B.E ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI 2022

(REGULAR PROGRAMME)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under section 3 of UGC Act, 1956)
(Accredited with A+ Grade by NAAC in the Second Cycle)
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KARPAGAM ACADEMY OF HIGHER EDUCATION

(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 2022

CHOICE BASED CREDIT SYSTEM

These regulations are effective from the academic year 2022 – 2023 and applicable to the candidates admitted to B. E. / B. Tech. during 2022 - 2023 and onwards.

1. ADMISSION

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) prescribed by the State Government / Central Government with Mathematics/ Physics/ Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship. (Any of the above three subjects) or any similar Examination of any other institution/ University or authority accepted by the Karpagam Academy of Higher Education as equivalent thereto).

Should obtained at least 45% marks (40% marks in case of candidates belonging to reserved category) in the above subjects taken together.

(OR)

Passed min. 3 years Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) subject to vacancies in the First Year, in case the vacancies at lateral entry are exhausted. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

Lateral Entry Admission

Candidates who possess Diploma in Engineering / Technology (10+3 or 10+2+2) awarded by the Directorate of Technical Education with passed minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology are eligible to apply for admission to the third semester of B. E./B. Tech.. Such candidates shall undergo two additional engineering subjects in the 3rd and 4th semester as prescribed by the University.

OR

Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.

OR

Passed D.Voc. Stream in the same or allied sector.

(The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

Eligibility criteria for admission in the third semester is given in the table below.

<table>
<tr><th>S. No.</th><th>Programme</th><th>Eligibility criteria</th></tr>
<tr><td>1.</td><td>B.E Bio Medical Engineering</td><td rowspan="10">Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks incase of candidates belonging to reserved category) in ANY branch of Engineering and Technology.

OR
Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.

OR
Passed D.Voc. Stream in the same or allied sector.
(The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)</td></tr>
<tr><td>2</td><td>B. E. Civil Engineering</td></tr>
<tr><td>3.</td><td>B. E. Computer Science and Design</td></tr>
<tr><td>4.</td><td>B. E. Computer Science and Engineering</td></tr>
<tr><td>5.</td><td>B. E. Electrical and Electronics Engineering</td></tr>
<tr><td>6.</td><td>B. E. Electronics and Communications Engineering</td></tr>
<tr><td>7.</td><td>B. E. Mechanical Engineering</td></tr>
<tr><td>8.</td><td>B. Tech. Artificial Intelligence and Data Science</td></tr>
<tr><td>9.</td><td>B. Tech Bio - Technology</td></tr>
<tr><td>10.</td><td>B. Tech Food Technology</td></tr>
</table>

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 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 Bio Medical Engineering
2. B. E. Civil Engineering
3. B. E. Computer Science and Design
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. Artificial Intelligence and Data Science
9. B. Tech. Bio-Technology
10. B. Tech Food Technology

3. MODE OF STUDY

Full-Time:

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

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

Change from one programme to another is not permitted.

4. STRUCTURE OF PROGRAMMES

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 of Engineering/Technology.

(iii) Elective courses for specialization in related fields.

(iv) Workshop practice, computer practice, engineering graphics,laboratory work, in-plant training, seminar presentation, projectwork, 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**

CBCS is introduced for students admitted in the academic year 2017-18. 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 enable students to undergo additional courses. CBCS is applicable to Full Time Undergraduate & 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 & 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 Hardcore courses cannot be substituted by another courses. 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 semester. Maximum no of students to be registered in each course shall depend on availablility of physical facilities, classroom availability and lab capacity. Registration of already requested courses by students in previous semester is not allowed.

Each course is normally assigned 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

Inevery semester, the curriculum shall normally have a blend of theory courses not exceeding6and practical courses not exceeding 3. However, the total number of courses per semester shall not exceed 8.

The prescribed credits required for the award of the degree shall be within the limits specified below.

PROGRAMME	PRESCRIBED CREDIT RANGE
B. E./B. Tech.	160– 165

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

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.

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 few courses may be by Internal Assessment only.

5. DURATION OF THE PROGRAMME

The prescribed duration of the programme shall be

Programme	Min. No. of semesters	Max. No. of semesters
B. E./B. Tech. (H. Sc. Candidates)	8	14
B. E./B. Tech. (Lateral Entry Candidates)	6	12

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

Additional classes for improvement, conduct of 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

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 classesand the conduct of the candidate has been satisfactory during the course.

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 programmeswith 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.

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 course plan for each course at the beginning of each semester.

8. CLASS COMMITTEE

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-learningprocess. 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 weight age 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 class room 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.

The class committee for a class under a particular branch is normally constituted by the Headof the Department. 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.

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

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

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

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.

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. Where ever 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

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.

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:

S. 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 x 2 =18Marks)**.
Part- B	Question 10 to 12 will be of either or type, covering two units of the syllabus. Each Question may have subdivision. (**3 x 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 x 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 x 2= 10Marks)**.
Part- C	Question 26 to 30 will be of either or type, covering Five units of the syllabus. Each Question may have subdivision. **(5 x 14=70 Marks).**

PRACTICAL COURSES:

S. 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 Continous 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 Examinatiion 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 Examinatiion 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.

ATTENDANCE

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

S. No.	Attendance %	Marks
1	91 and above	5.0
2	81-90	4.0
3	76-80	3.0

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 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.

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= 10Marks)**.
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

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.

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

If the candidate fails to secure a pass in a particular course ESE, itis 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 and considered valid for all remaining attempts till the candidate secures a pass in his/her ESE.

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 semesterwhen 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).

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

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 advice the students regarding the online courses and monitor their course.

Student Shall study atleast one online course from Sawayam/NPTEL in anyone 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 course 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

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

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 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.

$$\text{GPA} = \frac{\text{Sum of } [C * GP]}{sum\ of\ c}$$

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

REVALUATION

Revaluation and Re-totaling is 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.

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 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

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.

A regular candidate or a lateral entrant is eligible to register for BE(Honors),B.Tech(Honors). If, he / she has passed all the courses in the first appearance and

holds / maintains a CGPA of 7.5 at VI Semester. He / she has to take an additional 20 credits by studying online courses through Swayam/NPTEL . Such a candidate is eligible for the award of BE (Honor),B.Tech(Honor). However, is he / she fails in securing 20 additional credits butmaintains CGPA of 7.5 and above is not eligible for Honors degree but eligible for First class with Distinction.

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.

16.3 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

A candidate may for valid reasons and on 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. .

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.

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 IIIsemester.

Withdrawal from the ESE is NOT applicable to arrear Examinations.

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

18. PROVISION FOR AUTHORISED BREAK OF STUDY

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 extraordinary situation the candidate may apply for additional break of study not exceeding another one year by payingprescribed fee for 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.

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.

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 Clause17). However, additional break of study granted will be counted for the purpose of classification.

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 maybe eligible for the award of the degree.

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' (Clause18 and 18 respectively).

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 behavior 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.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
FACULTY OF ENGINEERING
UG PROGRAM (CBCS) – B.E –EEE (FULL TIME)
(2022–2023 Batch and onwards)

Course Code	Name of the course	Category	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PEO	PO & PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER I												
22BECC101	English	HSMC	2	i,j,l	2	0	2	3	40	60	100	11
22BECC102	Mathematics -I	BSC	2	a,b,e,l	3	1	0	4	40	60	100	13
22BECC141	Engineering Physics	BSC	2	a,b,c,e,g,l	3	1	2	5	40	60	100	15
22BECC142	Engineering Chemistry	BSC	2	a,b,c,e,l	3	0	4	5	40	60	100	18
22BECC143	Python Programming	ESC	2	a,b,c,d,e,l	2	0	2	3	40	60	100	22
22BEEE111	Workshop Practices	ESC	2	c,d	1	0	2	2	40	60	100	25
Semester Total					**14**	**2**	**12**	**22**	**240**	**360**	**600**	
SEMESTER II												
22BECC201	Communicative English	HSMC	2	i,j,l	2	0	2	3	40	60	100	27
22BEEE202	Mathematics – II (Transform Calculus and Numerical Methods)	BSC	2	a,b,c,e,l	3	1	0	4	40	60	100	29
22BECC203	Semiconductor Physics	BSC	2	a,b,c,e,g,l	3	0	0	3	40	60	100	31
22BEEE241	Electrical Circuit Analysis	ESC	1	a,b,c,d,e,l	3	1	2	5	40	60	100	34
22BEEE242	C Programming	ESC	2	a,b,c,d,e,l	3	0	4	5	40	60	100	37
22BEEE211	Engineering Graphics	ESC	2	c,d	2	0	2	3	40	60	100	40
Semester Total					**16**	**2**	**10**	**23**	**240**	**360**	**600**	

Course code	Name of the course	Category	Objectives and out comes		Instruction hours / week			Credit(s)	Maximum Marks			PAGE NO
			PEOs	POs	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER – III												
22BEEE301	Mathematics – III (Probability and Statistics)	BSC	2	a,b,c,e,l	3	1	0	4	40	60	100	42
22BEEE302	Electrical Machines – I	PCC	1	a,b,c,d,e,j	3	0	0	3	40	60	100	44
22BEEE303	Electromagnetic Field	PCC	1	a,b,c,d,e,j,l	3	1	0	4	40	60	100	47
22BEEE304	Transmission and Distribution	PCC	2	a,b,c,d,e,h,l	3	0	0	3	40	60	100	49
22BEEE305	Environmental Studies	HSMC	2	a,b,e,f,g,h,l	3	0	0	3	40	60	100	51
22BEEE341	Electron Devices and Circuits	PCC	2	a,b,c,d,e,l	3	0	2	4	40	60	100	54
22BEEE311	Electrical Machines Laboratory – I	LC	1	a,d,e,k,l	0	0	2	1	40	60	100	57
22BEEE351	Electricity Standards	MC	2		1	0	0	0	100	0	100	58
Semester Total					**19**	**2**	**4**	**22**	**380**	**420**	**800**	
SEMESTER – IV												
22BEEE401	Electrical Machines – II	PCC	1	a,b,c,d,e,g,l	3	0	0	3	40	60	100	59
22BEEE402	Linear Integrated Circuits	PCC	1	a,b,c,e	3	0	0	3	40	60	100	61
22BEEE403	Signals and Systems	PCC	1	a,b,c,d,e,g,l	2	1	0	3	40	60	100	63
22BEEE404	Digital Electronics	PCC	2	d,e	3	0	0	3	40	60	100	66
22BEEE441	Measurements and Instrumentation	PCC	1	a,b,c,d,e,l	3	0	2	4	40	60	100	68
22BEEE411	Electrical Machines Laboratory-II	LC	1	a,b,c,d,e,g,j,k,l	0	0	2	1	40	60	100	71
22BEEE412	Linear Integrated Circuits Laboratory	LC	1	a,b,c,e,j,k	0	0	2	1	40	60	100	73
22BEEE413	Digital Electronics Laboratory	LC	2	d,e,j,k	0	0	2	1	40	60	100	75
22BEEE451	Constitution of India	MC	2		1	0	0	0	100	0	100	77
Semester Total					**15**	**1**	**8**	**19**	**420**	**480**	**900**	

Course code	Name of the course	Category	Objectives and out comes		Instruction hours / week			Credit(s)	Maximum Marks			PAGE NO
			PEOs	POs	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER – V												
22BEEE501	Power Systems Analysis	PCC	2	a,b,c,d,e,g,l	3	0	0	3	40	60	100	79
22BEEE502	Control Systems	PCC	1	a,b,c,d,e,l	3	0	0	3	40	60	100	81
22BEEE503	Microprocessors and Microcontrollers	PCC	1	a,c,e,h,i,k,l	3	0	0	3	40	60	100	83
22BEEE504	Renewable Energy Systems	PCC	2	a,b,c,d,e,g,l	3	0	0	3	40	60	100	85
22BEEE5E_ _	Program Elective - I	PEC			3	0	0	3	40	60	100	
22BEEE511	Control Systems Laboratory	LC	1	a,b,c,d,e,j,k,l	0	0	2	1	40	60	100	87
22BEEE512	Microprocessors and Microcontrollers Laboratory	LC	1	a,c,e,j,k,l	0	0	2	1	40	60	100	88
22BEEE551	PCB design	MC	1		1	0	0	0	100	0	100	90
Semester Total					**16**	**0**	**4**	**17**	**380**	**420**	**800**	
SEMESTER – VI												
22BEEE601	Engineering Economics and Financial Management	HSMC	2	a,b,c	3	0	0	3	40	60	100	92
22BEEE602	Power System Protection and Switchgear	PCC	2	a,b,c,d,e,g,l	3	0	0	3	40	60	100	94
22BEEE603	Power Electronics	PCC	1	a,b,c,d,e,g	3	0	0	3	40	60	100	96
22BEEE6E_ _	Program Elective - II	PEC			3	0	0	3	40	60	100	
22BEEE6E_ _	Program Elective - III	PEC			3	0	0	3	40	60	100	
22BE_ _6OE_ _	Open Elective-I	OEC			3	0	0	3	40	60	100	
22BEEE611	Power Systems Laboratory	LC	2	a,c,d,g,j,k,l	0	0	2	1	40	60	100	98
22BEEE612	Power Electronics Laboratory	LC	1	a,b,c,d,e,g,j,k,l	0	0	2	1	40	60	100	99
22BEEE691	Mini project	MC	1	a,c,e,j,k,l	1	0	0	0	100	0	100	101
Semester Total					**19**	**0**	**4**	**20**	**420**	**480**	**900**	

