.Lathi, ―Modern Digital and Analog Communication Systems, 3/e, Oxford University Press,2007
3. Rappaport Theodore S - Wireless Communications: Principles and Practice, 2/E, Pearson Education India, 2010
4. Vijay. K. Garg, ―Wireless Communication and Networking, Morgan Kaufmann Publishers, 2007.
5. T.Pratt, C. Bostian and J.Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition., 2003
6. M. I .Skolnik ―Introduction to Radar Systems, Tata McGraw Hill 2006.
7. Myron Kyton and W.R.Fried ―Avionics Navigation Systems, John Wiley & Sons 1997.

21BEEEOE01 ELECTRIC HYBRID VEHICLES 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To study the basic concepts of electric hybrid vehicles.
- To study about energy storage system for hybrid vehicle.
- To study about energy management strategies

Course Outcomes (COs)

At the end of this course, students will demonstrate the ability to

- Understand the models to describe hybrid vehicles and their performance.
- Understand the concept of Electric Trains.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy storage systems.
- Understand the different strategies related to energy management systems.
- Understand the concept of different Motor drive.

UNIT I INTRODUCTION (9)

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS (9)

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRIC PROPULSION UNIT (9)

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE (9)

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES (9)

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Suggested Readings

1. Iqbal Hussein Electric and Hybrid Vehicles: Design Fundamentals CRC Press – 2nd edition 2010.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design Standardsmedia – 2nd edition 2009.
3. James Larminie, John Lowry Electric Vehicle Technology Wiley – 2nd edition 2012.
4. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
5. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
6. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and FuelCell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
7. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.
8. https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics
9. https://swayam.gov.in/nd1_noc20_ee18/preview
10. https://nptel.ac.in/courses/108103009/

B.E ELECTRICAL AND ELECTRONICS ENGINEERING **2021-2022**

21BEEEOE02	**RENEWABLE ENERGY RESOURCES**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

Course Objectives

- To gain the knowledge about environmental aspects of energy utilization.
- To study the basic principles of wind energy conversion.
- To gain the knowledge on solar cells, photovoltaic conversion.
- To study the basic principles of fuel cell.
- To know about Geo thermal power plants.
- To gain the knowledge about hydro energy.

Course Outcomes

At the end of this course, students will demonstrate the ability to

- Analyze the Energy Scenario in india
- Understand the concept of Solar Energy
- Understand the concept of Wind Energy
- Gain knowledge on Geo thermal power plants
- Understand the concept of Hydro Energy
- Analyze the different energy sources

UNIT I INTRODUCTION (9)

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY (9)

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY (9)

Introduction – Basic principles of wind energy conversion- components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Inter connected systems.

UNIT IV HYDRO ENERGY (9)

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES (9)

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

Suggested Readings

1. Rai.G.D Non-conventional sources of energy Khanna publishers 2011
2. Khan.B.H Non-Conventional Energy Resources The McGraw Hills, Second edition 2009
3. Rao.S. & Parulekar Energy Technology Khanna publishers, Eleventh Reprint 2013
4. Godfrey Boyl Renewable Energy: Power sustainable future Oxford University Press, Third edition 2012.
5. John W Twidell and Anthony D Weir Renewable Energy Resources Taylor and Francis – 3rd edition 2015.
6. https://nptel.ac.in/courses/103/107/103107157/
7. https://nptel.ac.in/courses/121/106/121106014/
8. https://nptel.ac.in/courses/108/108/108108078/

B.E-COMPUTER SCIENCE ENGINEERING **2021-2022**

21BECSOE01 INTERNET PROGRAMMING 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To study concepts of Internet, IP addresses and protocols
- To introduce the Java programming language and explore its current strengths and Weaknesses
- To Elaborate on the principles of web page development
- To write working Java code to demonstrate the use of applets for client side programming
- To study Internet telephony and various multimedia applications
- To learn java-specific web services architecture

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

- Learn the advanced concepts& techniques of Internet and Java.
- analyze the requirements for and create and implement the principles of web page development
- Understand the concepts of object-oriented and scripting
- Implement client side programming using java applets
- Generate applications based upon advanced java concepts
- Use AJAX and web services to develop interactive web applications

UNIT I Introduction (9)

Introduction - Network of Networks, Intranet, Extranet and Internet. World Wide Web- Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing- Classful and Classless Addressing, Subnetting

UNIT IIHTML (9)

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps- map, area, attributes of image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax,

Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction- Environment Variable, GET and POST Methods.

UNIT III PERL **(9)**

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie with example. Java Applets-Container Class, Components, Applet Life Cycle, Update method, Applications.

UNIT IV Client Server Programming **(9)**

Client-Server programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V Internet Telephony **(9)**

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Total Hours: 45

TEXT BOOKS:

1. Robert W. Sebesta, “Programming the World Wide Web”, Pearson Education, 2016
2. Paul Deitel, Harvey Deitel and Abby Deitel, “Internet and World Wide Web-How to Program”, 5th Edition, 2011.

REFERENCES:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
2. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI Learning, Delhi, 2011.