Course code	Name of the course	Category	Objectives and out comes		Instruction hours / week			Credit(s)	Maximum Marks			PAGE NO
			PEOs	POs	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER – VII												
22BEEE701	Professional Ethics And Entrepreneurship Development	HSMC	1	a,b,d, g,k,l	3	0	0	3	40	60	100	102
22BEEE702	Electrical Drives and Controls	PCC	1	a,b,c,d ,e,g	3	0	0	3	40	60	100	104
22BEEE703	Smart Grid	PCC	2	a,b,c,g ,h,l	3	0	0	3	40	60	100	106
22BEEE7E_ _	Program Elective -IV	PEC			3	0	0	3	40	60	100	
22BEEE7E_ _	Program Elective -V	PEC			3	0	0	3	40	60	100	
22BE_ _7OE_ _	Open Elective-II	OEC			3	0	0	3	40	60	100	
22BEEE751	Internship	LC	1		0	0	0	3	100		100	108
22BEEE791	Project Work Phase-I	PROJ	1	a,b,c,d ,e,f,g, h,i,j,kl	0	0	6	3	80	120	200	109
Semester Total					**18**	**0**	**6**	**24**	**420**	**480**	**900**	
SEMESTER – VIII												
22BEEE8E_ _	Program Elective -VI	PEC			3	0	0	3	40	60	100	
22BEEE8E_ _	Program Elective-VII	PEC			3	0	0	3	40	60	100	
22BEEE8E_ _	Program Elective-VIII	PEC			3	0	0	3	40	60	100	
22BEEE891	Project Work-Phase-II & Viva -Voce	PROJ	1	a,b,c,d ,e,f,g, h,i,j,kl	0	0	16	8	80	120	200	110
Semester Total					**9**	**0**	**16**	**17**	**200**	**300**	**500**	
Program Total					**126**	**7**	**64**	**164**	**2700**	**3300**	**6000**	

TOTAL CREDITS: 164

PROFESSIONAL ELECTIVE COURSES

SEMESTER V												
Course Code	Course Title	Category	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PEO	PO	L	T	P		CIA	ESE	Total	
									40	60	100	
22BEEE5E01	Electrical Machine Design	PEC	1	a,c,d,e,g	3	0	0	3	40	60	100	111
22BEEE5E02	Sensor and Transducer	PEC	2	a,b,c,d,e	3	0	0	3	40	60	100	113
SEMESTER VI												
Course Code	Course Title	Category	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PEO	PO	L	T	P		CIA	ESE	Total	
									40	60	100	
22BEEE6E01	Digital Signal Processing	PEC	1	a,b,c,d,e,g,l	3	0	0	3	40	60	100	115
22BEEE6E02	Computer Architecture	PEC	1	a,c,e	3	0	0	3	40	60	100	117
22BEEE6E03	Special Electrical Machines	PEC	1	a,c,d,e,h	3	0	0	3	40	60	100	119
22BEEE6E04	High Voltage Engineering	PEC	2	a,c,d,e,h,l	3	0	0	3	40	60	100	121
22BEEE6E05	Object Oriented Programming	PEC	1	c,d,e,l	3	0	0	3	40	60	100	123

SEMESTER VII												
Course Code	Course Title	Category	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PEO	PO	L	T	P		CIA	ESE	Total	
									40	60	100	
22BEEE7E01	Power Plant Engineering	PEC	2	c,d,e,h,I,j	3	0	0	3	40	60	100	125
22BEEE7E02	Electric Hybrid Vehicles	PEC	2	a,b,c,d,e	3	0	0	3	40	60	100	127
22BEEE7E03	Bio Medical Instrumentation	PEC	1	a,c,d,e,f	3	0	0	3	40	60	100	129
22BEEE7E04	Electrical Energy Conservation and Management	PEC	2	a,b,c,d,e,g	3	0	0	3	40	60	100	131
22BEEE7E05	Communication Engineering	PEC	1	a,b,c,d,e	3	0	0	3	40	60	100	133
SEMESTER VIII												
Course Code	Course Title	Category	Objectives & Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PEO	PO	L	T	P		CIA	ESE	Total	
									40	60	100	
22BEEE8E01	Industrial Automation	PEC	1	a,b,c.g.h	3	0	0	3	40	60	100	135
22BEEE8E02	Embedded Systems	PEC	1	a,b,c,d,h	3	0	0	3	40	60	100	137
22BEEE8E03	Power System Operation and Control	PEC	2	a,b,c,d,e,g,l	3	0	0	3	40	60	100	139
22BEEE8E04	Power Quality and Management	PEC	2	a,c,d,e,h,l	3	0	0	3	40	60	100	141
22BEEE8E05	Programmable Logic Controller And its Applications	PEC	1	a,b,c,e,h,i,l	3	0	0	3	40	60	100	143
22BEEE8E06	Internet of Things	PEC	1	a,b,d,e,h	3	0	0	3	40	60	100	145
22BEEE8E07	HVDC And FACTS	PEC	2	a,c,d,e,h,l	3	0	0	3	40	60	100	147

LIST OF OPEN ELECTIVES

COURSE OFFERED BY OTHER DEPARTMENT

SUB. CODE	TITLE OF THE COURSE	Category	L	T	P	C	CIA	ESE	TOTAL	PAGE NO
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE										
22BTADOE01	Fundamentals of Artificial Intelligence	OEC	3	0	0	3	40	60	100	149
22BTADOE02	Fundamentals Of Data Science	OEC	3	0	0	3	40	60	100	151
22BTADOE03	Internet Programming	OEC	3	0	0	3	40	60	100	153
22BTADOE04	Robotics And Automation	OEC	3	0	0	3	40	60	100	155
BIOMEDICAL ENGINEERING										
22BEBMEOE01	Human Anatomy And Physiology	OEC	3	0	0	3	40	60	100	157
22BEBMEOE02	Artificial Organs And Implants	OEC	3	0	0	3	40	60	100	159
BIO TECHNOLOGY										
22BTBTOE01	Bioreactor Design	OEC	3	0	0	3	40	60	100	161
22BTBTOE02	Food Processing And Preservation	OEC	3	0	0	3	40	60	100	163
22BTBTOE03	Basic Bioinformatics	OEC	3	0	0	3	40	60	100	165
22BTBTOE04	Fundamentals Of Nano Biotechnology	OEC	3	0	0	3	40	60	100	167
CIVIL ENGINEERING										
22BECEOE01	Housing, Plan and Management	OEC	3	0	0	3	40	60	100	169
22BECEOE02	Building Services	OEC	3	0	0	3	40	60	100	171
22BECEOE03	Repair and rehabilitation of structures	OEC	3	0	0	3	40	60	100	173
22BECEOE04	Computer-Aided Civil Engineering Drawing	OEC	3	0	0	3	40	60	100	175
22BECEOE05	Contracts Management	OEC	3	0	0	3	40	60	100	177
22BECEOE06	Air and Noise Pollution and Control	OEC	3	0	0	3	40	60	100	179
COMPUTER SCIENCE AND DESIGN										
22BECDOE01	Introduction To 3d Modelling And Animation	OEC	3	0	0	3	40	60	100	181
22BECDOE02	Digital photography	OEC	3	0	0	3	40	60	100	183

22BECDOE03	Mobile Application Development	OEC	3	0	0	3	40	60	100	185
COMPUTER SCIENCE AND ENGINEERING										
22BECSOE01	Internet Of Things	OEC	3	0	0	3	40	60	100	187
22BECSOE02	Machine Learning	OEC	3	0	0	3	40	60	100	189
22BECSOE03	Blockchain Technologies	OEC	3	0	0	3	40	60	100	191
ELECTRONICS AND COMMUNICATION ENGINEERING										
22BEECOE01	Neural Networks And Its Applications	OEC	3	0	0	3	40	60	100	193
22BEECOE02	Principles of Modern Communication System	OEC	3	0	0	3	40	60	100	195
FOOD TECHNOLOGY										
22BTFTOE01	Processing Of Food Materials	OEC	3	0	0	3	40	60	100	197
22BTFTOE02	Nutrition And Dietetics	OEC	3	0	0	3	40	60	100	199
22BTFTOE03	Ready To eat foods	OEC	3	0	0	3	40	60	100	201
22BTFTOE04	Agricultural Waste And Byproducts Utilization	OEC	3	0	0	3	40	60	100	203
22BTFTOE05	Design Of Food process equipment	OEC	3	0	0	3	40	60	100	205
MECHANICAL ENGINEERING										
22BEMEOE01	Computer Aided Design	OEC	3	0	0	3	40	60	100	207
22BEMEOE02	Industrial Safety and Environment	OEC	3	0	0	3	40	60	100	209
22BEMEOE03	Non-Destructive testing	OEC	3	0	0	3	40	60	100	211
COURSES OFFERED TO OTHER DEPARTMENT										
22BEEEOE01	Electric Hybrid Vehicle	OEC	3	0	0	3	40	60	100	213
22BEEEOE02	Renewable Energy Resources	OEC	3	0	0	3	40	60	100	215

PROGRAM OUTCOMES: On successful completion of the programme,

a	Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
b	Identify and formulate Electrical and Electronics Engineering problems from research literature and be ability to analyze the problem using first principles of Mathematics and Engineering Sciences.
c	Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into accountpublic health and safety and the social, cultural and environmental issues.
d	Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significantconclusion.
e	Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems and also being conscious of the limitations.
f	Understand the role and responsibility of the Professional Electrical and Electronics Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.
g	Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for Sustainable Development.
h	Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
i	Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
j	Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.
k	Demonstrate the acquisition of the body of engineering knowledge and insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.
l	Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

PROGRAM SPECIFIC OUTCOMES:

m	Analyze and design controllers for electrical system using analog and digital electronic circuits and systems.
n	Graduates will be motivated for continuous self learning in engineering practice and pursue research in advanced areas of Electrical Engineering in order to offer engineering services to the society, ethically.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Have successful technical and professional careers in their chosen fields such as circuit theory, Field theory, control theory and computational platforms.
PEO 2	Engrossinlifelongprocessoflearningtokeepthemselvesabreastofnew developments in the field of Electronics and their applications in power engineering

MAPPING:

PEO \PO	**a**	**b**	**c**	**b**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
PEO1	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
PEO2	✓	✓	✓	✓	✓	✓		✓		✓			✓	✓

Semester-I

22BECC101 **ENGLISH** **4H-3C**

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

End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students to

- Enable students to art Artificial Intelligence and Data Science, Computer Science and Design fluency and accuracy to inculcate proficiency in professional communication to meet the growing demand in the field of Global communication.
- Help students acquire their ability to speak effectively in real life situations.
- Inculcate the habit of reading and to develop their effective reading skills.
- Ensure that students use dictionary to improve their active and passive vocabulary.
- Enable students to improve their lexical, grammatical and communicative competence.
- Enrich the knowledge of official document writing such as Note taking, Precise writing ect..

Course Outcomes(COs)

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

1. Use English language for communication: verbal &non–verbal.
2. Enrich comprehension and acquisition of speaking & writing ability.
3. Gain confidence in using English language in real life situations.
4. Improve word power: lexical, grammatical and communication competence.
5. Guide the students to write business letters and other forms of technical writing.
6. Enable students to prepare for oral communication in formal contexts.

Unit: I - Basic Writing Skills **(9)**

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 **(9)**

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 - Grammarand Usage **(9)**

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

Unit: IV - Listening andReading Skills **(9)**

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

Unit: V-WritingPractices **(9)**

Comprehension - Précis writing - essay writing listening comprehension - common everyday situations: conversations and dialogues - communication at workplace – interviews - formal presentations

Total : 45

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 UniversityPress.
3. Liz Hamp - Lyons and Ben Heasly, (2006), Study Writing, Cambridge UniversityPress
4. F.T. Wood., (2007), Remedial English Grammar, Macmillan.
5. Michael Swan, (1995). Practical English Usage,OUP.

22BECC102 **Semester-I**

MATHEMATICS -I 4H-4C

Instruction Hours/week: L:3T:1P: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 forpractical applications.
- To understand geometrical aspects of curvature and elegant application of differential calculus which are needed in Engineeringapplications.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model Engineeringproblems.
- To familiarize the student with functions of several variables which is the foundation for many branches ofEngineering.
- To introduce sequence and series which is central to many applications in Engineering.

Course Outcomes(COs)

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

1. 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.
2. To equip the students to have basic knowledge and understanding in one field of materials, differential calculus
3. To solve simple standard examples using the ideas of differential equations.
4. To apply various techniques to solve Partial Differential Equations
5. To develop the tool of power series for learning advanced Engineering Mathematics.
6. To apply the knowledge acquired to solve various Engineering problems.

UNITI MATRICES (12)

Introduction - Characteristic equation – Eigen values 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 (12)

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

UNITIII DIFFERENTIAL EQUATIONS (12)

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

UNITIV FUNCTIONS OF SEVERALVARIABLES (12)

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.

UNITV SEQUENCES AND SERIES (12)

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 conditionalconvergence.

Total : 60

Suggested Readings:

1. Grewal B.S., (2014), Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, NewDelhi.
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 McGrawHill NewDelhi.
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. PeterV.O‟Neil,(2012),AdvancedEngineeringMathematics,7thEdition,Cengage learning.
10. Gilbert Strang, (2009), Introduction to Linear Algebra, 4th Edition,Wellesley-CambridgePress.

Websites :

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

22BECC141 **Semester-I**

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

Instruction Hours/week: L:3 T:1P: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.
- Understand the basics of laser and optical fiber with appropriate 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(COs)

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

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

UNIT I – PROPERTIES OF MATTER AND SOUND (9)

Elasticity –stress- strain diagram - factors affecting elastic modulus - tensile strength – Poisson‟s ratio – Twisting couple - Torsion pendulum- bending of beams – bending moment – young‟s modulus – uniform and non-uniform bending – I- shaped girders. Basics of sound - Sabine‟s formula – acoustic quality - Ultrasound– Production, Industrial and medical applications.

UNIT II – LASER ANDFIBER OPTICS (9)

Light: Introduction – various phenomena – LASER- characteristics - Einstein‟s co-efficients derivation. Nd:YAG, CO_2, Semiconductor LASER- Applications of LASER in industry and medicine.