WEBSITES:

1. https://nptel.ac.in/courses/106/105/106105084/
2. https://supportline.microfocus.com/Documentation/books/sx22sp1/piover.htm
3. https://www.geeksforgeeks.org/internet-and-web-programming/

21BECSOE02	**MACHINE LEARNING**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- To introduce the basic concepts and techniques of Machine Learning.
- To have a complete understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To learn Dimensionality Reduction Techniques.
- To understand Evolutionary Models and Graphical models of machine learning algorithms
- To design appropriate machine learning algorithms for problem solving

COURSE OUTCOMES

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

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Apply the appropriate machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
- Design systems that uses the appropriate graph models of machine learning
- Modify existing machine learning algorithms to improve classification accuracy / efficiency
- Analyse and suggest appropriate machine learning approaches for various types of problems

UNIT I INTRODUCTION (9)

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS (9)

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back

Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING (9)

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING (9)

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V ADVANCED LEARNING (9)

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

TEXT BOOKS:

1. Michael Bowles, "Machine Learning in Python-Essential Techniques for Predictive Analysis", Wiley Publication, 2015.
2. Stephen Marsland, "MachineLearning – An Algorithmic Perspective",SecondEdition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014.

REFERENCES:

1. EthemAlpaydin,"Introduction to Machine Learning",3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press,2014
2. Tom MMitchell,"Machine Learning",First Edition,McGrawHill Education, 2013.
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.

WEBSITES:

1. https://nptel.ac.in/courses/106106139/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
3. https://www.dataquest.io/blog/machine-learning-python/

21BEBMEOE01 ROBOTICS IN MEDICINE 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students

- To Discuss the basics of Robotics, Kinematics.
- To perceive the basics of Inverse Kinematics.
- To Explore various kinematic motion planning solutions for various Robotic configurations.
- To Explore various applications of Robots in Medicine

COURSE OUTCOMES

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

- Demonstrate kinds robotics techniques, vision, planning and applications.
- Design various robotics applications
- Simulate planar motion, Source , Goal scenes and Task Planner

UNIT I INTRODUCTION

Introduction Automation and Robots, Classification, Application, Specification, Notations, Direct Kinematics Dot and cross products, Coordinate frames, Rotations, Homogeneous coordinates Link coordination arm equation – Five-axis robot, Four-axis robot, Six-axis robot

UNIT II KINEMATICS

Inverse Kinematics – General properties of solutions tool configuration, Five axis robots, Three-Four axis, Six axis Robot, Workspace analysis and trajectory planning work envelope and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

UNIT III ROBOT VISION

Robot Vision Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation – Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured illumination, Camera calibration.

UNIT IV PLANNING

Task Planning Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp Planning, Fine-motion planning, Simulation of planar motion, Source and Goal scenes, Task Planner simulation.

UNIT V APPLICATIONS

Applications in Biomedical Engineering – Bio Engineering Biologically Inspired Robots, Neural Engineering, Application in Rehabilitation – Interactive Therapy, Bionic Arm, Clinical and Surgical – Gynecology, Orthopedics, Neurosurgery.

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Robert Schilling	Fundamentals of Robotics-Analysis and control‖	Prentice Hall	2003
2	J.J.Craig	Introduction to Robotics‖,	Pearson Education	2005

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Staugaard, Andrew C	Robotics and Artificial Intelligence: An Introduction to Applied Machine Learning‖	Prentice Hall Of India	1987
2	Grover, Wiess, Nagel, Oderey	Industrial Robotics: Technology, Programming and Applications‖	McGraw Hill	1986.
3	Wolfram Stadler	Analytical Robotics and Mechatronics‖	McGraw Hill,	1995
4	Saeed B. Niku,	Introduction to Robotics: Analysis, Systems, Applications‖	Prentice Hall	2001
5	K. S. Fu, R. C.	Robotics‖	McGraw Hill	2008

	Gonzales and C. S. G. Lee			

WEBSITES:

1. www.mit.edu 2. www.nptel.com

21BEBMEOE02 ARTIFICIAL ORGANS AND IMPLANTS 3H-3C

Instruction Hours/week: L:3 T:0 P:0 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students:

- To discuss the overview of artificial organs & transplants
- To extend the principles of implant design with a case study
- To explain the implant design parameters and solution in use
- To simplify about various blood interfacing implants

COURSE OUTCOMES:

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

1. Explain the implant design parameters and solution in use
2. Analyze about various blood interfacing implants
3. Perceive knowledge about artificial organs & transplants
4. Demonstrate different types of soft tissue replacement and hard tissue replacement

UNIT I ARTIFICIAL ORGANS

Artificial blood, Artificial skin, Artificial Heart, Prosthetic Cardiac Valves, Artificial lung (oxygenator), Artificial Kidney (Dialyser membrane), Dental Implants

UNIT II IMPLANT DESIGN & MATERIALS

Principles of implant design, Clinical problems requiring implants for solution. Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite, glass ceramics, carbons, medical applications

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION

Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV BLOOD INTERFACING IMPLANTS

Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS

Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

TEXT BOOKS:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	Kopff W.J	Artificial Organs	John Wiley and sons, New York, 1st edition	1976
2	Park J.B.,	Biomaterials Science and Engineering‖	Plenum Press	1984

REFERENCES:

S.NO.	Author(s) Name	Title of the book	Publisher	Year of publication
1	J D Bronzino	Biomedical Engineering handbook Volume II	CRC Press / IEEE Press	2000
2	R S Khandpur	Handbook of Biomedical Instrumentation	Tata McGraw Hill	2003
3	Joon B Park	Biomaterials – An Introduction	Plenum press, New York	1992
4	Yannas, I. V	Tissue and Organ Regeneration in Adults‖	New York, NY: Springer	2001
5	Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino	Clinical Engineering‖	CRC Press, 1st edition	2010
6	Myer Kutz	Standard Handbook of Biomedical Engineering & Design	McGraw- Hill	2003

WEBSITE:

1. www.mit.edu
2. www.nptel.com