Fiber optics - principle– modes of propagation of light in optical fibers – numerical aperture and acceptance angle – Attenuation - types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram) - Fiber optic sensors

UNIT III –THERMAL PHYSICS (9)

Laws of thermodynamics - thermal expansions – bimetallic strips – Mode of heat transfer - thermal conductivity, Forbe‟s and Lee‟s disc method: theory and experiment – heat conduction through compound media (series and parallel) – Joule Thomson‟s effect – porous plugexperiment – refrigerating mechanisms – Air conditioning mechanisms - microwave oven and solar water heater.

UNIT IV –QUANTUMPHYSICS (9)

Black body radiation - Photo electric effect – Compton effect –De Broglie hypothesis - uncertainty principle – super position principle - wave function and wave packets – Phase and group velocities - Schrödinger‟s wave equations – probability of fining a particle in one dimensional box- physical significance of wave function – Expectation values - Degeneracy

UNIT V –CRYSTAL PHYSICS (9)

Crystalline and amorphous solids – crystal structure - unit cell, primitive cell - crystal systems, Bravais lattices, Miller indices – inter-planar distances - Coordination number and packing factor for SC, BCC, FCC, HCP structures – ZnS and diamond structure – quasi crystal and liquid crystal – defects incrystal.

Total: 45

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. NaturePhysics
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 PhysicalSociety)

WEBLINKS

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 inphysics.

LIST OF EXPERIMENTS – PHYSICS (Any 8 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‟smodulus.
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 opticalfiber.
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. Characteristics of photodiode.

22BECC142 **ENGINEERING CHEMISTRY** **6H-5C**

(Theory & Lab.)

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

End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students :

- To learn the basics of Periodic properties, Intermolecularforces
- To infer the terminologies of electrochemistry and to analyze about energystorage devices
- To build the concept of corrosion and its prevention
- To summarize the basic water technology and itspurification.
- To analyze about spectroscopic technique
- To develop an understanding of the range and uses of analytical methods inchemistry

Course Outcomes (COs)

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

1. Rationaliseperiodicpropertiessuchasionization potential, electro negativity, oxidation states andelectronegativity.
2. Analyse the mechanism of different energystoragedevices.
3. Rationalise different types of corrosion anditsprevention.
4. List the various methods in the purificationofwater.
5. Distinguish the ranges of the electromagnetic spectrum used for excitingdifferent molecular energy levels in variousspectroscopictechniques
6. Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I-Periodic Properties, Intermolecular Forces **(9)**

Introduction to Periodic Properties- atomic and ionic sizes, ionization energies, electron affinity and electronegativity, effective nuclear charge. Penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations. Polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions.

UNIT II–Electrochemistry and Storage Device **(9)**

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 discharging reactions.

UNIT III–Corrosion and Its Control (9)

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aerationcorrosion- 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 (9)

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 (9)

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

Total Hours : 45

SUGGESTED READINGS

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

(ii) ChemistryLaboratory

Course Objectives

The goal of this course is for students:

- To develop knowledge of quantitative analysis of materials by classical andinstrumental methods for developing experimental skills in building technicalcompetence.
- To estimate the amount of sodium carbonate and sodium hydrogen carbonate, hardness, chloride in watersample
- To make the student acquire practical skills in the determination of conductance of solutions, EMFetc
- To acquaint the students with the determination of rate constant of areaction
- To carried out different types of titrations for estimation of concerned inmaterials
- Able to analyse and gain experimental skills

Course Outcomes(COs)

Upon completion of the course the students will be able to

1. Illustrate the principles of chemistry relevant to the analyze of science andengineering.
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, conductanceof solutions, redox potentials, chloride content of water,etc
4. Determine the partition coefficient of a substance between two immiscibleliquids.
5. Acquaint the students with the determination of acid value of anoil
6. Carrying out different types of titrations for estimation of concerned in materials using comparatively more qualities and quantities of materials involved for accurateresults.

Choice of 10 experiments from the following:

1. Determination of surface tensionandviscosity
2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixure usingvolumetrictitration
3. Determination of Ca / Mg usingcomplexometrictitration

4. Thinlayerchromatography
5. Determination of chloride contentofwater
6. Determination of the rate constant ofareaction
7. Conductometry - Determination of cell constant and conductanceofsolutions
8. pH Metry – Determination of Acid/Base
9. Potentiometry - determination of redox potentialsandemfs
10. Saponification/acid value ofanoil
11. Determination of the partition coefficient of a substance between two immiscibleliquids
12. Adsorption of acetic acidbycharcoal
13. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pHof minimum viscosity for gelatin sols and/or coagulation of the white partofegg

Semester-I

22BECC143 PYTHON PROGRAMMING 4H-3C

(Theory & Lab)

Instruction Hours/week: L:2T:0P: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 programminglanguage.
- Discover the need for working with the strings andfunctions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples andsets.
- Indicate the use of regular expressions and built-in functions to navigate the filesystem.
- Infer the Object-oriented Programming concepts inPython.
- Students will solve problems, explore real-world software development challenges,and create practical and contemporaryapplications.

Course Outcomes(COs)

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

1. Explain various operators used inpython.
2. Apply the string handling functions to solve the givenproblem
3. Describe Object oriented concepts withpython
4. Use image processing techniques in python programming to solve a givenproblem
5. Discuss the functions of networking inpython
6. Solve a givenanalogy

UNIT I INTRODUCTION (9)

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

UNIT II CONDITIONAL STATEMENT & STRING HANDLING (9)

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 (9)

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 PROCESSINGWITH PYTHON (9)

Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functionsSimple 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 NETWORKINGWITH PYTHON (9)

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 July2013)
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. "PythonCookbook"O"ReillyMedia;3rd edition(June1,2013)byDavidM.Baezly.
3. Guido Van Rossum, Fred . L. Drake 'Introduction to Python' – Network Theory Limited – March2011
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 Pythonprograms.
- Test and debug PythonPrograms.
- Implement Python programs with conditionals andloops.
- Use functions for structuring Pythonprograms.
- Represent compound data using Python lists, tuples, anddictionaries.
- Read and write data from/to files inPython.

Course Outcomes:

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

- Write, test, and debug simple Pythonprograms.
- Implement Python programs with conditionals andloops.
- Develop Python programs step-wise by defining functions and callingthem.
- Use Python lists, tuples, dictionaries for representing compounddata.
- Read and write data from/to files inPython.

List Of Experiments:

1. Compute the GCD of twonumbers.
2. Find the square root of a number (Newton‟smethod)
3. Exponentiation (power of anumber)
4. Find the maximum of a list ofnumbers
5. Linear search and Binarysearch
6. Selection sort, Insertionsort
7. Mergesort
8. First n primenumbers
9. Multiplymatrices
10. Programs that take command line arguments (wordcount)
11. Find the most frequent words in a text read from afile
12. Simulate elliptical orbits inPygame
13. Simulate bouncing ball inPygame

Semester-I

22BEEE111 WORKSHOP PRACTICES 3H-2C

(Theory & Lab)

Instruction Hours/week: L:1T:0P:2 **Marks:** Internal**:40** External**:60**Total**:100**

Course Objectives

- To prepare the students to gain the knowledge about various manufacturingmethods.
- To impart knowledge on the operations in CNCmachining
- To prepare the students to use the techniques, skills,and modern engineering toolsnecessary for engineeringpractice.
- To provide practical knowledge on the use of Basic ElectricalComponents.
- To provide practical knowledge on the use of Electroniccomponents.
- To provide practical knowledge on carpentry and domestic wiringcircuits.

Course Outcomes (COs)

Upon completion of this course, the students will

1. Understand different manufacturing processes which are commonly employed in theindustry.
2. Fabricate components using differentmethods.
3. Apply knowledge on fabrication of variouscomponents.
4. Create study models in interdisciplinarydomain.
5. Able to understand concepts of basic in handpractices.
6. Assemble different components and produce small devices of theirinterest.

(i) LECTURES&VIDEOS:

Detailed contents

1. Studyonvariousmanufacturingmethods-Casting,Forming,Machiningand Welding.
2. Study on CNCmachineoperation.
3. Study on Fittingoperationsandpowertools.
4. Study on Soldering process,Motor coil windingand Solar PVCells.
5. Study on P-N Junction DiodeCharacteristics.
6. Study onCarpentry.
7. Study on Domestic wiringcircuits.

(ii)WORKSHOPPRACTICE:

1. Machineshop
2. Fittingshop
3. Weldingshop
4. Casting
5. PlumbingExercises

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, NewDelhi,2009.
3. Choudhry S K, Elements of workshop technology, Vol 2, 13th edition, Indian book distributingcompany,Kolkatta,2010.
4. DKSingh, ManufacturingTechnology, 2nd edition,PearsonEducation,2008.
5. Kalpakjian S., Steven S. Schmid, Manufacturing Engineeringand Technology, 4th edition, PearsonEducationIndiaEdition,2001.
6. RoyA.Lindberg,ProcessesandMaterialsofManufacture,4th edition,PrenticeHallIndia,1997
7. RaoP.N.,ManufacturingTechnology,Vol. Iand Vol.II, 4thedition,TataMcGraw HillHouse,2018.

Semester-II

22BECC201 COMMUNICATIVE ENGLISH 4H-3C

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

End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students to

- Acquire their ability to speak effectively in real lifesituations.
- Enable students to communicate in effective way without anybarriers.
- Inculcate the habit of listening and to develop their effective listeningskills.
- Ensure that students use different aids in order to attain effectivecommunication.
- Realize the barriers of communication and overcome thebarriers.
- Enable students to improve their group behavior and presentationskill.

Course Outcomes(COs)

Students undergoing this course will be able to

1. Enrich comprehension and acquisition of listening, speaking & writingability.
2. Gain confidence in using English language and develop leadershipqualities.
3. To guide the students to effectively manage the team as a teamplayer.
4. To develop the students Interpersonal and Interviewskills.
5. Use English language for communication: verbal & non–verbal
6. To enable students to prepare for oral communication in formalcontexts.

Unit: I –Communication Skills **(9)**

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:1I – Elements of Communication **(9)**

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 CommunicationStyle.

Unit: III – Basic Listening Skills **(9)**

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 andGiving Presentations **(9)**

Purposeofaninterview,Do‟sandDon‟tsofaninterview-DealingwithFears,planning your Presentation, Structuring YourPresentation, Delivering Your Presentation, Techniques of Delivery.

Unit:V.-Writing Practices **(9)**

GroupDiscussion:Introduction,Communicationskillsingroupdiscussion,Do‟sand Don‟ts of groupdiscussion

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 EditionNewarrivals.
3. JohnAdair,4th Edition, (2009), . Effectivecommunication,1st Edition CengageLearning
4. Indiapvt.ltd
5. ButterField, (2011), Softskillforeveryone, Macmillan.
6. Stephen.P.Robbins, (2013).Communicationskills,OxfordPress

Semester-II

22BEEE202 **Mathematics–II** **4H-4C**

(Transform Calculus and Numerical Methods)

Instruction Hours/week: L:3T:1P: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 familiarize the prospective engineers with techniques in Transformcalculus.
- The syllabus is designed to develop the use of Transform techniques which is needed by Engineers for practical applications.
- It aims to equip the students in the fundamentals of numerical methods/algorithms to solve systems of different mathematicalequations.
- To learn numerical methods to obtain approximate solutions to mathematicalproblem.
- To make the student understand the purpose of using transforms to create a new domain in which it is easier to handle the problem that is beinginvestigated.
- To make the student to solve various Engineering problems using NumericalMethods.

Course Outcomes(COs)

Upon completion of this course the students will be able

1. To solve the problems in Engineering using TransformTechniques.
2. To derive numerical methods for various mathematical operations and tasks such as interpolation, differentiation andintegration.
3. To analyze and evaluate the accuracy of solution for ordinary differentialequations.
4. To implement numerical methods to solve Partial differentialequations.
5. To solve problems using Z -Transform techniques for discrete timesystems.
6. To improve facility in numericalmanipulation.

UNIT I –FourierTransforms **(12)**

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

UNIT II - Z – Transforms andDifferenceEquations **(12)**

Z-transforms, Elementary properties - Inverse Z-transform (using partial fraction and residues) - Initial and final value theorems - Convolution theorem - Formation of difference equations - Solution of difference equations using Z - transform.

UNIT III - Interpolation andNumericalIntegration **(12)**

Solution of polynomial and transcendental equations – Bisection method-Newton-Raphson method and Regula-Falsi method - Finite differences-Interpolation using

Newton‟s forward and backward difference formulae. Central difference interpolation:Gauss‟s forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson‟s 1/3rd and 3/8rules.

UNIT IV -Initial Value Problems for OrdinaryDifferentialEquations (12)

Ordinary differential equations: Taylor‟s series- Euler and modified Euler‟s methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne‟s And Adam‟s predicator-corrector methods.

UNIT V - Boundary Value Problems for PartialDifferentialEquations (12)

Partial differential equations: Finite difference solution two Dimensional Laplace equation and Poisson equation - Implicit and explicit methods for one Dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods) - Finite difference Explicit method for wave equation.

Total Hours: 60

Suggested Readings:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathy (2008), Numerical Methods, S.Chand Ltd.
2. Grewal B.S.,(2014), Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, NewDelhi.
3. Erwin Kreyszig, (2016), Advanced Engineering Mathematics, 10th Edition, John Wiley, India.
4. Bali. N.P and Manish Goyal,(2014), A Textbook of Engineering Mathematics, 9th Edition, Laxmi Publications Pvt.Ltd.
5. Gupta, S. K., (2013),Numerical Methods for Engineers, 3rd Edition, New Academic Science Ltd, United Kingdom.
6. R.L. Burden & J. D. Faires, (2000), Numerical Analysis, 7th Ed., BrooksColes.
7. Press, W. H. et al., (2007), Numerical Recipes in C: The Art of Scientific Computing, 3rd Edition, Cambridge UniversityPress.
8. James, G.,(2012), Advanced Modern Engineering Mathematics, 5th Edition, Pearson Education.
9. Ramana. B.V., (2016), Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, NewDelhi.
10. Wylie, R.C. and Barrett, L.C.,(2012), Advanced Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi,
11. Peter V. O‟Neil,(2012), Advanced Engineering Mathematics, 7th Edition, Cengage learning.

Websites:

1. www.sosmath.com
2. http://mathworld.wolfram.com/FourierSeries.html
3. www.nptel.ac.in

B.E Electrical Electronics Engineering **2022-2023**

22BECC203 **Semester-II**

Semiconductor Physics **3H-3C**

Instruction Hours/week: L:3T:0P: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 bandstructure.
- Inculcate the characteristics of electronic materials throughbasics.
- Divulge knowledge on the basics of semiconducting materials for diodeapplications.
- Introduce the features of light interaction with semiconductor foroptoelectronic applications.
- Impart the basic knowledge of new semiconducting materials for engineeringapplications.

Course Outcomes(COs)

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

1. Acquire knowledge on the transport of electrons and various bands in solidstructure.
2. Get the fundamental concepts semiconductors for device fabricationprocess.
3. Understand the magnetic, dielectric and superconducting properties for various engineering applications.
4. Have sound knowledge on interaction of light with semiconductor for differentoptoelectronic deviceapplications.
5. Acquire the knowledge on basic properties of modern electronic materials andtheir engineeringapplications.
6. Understand the various properties of semiconductors and diverseapplications.

UNIT I ELECTRONIC THEORY OF SOLIS (9)

Classical free electron theory, Density of states in metalsand energy band diagrams, Kronig-Penny model, Energy bands in solids, Direct and indirect band gaps, types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effect of temperature on Fermi level, Effective mass.

UNITII SEMICONDUCTORS (9)

Properties of semiconductor, 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 contact and Schottky contact, Hall effect – Determination of Hall coefficient - Applications

UNITIII MAGNETIC ANDDIELECTRIC MATERIALS (9)

Magnetic moment, magnetic dipoles - magnetic permeability and susceptibility, types of magnetic materials - Ferromagnetism: origin and exchange interaction, Domain Theory, Hysteresis on the basis of domains, Energy product, hysteresis loss, soft and Hard magnetic materials - Dielectric materials: Polarization, Types - dielectric loss, internal field, Clausius - Mosotti relation, dielectric breakdown.

UNITIV OPTICAL PROPERTIESOFSEMICONDUCTORS (9)

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

UNITV NANOMATERIALS (9)

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, vapour deposition technique, PLD, Properties and Applications of Nanomaterials – Carbon nanotubes - Coulomb blockade, single electron transistor, Photolithography - 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. LeszekMalkinski, 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 ofPhysics).
4. Journal of Electronic Materials(IEEE/TMS).
5. NatureNanotechnology.

Web Links

1.https://nptel.ac.in/courses/115102025/
2.https://nptel.ac.in/courses/108/108/108108122/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/MIT6_012F09_lec01.pdf

Semester-II

22BEEE241 ELECTRICAL CIRCUIT ANALYSIS 6H-5C

(Theory & Lab.)

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

End Semester Exam:3 Hours

i) Theory

Course Objectives

- To gain knowledge on the principles and procedure for the Analysis of Circuits.
- To enable the students to understand the DC circuit analysis
- To enable the students to understand the network theorems.
- To learn the Sinusoidal steady state analysis.
- To understand transients and resonance in RLC circuits
- To understand transients and resonance in coupled circuits.

Course Outcomes (COs)

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

1 Explain the basic concepts of electric circuits.

2 Illustrate the network theorems for DC circuits.

3 Illustrate the network theorems for AC circuits.

4 Explain the concepts of resonant circuits.

5 Discuss the dynamic behavior of electric circuits.

6 Explain the concepts of two port networks.

UNIT I BASIC CIRCUITS ANALYSIS (12)

Ohm's Law – Kirchoff's laws – DC and AC Circuits – Real & Reactive Power, Power factor – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK THEOREMS (12)

Network reduction: voltage and current division, source transformation – Star-delta conversion – Thevenin‟s and Norton‟s Theorem – Superposition Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS (12)

Series and parallel resonance – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE ANALYSIS (12)

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and AC with sinusoidal input.

UNIT V THREE PHASE CIRCUITS & TWO PORT NETWORKS (12)

Three phase balanced / unbalanced voltage sources – Analysis of three phase 3-wire and 4- wire circuits with star and delta connected loads, balanced and unbalanced loads – Phasor diagram of voltages and currents – power and power factor measurements in three phase circuits- Overview of two port networks

SUGGESTED READINGS

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

(ii) Laboratory

ELECTRICAL CIRCUIT ANALYSIS LABORATORY

Course Objectives

- The objective of the Electrical Circuits lab is to expose the students to the electrical circuits and give them experimental skill.
- This course introduces the basic concepts of simple DC & AC Circuits
- The basic Two Port Network Parameters
- Will able to articulate in working of various components of acircuit
- To design electrical systems
- To analyze a given network by applying various network theorems
- To gain practical experience on electric circuits and verification of theorems

Course Outcomes (COs)

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

1. Illustrate the significance of the basic terminologies in electrical circuits and relation between the electrical quantities of R, L andC.
2. Experiment with the basic laws and theorems in electrical circuits**.**
3. Find the current and voltage value using Mesh and Nodal Analysis.**(Re**
4. Demonstrate and analyze the current and voltage variations with circuit elements**.(Un)**
5. Design the AC and DC circuits using NetworkTheorems.**(Cr)**
6. Discuss Application of Mesh and Node Voltage techniques to DC and ACcircuits.**(Cr)**

LIST OF EXPERIMENTS

1. Experimental verification of electrical circuit problems using ohm's laws.
2. Node and Mesh Analysis for AC and DCcircuits.
3. Experimental verification of electrica lcircuitproblemsusingKirchhoff"svoltage laws and Kirchhoff"s currentlaws.
4. Simulation and theoretical verification of electrical circuit problems using Thevenin"s theorem.
5. Simulation and theoretical verification of electrical circuit problems using Norton"s theorem.
6. Simulation and theoretical verification of electrical circuit problems using Superpositiontheorem.

Semester-II

22BEEE242 **C PROGRAMMING** **7H-5C**

(Theory & Lab.)

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

End Semester Exam:3 Hours

i) Theory

Course Objectives

Students undergoing this course are exposed to:

- To Identify and understand the working of key components of acomputer program.
- To Identify and understand the various kinds of keywords and different data types ofC programming
- To Understand, analyze and implement software development tools likealgorithm,
- To develop pseudo codes and programming structures.
- To Study, analyze and understand logical structure of a computer program, anddifferent constructs to develop a program in "C"language.

Course Outcomes(COs)

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

1. Formulate simple algorithms for arithmetic and logical problems
2. Translate the algorithms to programs (in Clanguage)
3. Test and execute the programs and correct syntax and logicalerrors
4. Implement conditional branching, iteration andrecursion
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach
6. Use arrays, pointers and structures to formulate algorithms andprograms
7. Apply programming to solve matrix addition and multiplication problemsand searchingand sortingproblems
8. Apply programming to solve simple numerical method problems, namelyroot findingof function, differentiation of function and simpleintegration.

Unit I – Introduction to Programming **(9)**

Introduction to components of a computer system - Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Structure of C Program,Character Set, Variables And Identifiers, Keywords- Built-In Data Types- Arithmetic Operators And Expressions, Constants And Literals, Simple Assignment Statement- Basic Input/Output Statement- Simple 'C' Programs, usage ofconstkeyword

Unit II – Arithmetic expressions, precedence, Conditional Branching and Loops (9)

Conditional Branching-simple If, If…Else, Nested If…Else, Switch Case, Break, Continue, return- Loops-While, do…while, for, goto-Writing and evaluation of conditionals and consequent branching- Iteration and loops.

Unit III - Array and Basic Algorithms (9)

One Dimensional Arrays- Array Manipulation; Searching, Insertion, Deletion Of An Element From An Array- Finding The Largest/Smallest Element In An Array- Two Dimensional Arrays, -Addition / Multiplication Of Two Matrices- Strings As Array Of Characters.Basic Sorting Algorithms-Bubble, Insertion and Selection sorting, Finding roots of equations, notion of order of complexity through example programs (no formal definitionrequired).

Unit IV – Function and Recursion (9)

Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays Example Problems- Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion.

Unit V - Structure, Pointers and File Handling (9)

Structures – initialization - nested structures – structures and arrays – structures and pointers - union – typedef and enumeration types - bit fields - File Management in C – Files and Streams – File handling functions – Sequential access file- Random access file – Command line arguments.

SUGGESTED READINGS :

1. E.Balagurusamy,Computing Fundamentalsand C Programming,TMH Education, 5th Edition,(2017).
2. E.Balaguruswamy, Programming in ANSIC, Tata McGraw-Hill, 7th Edition,(2017).
3. Byron Gottfried, Schaum's, Outline of Programming with C, McGraw-Hill, 3rd Edition,(2017).
4. Brian W.Kernighan and Dennis M.Ritchie, The C Programming Language, Prentice Hall ofIndia, 2nd Edition,(2015).

WEBSITES:

1) https://www.coursera.org/learn/problem-solving
2) https://www.edx.org/learn/problem-solving
3) https://www.udemy.com/topic/problem-solving/
4) https://swayam.gov.in/nd1_noc19_cs43/preview

(ii) Laboratory

Course Objectives:

Students undergoing this course are exposed to:

- To develop programs in C using basicconstructs.
- To develop applications in C using fileprocessing
- To provide an awareness to Computing and CProgramming
- To learn to develop algorithm for simple problemsolving
- To write programs to solve mathematicalproblems.
- To develop applications in C using strings, pointers, functions,structures

Course Outcomes(COs)

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

1. Formulate the algorithms for simpleproblems
2. Translate given algorithms to a working and correctprogram
3. Correct syntax errors as reported by thecompilers
4. Identify and correct logical errors encountered at runtime
5. Write iterative as well as recursiveprograms
6. Represent data in arrays, strings and structures and manipulate them through aprogram
7. Declare pointers of different types and use the mind defining self- referentialstructures.
8. Create, read and write to and from simple textfiles.

LIST OF EXPERIMENTS:

1. Programs using I/O statements andexpressions.
2. Programs using decision-makingconstructs.
3. WriteaprogramtofindwhetherthegivenyearisleapyearorNot?(Hint:not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leapyear)
4. Design a calculator to perform the operations, namely, addition,subtraction, multiplication, division and square of anumber.
5. Check whether a given number is Armstrong number ornot?
6. Populate an array with height of persons and find how many persons are above the averageheight.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of theindividuals.
8. Convert the given decimal number into binary, octal and hexadecimalnumbers using user definedfunctions.
9. From a given paragraph perform the following using built-infunctions:

a. Find the total number ofwords.

b. Capitalize the first word of eachsentence.

c. Replace a given word with anotherword.

10. Sort the list of numbers using pass byreference.
11. Generate salary slip of employees using structures andpointers.
12. Compute internal marks of students for five different subjects using structuresandfunctions.

Semester-II

22BEEE211 ENGINEERING GRAPHICS 4H-3C

(Theory & Lab.)

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

End Semester Exam:3 Hours

Course Objectives

- To enhance visualization skills, which will facilitate the understanding of engineeringsystems.
- To prepare the students to design the components with realisticconstraints.
- To make thestudentstoconsidereconomic,environmental,ethical,healthandsafetywhentheydesign.
- To make thestudentstodesignthecomponentswithconsideringmanufacturability,andsustainability
- To communicate effectively throughdrawings.
- To make the students to understand to use necessary for engineeringpractice.

Course Outcomes(COs)

Oncompletion ofthiscourse, studentswillbeableto

1. Know theengineeringdesignanditsplaceinsociety
2. Understandthevisualaspectsofengineeringdesignandengineeringgraphicsstandards
3. Maketheengineeringcommunicationeffectively.
4. Prepare the 2Dfreehandsketching.
5. Acquiretheknowledge ofprojectionsofpoints,linesandplanesurfaces.
6. Understandthebasicconceptofprojectionofsolids.

UNITI INTRODUCTION (9)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Bureau ofIndian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used indrawingpracticegeometricconstructions,principlesofdimensioning– linear,angular,alignedsystem,unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and VernierScale.

UNITII FREE HANDSKETCHING (9)

Representation of Three-Dimensional objects – General principles oforthographic projection – Need forimportance of multiple views and their placement– First angle projection – layout views – Developingvisualizationskillsthroughfree handsketchingofmultiple viewsfrom pictorial viewsof objects.

UNITIII INTRODUCTION TO COMPUTER GRAPHICS–2D (9)

Overview of Computer Graphics and drafting tools , listing the computer technologies that impact on graphical communication,DemonstratingknowledgeofthetheoryofCADsoftware, Sketching of 2D simple geometries, editing and dimensioning of 2D geometries.Projection of points and straight lines located in the first quadrant inclined to both planes– Determination of true lengths and true inclinations (By using CADsoftware).

UNITIV PROJECTIONOFPLANESURFACES ANDSOLIDS (9)

Projectionofpolygonalsurfaceandcircularlaminainclinedtobothreferenceplanes (By using CAD software).Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V ISOMETRICPROJECTIONS (9)

Demonstrating knowledge of the theory of CAD software, Introduction to 3D modeling packages. Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple solids, truncated prisms, pyramids, cylinders and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa.

SUGGESTEDREADINGS

1. VenugopalKandPrabhuRajaV,(2021),EngineeringGraphics,NewAgeInternationalPublishers.
2. CMAgrawal and Basant Agrawal, (2019),EngineeringGraphics,TataMcGrawHill,NewDelhi.
3. JamesD.Bethune,(2020),EngineeringGraphicswithAutoCAD,MacromediaPress.
4. Narayana,K.L.&P Kannaiah, (2010), Textbookon Engineering Drawing,ScitechPublishers.
5. Shah,M.B.&RanaB.C.,(2017),EngineeringDrawingandComputerGraphics,PearsonEducation.
6. BhattN.D.,Panchal V.M.&IngleP.R,(2019),EngineeringDrawing,CharotarPublishingHouse.

Semester-III

22BEEE301 **Mathematics –III** **4H-4C**

(Probability And Statistics)

Instruction Hours/week: L:3T:1P:0 **Marks: Internal:40 External:60Total: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 randomvariables.
- To introduce the basic concepts of two-dimensional randomvariables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real lifeproblems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical qualitycontrol.
- To gain the knowledge about the techniques in quality control that modelengineering problems.

Course Outcomes(COs)

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

1. Explain the fundamental concepts of probability and standard distributions which can describe real lifephenomenon.
2. Explain the basic concepts of one- and two-dimensional random variables and their applications inengineering.
3. Apply the concept of testing of hypothesis for small and large samples in real lifeproblems.
4. Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical qualitycontrol.
5. Discuss the notion of sampling distributions and statistical techniques used in engineering and managementproblems.
6. Discuss about the techniques in quality control that model engineeringproblems.

UNIT I –Probability andRandomVariables (12)

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 - DimensionalRandomVariables (12)

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 ofHypothesis (12)

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

UNIT IV –Design ofExperiments (12)

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

UNIT V –StatisticalQuality Control (12)

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

Total Hours: 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.
3. www.mathcentre.ac.uk

Semester-III

22BEEE302 ELECTRICAL MACHINES-I 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- To Study the construction details of DC machines with back EMF equation and torque equation.
- To acquire the knowledge on working principles of DC machines as Generator types, determination of their no- load/load characteristics, starting and methods of speed control ofmotors.
- To estimate various losses taking place in D.C. Motor and to study the different testing methods to arrive at theirperformance.
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the single phasetransformers.
- To acquire the knowledge of constructional details, the principle of operation, prediction of performance, the methods of testing the three phase transformers andautotransformer.

Course Outcomes (COs)

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

1. Explain the concepts of magnetic fields
2. Illustrate the concepts of magnetic circuits.
3. Describe the operation of dc machines.
4. Compare the operation of different dc machine configurations.
5. Analyze the single phase transformers circuits.
6. Examine the three phase transformers circuits.

UNIT I MAGNETIC FIELDS ANDMAGNETICCIRCUITS (9)

Review of magnetic circuits, review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque

as a partial derivative of stored energy with respect to angular position of a rotatingelement.UNIT II DC MACHINES (9)

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armaturereaction.

UNIT-III DC MACHINE - MOTORINGANDGENERATION (9)

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DCmachines

UNIT- IV SINGLEPHASE TRANSFORMERS (9)

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses. Parallel operation of singlephasetransformers.

UNIT V THREEPHASETRANSFORMERS (9)

Three-phase transformer - construction, types of connection and their comparative features. Parallel operation of three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

SUGGESTED READINGS

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGrawHillEducation, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines",CBS Publishers,2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers,2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education,2010.

WEB LINKS

1. https://nptel.ac.in/courses/108105155/
2. https://nptel.ac.in/courses/108/105/108105155/

Semester-III

22BEEE303 ELECTROMAGNETIC FIELD 3H-4C

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

End Semester Exam:3 Hours

Course Objectives

- Tointroducethebasicmathematicalconceptsrelatedtoelectromagneticvectorfields.
- To understand the concepts of Conductors, Dielectrics and Capacitance.
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday"s law, induced emf and Maxwell"s equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

Course Outcomes (COs)

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

1. Illustrate the basic laws of electromagnetism.
2. Describe the electric field intensity in various geometric by using appropriate law.
3. Elaborate the concept of Conductors, Dielectrics and Capacitance.
4. Apply the concept of time varying electric and magneticfields.
5. Describe Maxwell's equation in different forms and different media.
6. Explain the propagation of EM waves.

UNIT I REVIEW OF VECTOR CALCULUS AND STATICELECTRICFIELD (9)

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration,vector operatordel, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.Coulomb"s law, Electric field intensity, Electrical field due to point charges. Line,Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT II CONDUCTORS, DIELECTRICSANDCAPACITANCE (9)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials,Capacitance,

Capacitance of atwo wire line, Poisson‟s equation, Laplace‟s equation, SolutionofLaplaceandPoisson‟sequation,ApplicationofLaplace‟sandPoisson‟sequations.

UNIT-III STATICMAGNETIC FIELDS (9)

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and VectorMagnetic potentials. Steady magnetic fields produced by current carrying conductors.

UNIT- IV MAGNETIC FORCES, MATERIALSANDINDUCTANCE (9)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutualinductances.

UNIT V TIME VARYING FIELDS ANDMAXWELL'SEQUATIONS (9)

Faraday‟s law for Electromagnetic induction, Displacement current, Point form of Maxwell‟s equation, Integral form of Maxwell‟s equations, Motional Electromotive forces. BoundaryConditions.DerivationofWaveEquation,UniformPlaneWaves,Maxwell‟sequationin Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poyntingtheorem.

SUGGESTED READINGS

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication,2014.
2. WilliamH.HaytandJohnA.Buck,„EngineeringElectromagnetics‟,TataMcGrawHill,8th Revised edition,2014.
3. KAGangadhar,„ElectromagneticFieldTheory‟,KhannaPublishers;EighthReprint: 2015.
4. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi,2009.
5. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India,2012.
6. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans,1954.
7. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication,1980.

WEB LINKS

1. https://nptel.ac.in/courses/117103065/
2. https://nptel.ac.in/courses/108106073/

Semester-III

22BEEE304 TRANSMISSION AND DISTRIBUTION 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To impart knowledge about the configuration of the electrical powersystem
- To study the line parameters and interference with neighbouringcircuits
- To analyse and model different components of powersystem
- To learn different insulators and undergroundcables
- To compute sag and conductor length for different weatherconditions.
- To learn different types of groundingsystems.

Course Outcomes (COs)

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

1. Interpret the structure of electric supply and distribution systems.
2. Determine the line parameters for different configurations.
3. Identify the performance of short, medium and long transmission lines.
4. Classify the various insulators and cables for transmission and distribution.
5. Solve sag and tension of overhead lines for different weather conditions.
6. Determine the methods of grounding.

UNIT 1 STRUCTURE OFPOWERSYSTEM (9)

Structure of electric power system: generation, transmission and distribution; overhead and underground systems, Types of AC and DC distributors–distributed and concentrated loads–voltage tolerances - interconnection–EHVAC and HVDC transmission-Introduction to FACTS

UNIT I1 TRANSMISSIONLINEPARAMETERS (9)

Parameters of single and three phase transmission lines with single and double circuits-Resistance, inductance and capacitance of solid ,stranded and bundled conductors, conductor types-Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects-Effects of earth on the capacitance of the transmission line - interference with neighbouring communication circuits, corona discharge, factors affecting corona

UNIT III MODELLING AND PERFORMANCE OFTRANSMISSIONLINES (9)

Classification of lines–short line, medium line and long line-Evaluation of A,B,C,D constantsequivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance and surge impedance loading; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power-circle diagrams, methods of voltage control ;Ferranti effect.

UNIT IV INSULATORSANDCABLES (9)

Insulators-Types, voltage distribution in insulator string, improvement of string efficiency, Underground cables-Types of cables, Parameters of cable, Grading of cables, Power factor and heating of cables, Capacitance of 3-core belted cable, D.C cables.

UNIT V MECHANICAL DESIGN OF LINESANDGROUNDING (9)

Mechanical design of transmission line - sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Sub-station Layout (AIS,GIS), Methods of grounding

SUGGESTED READINGS

1. S.N.Singh, „Electric Power Generation ,Transmission and Distribution", Prentice Hall of India
2. Pvt.Ltd, New Delhi,2008.
3. B.R.Gupta,„ Power System Analysis and Design", S.Chand, New Delhi, Fifth Edition2005-08.
4. R.K.Rajput, „Power System Engineering"Laxmi Publications (P)Ltd, New Delhi, 2006
5. D.P.Kothari,I.J.Nagarath, „Power System Engineering"Tata Mc Graw-HillPublishing
6. Company limited, New Delhi,2007.
7. C.L.Wadhwa, „Electrical Power Systems", New Academic Science Ltd,2009
8. Luces M.Fualkenberry ,Walter Coffer, „Electrical Power Distribution andTransmission",
9. Pearson Education,2007.
10. HadiSaadat, „Power System Analysis, "PSA Publishing; Third Edition, 2010.
11. J.Brian, Hardy and Colin R.Bayliss,, Transmission and Distribution inElectrical
12. Engineering",Newnes;FourthEdition,2012.
13. Gorti Ramamurthy ,"Transmission and Distribution", Hand book of ElectricalPower
14. Distribution, 2009, UniversitiesPress.

WEB LINKS

1. https://nptel.ac.in/courses/117106108/
2. https://nptel.ac.in/courses/108102042/

Semester-III

22BEEE305 ENVIRONMENTAL STUDIES 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

The goal of this course is for students

- Create the awareness about environmental problems among people.
- Develop an attitude of concern for the environment.
- Motivate public to participate in environment protection andimprovement.
- Togainavarietyofexperiencesandacquireabasicunderstandingofenvironmentandit‟s associatedproblems
- To help the individuals in acquiring skills for identifying and solvingenvironmental problems
- Relate critically about their roles and identities as citizens, consumers andenvironmental actors in a complex, interconnected world.

Course Outcomes(COs)

Upon completion of the course the students will be able to

1. Master core concepts and methods from ecological and physical sciences and their application in environmental problemsolving.
2. Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies andinstitutions.
3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and naturalsystems.
4. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
5. Apply systems concepts and methodologies to analyze and understand interactions between social and environmentalprocesses.
6. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I - Introduction - EnvironmentalStudies &Ecosystems (9)

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, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II - Natural Resources - Renewable andNon-Renewable Resources (9)

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 andIts conservation (9)

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 (9)

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 and industrial wastes. Role of an individual in prevention of pollution. Casestudies.

UNIT V - Social Issues andTheEnvironment (9)

Concept of sustainability and sustainable development. Water conservation - Rainwater harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its 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 project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and 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.

Total Hours : 45

SUGGESTED READINGS

1. Anubha Kaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, NewDelhi.
2. Erach Bharucha. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
3. Rajagopalan, R. 2016. Environmental Studies: From Crisis to Cure, Oxford UniversityPress.

4. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, NewDelhi.
5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S. Chand& Company Pvt. Ltd., NewDelhi.
6. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, NewDelhi.
7. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, NewDelhi.
8. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, NewDelhi.
9. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, NewDelhi.
10. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, NewDelhi.

Semester-III

22BEEE341 ELECTRON DEVICES AND CIRCUITS 5H-4C

(Theory & Lab.)

Instruction Hours/week: L:3T:0P:2 **Marks: Internal:40 External:60Total:100**

End Semester Exam:3 Hours

i) Theory

Course Objectives

The student should be made to:

- Understand the structure of basic electronicdevices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT andFET.
- Explore the operation of multistage and differentialamplifiers.
- Explore the characteristics of amplifier gain and frequencyresponse.
- Learn the required functionality of positive and negative feedbacksystems.

Course Outcomes (COs)

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

1. Explain the structure and working operation of basic electronic devices.
2. Identify and differentiate both active and passive elements
3. Explain the characteristics of different electronic devices such as diodes and transistors
4. Choose and adapt the required components to construct an amplifier circuit.
5. Acquire knowledge in design and analysis of oscillators.
6. Develop knowledge in feedback amplifiers

UNIT I PN JUNCTION DEVICES (9)

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance –Rectifiers – Half Wave and Full Wave Rectifier, – Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener asregulator.

UNIT II TRANSISTORS AND THYRISTORS (9)

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT –Structure and characteristics.

UNIT III AMPLIFIERS (9)

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER (9)

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods,power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS (9)

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback –Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

SUGGESTED READINGS

1. David A. Bell," Electronic devices and circuits", Oxford University higher education, 5th edition2018.
2. Sedra and smith, "Microelectronic circuits",7th Edition., Oxford UniversityPress
3. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition,2019.
4. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition,2017.
5. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.

ii. Laboratory

CourseObjectives

- To learn the operation and application ofCRO
- To understand the concept of rectifieroperation
- To understand Basic electronic Circuits and their applications using ActiveDevices
- To learn basic function of semiconductor devices.
- To understand basic construction and operation oftransistor.
- To understand SCR and UJTCharacteristics

Course Outcomes (COs)

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

1. Illustrate the output wave forms of Full WaveRectifiers.
2. Construct the Zener diodecharacteristics.
3. Demonstrate the Characteristics of BJT CEConfiguration.
4. Identify the Characteristics of BJT CBConfiguration
5. Illustrate the Characteristics of BJT CCConfiguration.
6. Analyze the Transfer Characteristics of Junction Field Effect Transistor.

List of Experiments

1. Study of CRO andApplications
2. V-I Characteristics of P- N JunctionDiode
3. V-I Characteristics of a Zener Diode & Zener RegulatorCharacteristics

4. V-I Characteristics of Light Emitting Diode(LED)
5. Half Wave Rectifier & Full Wave Rectifier without and withFilter
6. Characteristics of BJT in CE & CBConfiguration
7. Characteristics of BJT in CCConfiguration
8. Drain and Transfer Characteristics of Junction Field Effect Transistor(JFET)
9. SCRCharacteristics
10. UJTCharacteristics

Semester-III

22BEEE311 ELECTRICAL MACHINES LABORATORY-I 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To experimentally verify the principle of operation, performance and characteristics of DC Motors.
- To experimentally verify the principle of operation, performance and characteristics of DC Generators
- To experimentally verify the principle of operation, performance and characteristics of Transformers
- To study the operation of DC motor starters, different connections ofTransformers.
- To study the speed control of DCmotors.
- To studyabout Sumpner"stest.

Course Outcomes (Cos)

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

1. Analyze the characteristics of DC shunt generator DC compound generator andcalculatecritical resistance and critical speed.
2. Examine load characteristics of DC shunt, series and compound motor and identifyits maximum efficiency operatingpoint.
3. Estimate the efficiency of DC machines in different methods.
4. Determine the load characteristics of single phase transformer, separate the different losses and find the efficiency.
5. Predetermine the equivalent circuit parameters of single phase transformer in twodifferent methods and compare the results.
6. Estimate the efficiency of transformer.

LIST OF EXPERIMENTS

1. Open circuit characteristics and load test on separately excited DCgenerator.
2. Open circuit characteristics and load test on DC compoundgenerator.
3. Open circuit characteristics and load test on DC shuntgenerator.
4. Load test on DC shuntmotor.
5. Load test on DC seriesmotor.
6. Load test on DC compound motor.
7. Swinburne"s test and speed control on DC shuntmotor.
8. OC and SC tests on single phasetransformer.
9. Load test on single phasetransformer.
10. Sumpner"stest.

Semester-III

22BEEE351 ELECTRICITY STANDARDS 1H-0C

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

End Semester Exam:3 Hours

Course Objectives

- Understanding the basic knowledge of electricitystandards.
- Gain information regarding various electricity equipmentstandards.

Course Outcomes (Cos)

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

1. Acquire knowledge on various Indian and Internationalstandards.
2. Understand the standards used for transformer and theirsizing.

UNIT I INDIAN AND INTERNATIONAL STANDARDS

Indian Standards – IS – International Standards – ANSI – IEEE – IEC – Transformers – IEC 60076 & IS 2026, Rotating Machines – IEC 60034 & IS 34.

UNIT II STANDARDS FOR SIZING

Battery – IEEE 1115 – Instrument Transformers – IEC 60044 & IS 2705 – Short Circuit study – IEC 60909 & IEC 61363 – Harmonic Study – IEEE519.

SUGGESTED READINGS

1. Robert J. Alonzo, Electrical Codes, Standards, Recommended Practice and Regulations :An Examination of Relevant Safety Considerations, P.E. ISBN:978-0-8155-2045-0.

2. Donald Fink, H. Wayne Beaty, Standard Handbook for Electrical Engineers, McGraw-Hill Education; 16th edition,2012.

Semester-IV

22BEEE401 **ELECTRICAL MACHINES–II** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- Understand the concept of AC machine windings.
- Understand the concept of MMFs and rotating magneticfields.
- To study about InductionMachines.
- To study and understand about Single Phase InductionMotors.
- To understand about SynchronousMachines
- To derive the various relations of electrical and mechanical parameters in ACMachines

Course Outcomes (COs)

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

1. Illustrate the concept of AC machinewindings.
2. Explain the concepts of rotating magneticfields.
3. Explain the operation of acmachines.
4. Determine the performance characteristics of InductionMachines.
5. Compare the different types of single phase induction motor based on its startingmethods.
6. Summarize the operation of synchronous motor and determine the performance of motor under different loading and excitation conditions.

UNIT I FUNDAMENTALS OF AC MACHINE WINDINGS (9)

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; singleturn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distributionfactor.

UNIT II PULSATING AND REVOLVINGMAGNETIC FIELDS (9)

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current. Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magneticfield.

UNIT III INDUCTIONMACHINES (9)

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and statorresistances,

stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed InductionMachines.

UNIT-IV SINGLE-PHASE INDUCTION MOTOR (9)

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Types of Single Phase Induction Motor, Split-phase starting methods and applications**.**

UNIT-VSYNCHRONOUS MACHINES (9)

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and loaddivision.

SUGGESTED READINGS

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education,2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers,2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education,2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education,1984.
6. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley &Sons,2007.

WEB LINKS

1. https://nptel.ac.in/courses/108106072/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105131/lec84.pdf

Semester-VI

22BEEE402 LINEAR INTEGRATED CIRCUITS 3H-3C

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

End Semester Exam:3 Hours

CourseObjectives

- To study the IC fundamentals and IC fabricationprocedure.
- To study characteristics; realize circuits, design for signal analysis using Op-ampICs.
- To study the applications of Op-amp, A/D Converter and D/AConverter.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits,ADCs.
- To introduce the basic building blocks of linear integratedcircuits.
- To introduce the concepts of waveform generation and introduce some special functionICs.

Course Outcomes (COs)

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

1. Explain the IC fabrication steps.
2. Summarize the Characteristics Of Op-Amp
3. Design linear and non linear applications of OP – AMPs.
4. Identify the different types of Special ICs.
5. Summarize the applications of different types of ICs.
6. Describe the functional blocks of Special ICs.

UNITI IC FABRICATION (9)

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNITII CHARACTERISTICS OF OP-AMP (9)

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters ,summer, differentiator and integrator.

UNITIII APPLICATIONS OF OP-AMP (9)

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, , comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using op-amps.

UNITIV SPECIAL ICs (9)

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic ,Analog multiplier ICs.

UNITV APPLICATION ICs (9)

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

SUGGESTED READINGS

1 David A.Bell, Op-amp & Linear ICs, Oxford,2010

2. D.Roy Choudhary, Sheil B.Jani, Linear Integrated Circuits, New Age,2003

3. Ramakant A.Gayakward, Op-amps and Linear Integrated Circuits, Pearson Education ,2003

4. Fireo, Opamps & Linear Integrated Circuits Concepts & Applications, Cengage,2003

Semester-IV

22BEEE403 **SIGNALS AND SYSTEMS** **3H-3C**

Instruction Hours/week: L:2 T:1 P:0 **Marks: Internal:40 External:60Total:100**

End Semester Exam:3 Hours

Course Objectives

- 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 (COs)

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

1. Illustrate different types ofsignals
2. Describe continuous systems in time and frequency domain using differenttransforms.
3. Identify discrete systems in different domain using FourierTransform.
4. Determine the stability of thesystem.
5. Illustrate state-space analysis of signals and its multi-input, multi-outputrepresentation.
6. Explain the Sample and reconstruct signal.

UNITI INTRODUCTION TO SIGNALSAND SYSTEMS (9)

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

UNITII LTI SYSTEMS AND ANALYSIS (9)

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations and difference equations.

UNITIII FOURIER SERIES AND FOURIER TRANSFORM (9)

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation tothe impulse response, Fourier series representation, 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.

UNITIV LAPLACE TRANSFORM ANALYSIS (9)

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 TRANFORMAND SAMPLING (9)

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. 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.

Suggested Readings

1.A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

2.R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall,1998.

3.Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.

4.B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.

5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.

6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited,c1998.

7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons,1995.

8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.

9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi,2001.

10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company),1999.

WEB LINKS

1.https://nptel.ac.in/courses/108104100/

2.https://nptel.ac.in/content/storage2/courses/117101055/downloads/Lec-32.pdf

3.https://nptel.ac.in/content/storage2/courses/117101055/downloads/Lec-24.pdf

Semester-IV

22BEEE404 **DIGITAL ELECTRONICS** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- To present the Digital fundamentals, Boolean algebra and its applications in digitalsystems
- To familiarize with the design of various combinational digital circuits using logicgates
- To introduce the analysis and design procedures for synchronous andasynchronous sequential circuits
- To explain the various semiconductor memories and relatedtechnology
- To introduce the electronic circuits involved in the making of logicgates
- To familiarize with various storage devices

Course Outcomes (COs)

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

1. Recall the use of number systems and its conversion and compare the operation, characteristics of digital logicfamilies
2. Apply the minimal SOP and POS forms of logic expression using K map and implement it with thecombinationallogic
3. Analyze and design a synchronous sequential circuit to obtain a state table, state diagram for thetime sequence of all thevariables
4. Analyze and design an asynchronous sequential circuit and describe the race conditions, hazards and errors in digital circuits
5. Relate the concepts of ROM, RAM and CAM
6. Summarize the concepts of PLD andCPLD.

UNIT I FUNDAMENTALS OF DIGITAL SYSTEMS ANDLOGICFAMILIES (9)

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Booleanalgebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binaryarithmetic,one‟s and two‟s complements arithmetic, codes, error detecting and correcting codes,characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic.

UNIT II COMBINATIONAL DIGITAL CIRCUITS (9)

Standard representation for logic functions, K-map representation, simplification of logic functions usingK-map, minimization of logical functions. Don‟t care conditions, Multiplexer,De-Multiplexer/Decoders,Adders, Subtractors, BCD arithmetic, carry look ahead adder,serialadder, ALU, elementary ALU design,popular MSI chips, digital comparator, parity checker/generator,

code converters, priority encoders,decoders/drivers for display devices,Q-M method of function realization.

UNIT III SEQUENTIAL CIRCUITS AND SYSTEMS (9)

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-Tand D type‟s flipflops, applications of flipflops, shiftregisters, applications of shiftregisters, serial toparallel converter, parallel to serial converter, ring counter, sequencegenerator, ripple(Asynchronous) counters, synchronous counters, counters design using flipflops,specialcounter IC‟s, asynchronous sequential counters, applications ofcounters.

UNIT-IV A/D AND D/A CONVERTERS (9)

Digital to analog converters: weighted resistor/converter, R-2R LadderD/A converter, specifications for D/A converters, examples of D/A converter lCs, sampleand hold circuit, analog to digital converters: quantization and encoding, parallelcomparator A/D converter, successive approximation A/D converter, counting A/Dconverter, dual slope A/D converter, A/D converter using voltage to frequency and voltageto time conversion, specifications of A/D converters, example ofA/D converter ICs.

UNIT- V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES. (9)

Memory organization and operation, expanding memory size, classificationand characteristics of memories, sequential memory, read only memory (ROM), read andwrite memory(RAM), content addressable memory (CAM), charge de coupled devicememory (CCD), commonly used memory chips, ROM as a PLD, Programmable logicarray, Programmable array logic, complex Programmable logic devices (CPLDS),Fundamentals of FieldProgrammable Gate Array(FPGA).

Suggested Readings

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education,2009.

2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India,2016.

Web Links:

1.https://nptel.ac.in/courses/108/105/108105132/

2.https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/117101106/lec25.pdf

Semester-IV

22BEEE441 MEASUREMENTS AND INSTRUMENTATION 5H-4C

(Theory & Lab.)

Instruction Hours/week: L:3T:0P:2 **Marks: Internal:40 External:60Total:100**

End Semester Exam:3 Hours

(i)Theory

Course Objectives

- To study the units, dimensions and standards.
- To study the different types of measuring instruments.
- To provide adequate knowledge in electrical and electronic measurement techniques and Instruments.
- To make the students to have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.
- Introduction to general instrument system, error, calibration etc.
- Emphasisislaidonanalogganddigitaltechniquesusedtomeasurevoltage,current,energy and power,etc.

Course Outcomes (COs)

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

1.Explain the functional elements and types of instruments.

2. Acquire the knowledge of electrical and electronic instruments.

3.Apply their knowledge to measure electrical quantities using standard analog and digital measuring instruments.

4. Recall knowledge of measurement systems towards measurements, including error analysis, interpretation, experimental uncertainty, calibration,etc.

5. Apply basic concepts of measurement systems with electrical signals, including signal conditioners (gain, attenuation), indicating and recording devices.

6. Evaluate different electrical parameters using conventional bridges and acquire data through digital measuring instruments and interpret the data.

UNITI INTRODUCTION (9)

Functional elements of an instrument – Units and standards of measurements – Static and dynamic characteristics – Sources of Errors in measurement – DC and AC bridges –Wheatstone, Kelvin‟s double, Maxwell, Anderson, Wien and Schering bridges–Measurement of high resistance –

Standards and calibration.

UNIT II MEASURING INSTRUMENTS (9)

Classification of instruments – working principle of potentiometers – Principle of operation and construction of PMMC, MI, type instruments – Principle types and working of analog and digital voltmeters, ammeters and multimeters – Determination of B–H curve and measurement of iron loss – Instrument transformers – CT and PT – Instruments for measurement of frequency and phase.

UNITIII MEASUREMENT OF POWERANDENERGY (9)

Dynamometer type wattmeter – Single and three phase wattmeters – Induction type instruments – Single and three phase energy meters – calibration of energy meters – direct and phantom loading– Grounding techniques – Megger - Power factor meter- Principle of operation, construction and types of digital frequency meters, Digital Energymeters,Smart Energy meter.

UNITIV STORAGE, DISPLAY DEVICES AND TRANSDUCERS (9)

Magnetic measurements – Magnetic disk and tape–recorders – Strip chart recorder – XYrecorder.Digital plotters and printers – Cathode ray Oscilloscope– digital CRO and dot matrix display. Classification of transducers – Selection of transducers – Resistive – capacitive and inductive transducers – LVDT – Piezo-electric, optical and digital transducers.

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UNITV VIRTUAL INSTRUMENTATION (9)

Concept of VIs and sub VI - Display types – Digital – Analog – Chart and Graphs. Loops structures - Arrays – Clusters. Local and global variables – String and file I/O. Timers and dialogcontrol.

SUGGESTED READINGS

1. Doebelin. E.O. Measurement Systems Application and Design Tata McGraw HillPublishing Company, New Delhi. Tata McGraw Hill2003.
2. Sawhney. A. K. A Course in Electrical and Electronic Measurements and Instrumentation Dhanpat Rai and Co.,New Delhi.2011
3. Sanjay Gupta and Joseph John Virtual Instrumentation using LabVIEW Tata McGrawHill Publishing Company Ltd., 2nd Edition2010.

WEB LINKS

1.https://nptel.ac.in/courses/108105153/ 2.https://nptel.ac.in/courses/108105064/

ii) LABORATORY

CourseObjectives

- To deal with measurement of inductance and capacitance.
- To deal with measurement of resistance.

- To deal with calibration of currenttransformer
- To deal with calibration of single phase energymeter.
- To get the knowledge of two watt meter method to measure 3 phase power andpower factor
- To deal with calibration of voltmeter, ammeter andwattmeter.

Course Outcomes (COs)

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

1.Take part in the measurement of displacement, resistance, inductance, torque and angle etc.,
2.Analyse the ac and dc bridges
3.Demonstrate about PMMC and PMMI.
4. Summarize the procedure and usage of instruments
5.Evaluate the different types of meters.
6.Illustrate the usage the smart energy meter.

LIST OF EXPERIMENTS

1.Calibration of Pressure and Displacement Transducer.

2.Measurement of inductance & capacitance.

3. Measurement of resistance using wheatstone bridge

4. Calibration of current transformer and Study of instrument transformers.

5. Calibration of single phase energymeter.

6. Conversion of Galvanometer into Voltmeter and Ammeter.

7. Measurement of three phase power and power factor using two wattmetermethod.

8.Measurements of resistance using Kelvin‟sbridge.

9.Calibration of Voltmeter, Ammeter and Wattmeter

10.Study of phantom loading.

11. Study of Smart Energy Meter.

Semester-IV

22BEEE411 ELECTRICAL MACHINES LABORATORY-II 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To acquire the knowledge on performance characteristics of various ACmachines.
- To understand the various losses in ACmachines.
- To analyze the equivalent circuit parameters of ACmachines.
- To find the efficiency of single phase inductionmotor.
- To study about speed control of Inductionmachines
- To analyse the performance characteristics of three phase InductionMotor

Course Outcomes (COs)

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

1. Compare the different indirect testing methods to predetermine the voltage regulation of three phase salient and non-salient pole alternator.
2. Find the positive, negative and zero sequence impedance of alternators.
3. Analyze the operation of synchronous motor on infinite bus for different excitation Condition.
4.Examine the performance of three phase induction motor by conducting direct and indirect testing.
5.Analyze the performance of single phase induction motor by conducting direct and indirect testing.
6. Choose the appropriate induction motor starter for various industrial and commercial applications.

LIST OF EXPERIMENTS

1.Regulation of Alternator by EMF and MMF Methods.
2.Load test on three phase Alternator.
3.Regulation of salient pole Alternator by Slip Test.
4.Regulation of Alternator by ZPF method.
5.Parallel operation of alternator with busbar.
6.V and Inverted V curves of Synchronous Motor.
7.Equivalent Circuit of three phase InductionMotor.
8.Load Test on three phase InductionMotor.
9.Performance characteristics of three phase Induction Motor by Circle Diagram.
10.Load Test on single phase Induction Motor.

11. Speed control of Induction Motor.

Semester-III

22BEEE412 LINEAR INTEGRATED CIRCUITS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To understand the basics of linear integrated circuits and availableICs
- To understand the characteristics of the operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To understand the basics of R-2RLadder.
- To understand the concept of SMPS.

Course Outcomes (COs)

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

1. Design amplifiers, oscillators, D-A converters using operational amplifiers.
2. Design filters using op-amp and performs an experiment on frequency response.
3. Analyze the working of PLL and describe its application as a frequency multiplier.
4. Design DC power supply using ICs.
5. Analyze the performance of filters, multivibrators, A/D converter and analogmultiplier.
6. Summarize the usage of SMPS.

LIST OF EXPERIMENTS

1. Inverting, Non inverting and differential amplifiers.

2. Integrator and Differentiator.

3. Instrumentation amplifier

4. Active low-pass, High-pass and band-passfilters.

5. Astable & Monostable multivibrators using Op-amp

6. Schmitt Trigger using op-amp.

7. Phase shift and Wien bridge oscillators using Op-amp.

8. Astable and Monostable multivibrators using NE555Timer.

9. PLL characteristics and its use as Frequency Multiplier, Clock synchronization

10. R-2R Ladder Type D- A Converter using Op-amp.

11. DC power supply using LM317 andLM723.

12. Study of SMPS.

Semester-IV

22BEEE413 DIGITAL ELECTRONICS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To understand combinational and logical digital circuits and their differences.
- To understand the concepts Flip-flop, shifts register, counters.
- To learn symbol, working principle of basic Digital electronics circuits for data processing application.
- To Understand the concept of shift register.
- To design counters using Flipflops.
- To study different code converters.

Course Outcomes (COs)

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

1.Define the truth table of Logic Gates and Flip Flops.

2.Apply Boolean functions to implement adder, subtractor circuits.

3. Apply code conversion techniques in digital circuits.

4.Design of Multiplexer and Demultiplexer.

5.Design of 4-bit shift register.

6.Design of modulo-4 counter

List of Experiments

1. Verification of the truth tables of TTL gates.
2. Verify the NAND and NOR gates as universal logic gates.

3.Verification of Boolean function

4.Design and verification of the truth tables of Half and Full adder circuits.

5.Design and verification of the truth tables of Half and Full subtractor circuits.

6. Design and implement counters using ICs.

7. Design of Binary to BCD Codeconverters
8. Verification of the truth table of the Multiplexerand De-multiplexer.
9. Study offlip-flops.
10. Study ofcounters.
11. Design of 4-bit shift register (shift right).
12. Design of modulo-4 counter using J K flipflop.

Semester-IV

22BEEE451 **CONSTITUTION OF INDIA** **1H-0C**

Instruction Hours/week: L:1T:0P:0 **Marks: Internal:100Total: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 inIndia.
- To understand about Indiansociety.
- To understand the functions of Governor and ChiefMinister
- To know about the culture among thepeople.
- To acquire knowledge on constitutional remedies forcitizens

Course Outcomes(COs)

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

1. Identify functions of the state and central government.
2. Understand and abide the rules of the Indianconstitution.
3. Appreciate different culture among thepeople.
4. Understand the functions of Governor and ChiefMinister
5. Appreciate the working of Parliamentary System inIndia.
6. Gain knowledge on right for women, children, scheduled castes, scheduled tribes andother WeakerSections.

UNITI 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.

UNITII STRUCTURE AND FUNCTION OF CENTRALGOVERNMENT

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

UNITIII STRUCTURE AND FUNCTION OF STATEGOVERNMENT

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

UNITIV CONSTITUTION FUNCTIONS

IndianFederalSystem–Center–StateRelations–President‟sRule–ConstitutionalAmendments– Constitutional Functionaries - Assessment of working of the Parliamentary System inIndia.

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 WeakerSections.

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-V

22BEEE501 POWER SYSTEM ANALYSIS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To impart knowledge on the need for "power system analysis" and model variouspower systemcomponents.
- To formulate the power balance equations and to conduct the power flow analysis by GaussSeidel and Newton-Raphsonmethods.
- To model and carry out short circuit studies of power system for symmetrical faults andto determine the fault levels of different buses.
- To learn about the symmetrical components and their application to carry out shortcircuit studies of power system for unsymmetrical faults and to determine the fault levels of differentbuses.
- To model and analyze the stability of the power system due to balanced faults by equalarea criteria.
- To analyze the explicit integrationmethods.

Course Outcomes(COs)

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

1. Build the various power system components for steady-state analysis.
2. Solve the power flow analysis by Gauss-Seidel and Newton-Raphsonmethods.
3. Determine the fault current for balancedfaults.
4. Determine the fault current for unbalancedfaults.
5. Illustrate short circuit analysis of the power system for unbalanced faults usingsymmetrical componenttheory.
6. Determine the stability of the system with the help of equal area criteria andModified-Euler and Runge-Kutta fourth ordermethods.

UNIT I POWERSYSTEMOVERVIEW (9)

Need for system planning and operational studies - Power scenario in India - Power system components – Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive network-, Bus admittance matrix from primitive parameters - Representation of off-nominal transformer - Formation of bus admittance matrix of large power network.

UNIT II POWER FLOW ANALYSIS (9)

Significance of Power Flow Analysis in planning and operation- Formulation of Power Flow

problem in polar coordinates - Bus classification - - Power flow solution using Gauss-Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton-Raphsonmethod.

UNIT III SYMMETRICALFAULTANALYSIS (9)

Importance of short circuit studies-Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin‟s theorem - Bus Impedance matrix by building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages – Fault level - Current limiting reactors.

UNIT IV UNSYMMETRICALFAULTANALYSIS (9)

Symmetrical components - Sequence impedances – Sequence circuits of synchronous machine, transformer and transmission line-Sequence networks - Analysis of unsymmetrical faults: single-lineto-ground, line-to-line and double-line-to-ground using Thevenin‟s theorem and Z-Bus-computation of post fault currents in symmetrical component and phasor domains.

UNIT VSTABILITYANALYSIS (9)

Importance of stability studies-Classification of power system stability: rotor angle stability and voltage stability –Single Machine Infinite Bus(SMIB) system: Development of swing equation - Equal area criterion - Critical clearing angle and time -solution of the swing equation – modified Euler method and Runge-Kutta fourth order method.

SUGGESTED READINGS:

1. JohnJ.Grainger,WilliamD.Stevenson,Jr,„PowerSystemAnalysis‟,McGrawHillEducation (India) Private Limited, New Delhi, 2015.
2. KothariD.P.andNagrathI.J.„„PowerSystemEngineering‟,TataMcGraw-HillEducation, Second Edition,2008.
3. HadiSaadat„„PowerSystemAnalysis‟,TataMcGrawHillEducationPvt.Ltd.,NewDelhi,21st reprint, 2010.
4. PaiMA„„ComputerTechniquesinPowerSystemAnalysis‟,TataMcGraw-HillPublishing Company Ltd., New Delhi, Second Edition,2007.
5. J.DuncanGlover,MulukutlaS.Sarma,ThomasJ.Overbye„„PowerSystemAnalysis&Design‟, Cengage Learning, Fifth Edition, 2012.
6. Gupta B.R., „Power System - Analysis and Design‟, S. Chand Publishing,2001.
7. Kundur P.„„Power SystemStabilityand Control",TataMcGraw HillEducationPvt. Ltd., NewDelhi, 10th reprint,2010.

Semester-V

22BEEE502 CONTROL SYSTEMS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To understand the use of transfer function models for analysis physical systems and introduce the control systemcomponents.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses ofsystems.
- To introduce stability analysis and design ofcompensators.
- To introduce state variable representation of physicalsystems.
- To develop state space models from transfer functions and appreciate itssignificance.

Course Outcomes (COs)

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

1. Demonstrate an understanding of the fundamentals of (feedback) controlsystems.
2. Determine the time -domain responses and frequency-domain responses of first andsecond-order systems to step and sinusoidal (and to some extent, ramp)inputs.
3. Analyze the Performance of The given System using frequency response plots and root locus
4. Design the different types of compensators using frequency response plots to stabilize thecontrol system.
5. Design a lag, lead, lag-lead compensators based on its specifications using root locus andbode plot approach and Explain the concept of P,PI and PID Controller.
6. Solve system equations in state-variable form (state variable models).

UNITI INTRODUCTION TO CONTROLSYSTEM (9)

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 diagramalgebra.

UNIT II TIME RESPONSE ANALYSIS (9)

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 thetime-response.

Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus

technique. Construction ofRoot-loci

UNIT IIIFREQUENCY-RESPONSEANALYSIS (9)

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 TOCONTROLLERDESIGN (9)

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 ofcontrollers.

UNIT V STATE VARIABLE ANALYSIS AND NON LINEAR CONTROL (9)

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-time systems. Stability of linear discrete-time systems. Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts and analysis.

SUGGESTED READINGS

1.M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2.B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.
3.K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
4.I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.

WEB LINKS

1.https://www.tutorialspoint.com/control_systems/control_systems_introduction.htm

2. https://www.electronicshub.org/control-

system/3.https://nptel.ac.in/courses/107106081/

Semester-V

22BEEE503 MICROPROCESSORS AND MICROCONTROLLERS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

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

Course Outcomes (COs)

At the end of this course students will demonstrate the ability to

1. Write assembly language program (ALP) for different applications for 8085 and8086
2. Identify interrupt concepts of variousMicroprocessor.
3. Gain knowledge on advanced Pentiumprocessors
4. Interface memory and I/O device withcontrollers
5. Choose suitable processor for variousapplications
6. Distinguish and analyze the properties of Microprocessors &Microcontrollers.

UNITI MICROPROCESSOR-8085/8086 (9)

Introductionto 8085-Introductionto 8086 -Register Organization -Architecture-Signals-Memory Organization- Bus Operation-I/O Addressing-Minimum Mode-Maximum Mode-Timing Diagram- Interrupts - Service Routines – I/O and Memory Interfacingconcepts.

UNITII PROGRAMMINGOF8086 (9)

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

UNIT III ADVANCED PROCESSORANDMICROCONTROLLER (9)

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

UNIT IV INTERFACINGWITH PERIPHERALS (9)

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 RISCANDARM (9)

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 DelmarLearning, 2005.
5. Jonathan W Valvano Introduction to Arm(r) Cortex-M Microcontrollers CreatespaceIndependent Publisher2012

Website Link

1. https://nptel.ac.in/courses/108/105/108105102/
2. http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html

Semester-V

22BEEE504 RENEWABLE ENERGY SYSTEMS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To gain the knowledge about environmental aspects of energyutilization.
- To understand the basic principles of wind energy conversion, solar cells,photovoltaic conversion.
- To understand the basic principles fuel cell, Geo thermal powerplants.
- To gain the knowledge about hydroenergy.
- To understand the concept WindEnergy.
- To understand the concept hydroEnergy.

Course Outcomes (COs)

At the end of the course student understands about all types of energy sources and utilization.
At the end of this course, students will be able to

1. Analyze the Energy Scenario inindia.
2. Define the concept of SolarEnergy
3. Elaborate the concept of Wind Energy
4. Importance of HydroEnergy
5. Compare the different energysources.
6. Explain about all types of energy sources andutilization.

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 SOLARENERGY (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 WINDENERGY (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 HYDROENERGY (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,2012
3. John W Twidell and Anthony D Weir , Renewable Energy Resources , Taylor and Francis – 3rd edition ,2015

Semester-V

22BEEE511 CONTROL SYSTEMS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To provide a platform for understanding the basic concepts of linear control theory andits application to practicalsystems.
- To understand physical system in both time domain and frequencydomain
- To analyze the system and determine the stability property ofsystem
- To determine the controller for anysystem
- To understand the transfer function of DC motor, DCgenerator.
- To understand speed control of DCmotor

Course Outcomes (COs)

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

1. Determine the transfer function of DC Shunt Motor.
2. Determine the frequency response of different compensators
3. Measure the step response of P Controller.
4. Measure the step response of PI&PID Controller.
5. Identify the type of damping from the given Characteristic equation.
6. Evaluate the speed control of DC motor.

LIST OF EXPERIMENTS

1.Transfer function of separately Excited DC generator.
2.Transfer function of armature controlled DC shunt motor.
3.Transfer function of field controlled DC shunt motor.
4.Transfer function of AC servomotor.
5.Step response of P, PI, and PIDcontrollers.
6.Identification of type of damping from the given characteristic equation of second order system.
7.Simulation of step response & step response of second order under damped system using „C" and Scilab.
8.Frequency response of Lead compensatornetwork.
9.Frequency response of Lag compensator network.
10.DC Motor speedcontrol.

Semester-V

22BEEE512 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To introduce students to basic Assembly Language Programming (ALP) in 8086 and8085
- To infuse practical training on interfacing peripheral devices with 8086microprocessor
- To inculcate basic programming on advancedcontroller
- To know about ADC and DAC programmingconcepts
- To understand interfacingconcepts
- To enhance their practical knowledge on microcontrollerprogramming

Course Outcomes (COs)

At the end of this course students will be able to

1. Write program onsubroutine
2. Interface data converters withmicrocontrollers
3. Design speed control applications using advancedcontroller
4. Program advancedprocessors
5. Write program for design of simplesystem
6. Understand interfacingconcepts

LIST OF EXPERIMENTS

8-bit Microprocessor 8085 Microprocessor

1.Simple arithmetic operations

•Multi precision addition / subtraction / multiplication /division

2.Programming with controlinstructions

•Increment /Decrement

•Ascending / Descendingorder

•Maximum / Minimum ofnumbers

•Rotateinstructions.

•Hex / ASCII / BCD code conversions

3.InterfaceExperiments

•A/D Interfacing

•D/A Interfacing

4. Simple Interfacing experiments using8279

8086 Microprocessor

5. Basic arithmetic and Logicaloperations

6. Floating point operations, string manipulations, sorting andsearching

8051 Microcontroller

7. Demonstration of basic instructions with 8051 Micro controller execution,including

•Conditional jumps,looping

•Callingsubroutines

8. Parallel port programming with 8051 using port 1facility

•Steppermotor

9. Flashing of LEDS using ARM

10. Implementing zigbee protocol with ARM.

Semester-V

22BEEE551	**PCB DESIGN**	**1H-0C**

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

End Semester Exam:3 Hours

Course Objectives

This is a basic course for designing of PCB using software. PCB (Printed Circuit Board) designing is an integral part of each electronics products and this program is designed to make students capable to design their own projects PCB up to industrialgrade.

Course Outcomes (COs)

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

1. Understand basics of PCB designing.
2. Apply advance techniques, skills and modern tools for designing and fabrication of PCBs.
3 Apply the knowledge and techniques to fabricate Multilayer, SMT and HDIPCB.
4 Understand concepts of Packaging.

Course Contents

Unit-I Introduction

Need for PCB, Types of PCBs : Single and Multilayer, Technology: Plated Through Hole, Surface Mount, PCB Material, Electronic Component packaging, PCB Designing, Fabrication, Production, Electronic Design Automation Tools: Proprietary tools like Eagle, Ultiboard, Orcad and Opensource tools like KiCad, Design Issues: Transmission line, Cross talk and Thermal management.

Unit-II PCB Design

Introduction to KiCad, Schematic entry / drawing, netlisting, layering, component foot print library selection & designing, design rules, component placing: Manual & automatic, track routing: automatic & manual, rules: track length, angle, joint & size, Autorouter setup. IPC standards for schematic, designing, material and documentation

Suggested Readings

1. Jon Varteresian, Fabricating Printed Circuit Boards, Newnes, 2002

2. R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill 2001

3. Mark Madou, Fundamentals of Microfabrication, CRC Press, ISBN: 0-8493-9451-1

4. Elaine Rhodes, Developing Printed Circuit Assemblies: From Specifications to Mass Production, 2008

5. C. Robertson. PCB Designer´s Reference. Prentice Hall, 2003

Semester-VI

22BEEE601 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To know the fundamentals of cost analysis andeconomics.
- To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.
- To make the students to understand capital market, break even point analysis and depreciation.
- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

Course Outcomes (COs)

1. Evaluate the economic theories, cost concepts and pricing policies
2. Understand the market structures and integration concepts
3. Understand the measures of national income, the functions of banks and concepts of globalization
4. Apply the concepts of financial management for project appraisal
5. Understand accounting systems and analyze financial statements using ratio analysis
6. Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems.

UNITI FUNDAMENTALS OF ENGINEERING ECONOMICS (9)

Introduction to Engineering Economics – Definition and Scope – Significance of Engineering Economics- Demand and supply analysis-Definition – Law of Demand – Elasticity of Demand – Demand Forecasting. Supply – Law of supply – Elasticity of Supply.

UNITII FINANCIAL MANAGEMENT (9)

Objectives and functions of financial management – financial statements, working capital management– factors influencing working capital requirements – estimation of working capital. Capital budgeting - Need for Capital Budgeting – Project Appraisal Methods - Payback Period – ARR – Time Value of Money.

UNITIII CAPITAL MARKET (9)

Stock Exchanges – Functions – Listing of Companies – Role of SEBI – Capital Market Reforms. Money and banking - Money – Functions –Inflation and deflation – Commercial Bank and its functions – Central bank and its functions.

UNITIV NEW ECONOMIC ENVIRONMENT (9)

National Income – concepts – methods of calculating national income - Economic systems, economic Liberalization –Privatization – Globalization. An overview of International Trade – World Trade Organization – Intellectual PropertyRights.

UNITV COST ANALYSIS AND BREAK EVEN ANALYSIS (9)

Cost analysis - Basic cost concepts – FC, VC, TC, MC – Cost output in the short and long run. Depreciation - meaning – Causes – Methods of computing Depreciation (simple problems in Straight Line Method, Written Down Vale Method). Meaning – Break Even Analysis - Managerial uses ofBEA.

SUGGESTED READINGS

1.Ramachandra Aryasri .A, and V. V.Ramana Murthy Tata McGraw Hill,–,New Delhi 2007
2.Varshney R. L., and K.L Maheshwari Managerial Economics Sultan Chand & Sons, New Delhi 2001.
3.M.L.Jhingan Principles of Economics Konark Publications 2010.
4.Prasanna Chandra Fundamentals of Financial Management Tata McGraw Hill, New Delhi. 2007

Semester-VI

22BEEE602 POWER SYSTEM PROTECTION AND SWITCHGEAR 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To expose the students to the various faults in power system and learn the various methods of protectionscheme
- To understand the current interruption in Power System and study the variousswitchgears.
- Discussion on various earthing practices, usage of symmetrical components to estimatefault current and faultMVA.
- Study of Relays, protection scheme, and solid staterelays.
- To understand the method of circuit breaking, various arc theories, Arcing phenomena– capacitive and inductive breaking,
- To understand the different types of circuit breakers.

Course Outcomes

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

1. Analyse different types of faults and their effects on the power system and understand the practical significance of protectionzones.
2. Illustate the basic principles, construction and characteristics of different Electromagneticrelays
3. Compare the different power equipments like transformer, generator etc.,against various electrical faults
4. Distinguish different aspects of static relays and numerical protections chemes.
5. Explain the principles, construction, selection of circuit breaker.
6. Illustrate the problems associated with different types of circuitbreaker.

UNITI INTRODUCTION (9)

Principles and need for protective schemes – nature and causes of faults –Power system earthing - Zones of protection and essential qualities of protection – Protection scheme.

UNITII OPERATING PRINCIPLES ANDRELAYCONSTRUCTIONS (9)

Electromagnetic relays – Over current, directional, distance and differential, under frequency Relays, Reverse power relay, Relay Coordination, Microprocessor based Relay staticrelays.

UNITIII APPARATUS PROTECTION (9)

Apparatus protection: Transformer, generator, motor; protection of bus bars and transmission lines– CTs and PTs and their applications in protection schemes.

UNITIV THEORY OFCIRCUIT INTERRUPTION (9)

Physics of arc phenomena and arc interruption. Restriking voltage, Recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping, and interruption of capacitive current – DC circuitbreaking.

UNITV CIRCUITB REAKERS (9)

Types of Circuit Breakers – Air blast, Air break, oil, SF6 and Vacuum circuit breakers – comparative merits of different circuit breakers – Testing of circuitbreakers.

SUGGESTED READINGS

1. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New Delhi, 2008.Switchgear

Protection and Power Systems (Theory, Practice & SolvedProblems)

2. Y.G.Paithankar and S.R.Bhide, Fundamentals of power system protection, SecondEdition,

Prentice Hall of India Pvt. Ltd., New Delhi –2010

1. BadriRam ,B.H.Vishwakarma, Power System Protection and Switchgear, NewAge

International Pvt Ltd Publishers, Second Edition 2011.

2. B.Rabindranath and N.Chander, Power System Protection and Switchgear, NewAge

International (P) Ltd., First Edition2011.

3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, A Text Book on PowerSystem

Engineering, Dhanpat Rai & Co.,1998.

4. C.L.Wadhwa, Electrical Power Systems, 6th Edition, New Age International (P)Ltd.,

2010.

5. RavindraP.Singh, " Switchgear and Power System Protection " PHI LearningPrivate

Ltd., New Delhi2009.

Semester-VI

22BEEE603 **POWER ELECTRONICS** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- Different types of power semiconductor devices and their switching Operation, characteristics and performance parameters of controlled rectifiers
- Operation, switching techniques and basics topologies of DC-DCswitching
- Different modulation techniques of pulse width modulated inverters and toregulators.
- Operation of AC voltage controller and variousconfigurations
- To analyze converters its load and drive interaction
- Understand harmonic reductionmethods.

Course Outcomes (COs)

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

1. Define the different power switching devices.
2. Analyze and design various DC-AC and AC-AC converters
3. Identify the converters for real timeapplications.
4. Analyze and design DC-DC and AC-DC power converters and estimate its performance as per the requirements and constraintsspecified.
5. Explain the operation of voltage sourceinverters.
6. Illustrate the modulation techniques.

UNIT I POWER SEMICONDUCTOR DEVICES (9)

Diode,Thyristor,MOSFET,TRIAC,GTO,IGBT: I-VCharacteristics;Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT,IGCT,Heatsinks.

UNIT II THYRISTOR RECTIFIERS (9)

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load andhighly inductive load; Three-phase full-bridge thyristor rectifier with R-loadand highly inductive load; Input current wave shape and power factor.

UNIT III DC-DC BUCK AND BOOST CONVERTER (9)

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average outputvoltage.

UNIT IV SINGLE-PHASE VOLTAGE SOURCE INVERTER (9)

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle,bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage.

UNIT V THREE-PHASE VOLTAGE SOURCE INVERTER (9)

Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation, Cycloconverter

SUGGESTED READINGS

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications andDesign", John Wiley & Sons,2013.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media,2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India,2009.

WEB LINKS

1. https://nptel.ac.in/courses/108105066/
2. https://nptel.ac.in/content/storage2/courses/108105066/PDF/L 34(DP)(PE)%20((EE)NPTEL).pdf
3. https://nptel.ac.in/content/storage2/courses/108103009/download/M4.pdf

Semester-VI

22BEEE611 POWER SYSTEMS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To understand power system planning and operationalstudies.
- To acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution ofNetworks.
- To analyze the power flow using GS and NRmethod.
- To find Symmetric and Unsymmetricalfault
- To understand the economicdispatch.
- To analyze the electromagnetictransients.

Course Outcomes (COs)

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

1.Analyze the various line parameters

2.Evaluate the voltage regulation and efficiency of different types of transmission lines.

3.Evaluate the Bus impedance Matrix.

4. Apply load flow analysis to an electrical power network and interpret the results using Gauss-Seidel and Newton RaphsonMethods.

5. Apply load flow analysis to an electrical power network and interpret the results using Fast-DecoupledMethods.

6. Evaluate the Economic dispatch in powersystems

LIST OF EXPERIMENTS

1. Computation of Line Parameters.
2. Find the Voltage Regulation And Efficiency Of A Medium Transmission Line Using NominalT Method ThroughScilab.
3. Find the Voltage Regulation And Efficiency Of A Medium Transmission Line Using NominalPi Method ThroughScilab.
4. Formation of Bus Impedance Matrix.
5. Formation of Bus AdmittanceMatrix.
6. Load Flow Analysis - I: Solution of Load Flow and related Problems using Gauss-Seidel Method.
7. Load Flow Analysis - II: Solution of Load Flow and related Problems using Newton-Raphson and Fast-Decoupled Methods.
8. Load – Frequency Dynamics of single area and two-Area Systems.
9. Economic Dispatch in Power Systems without considering transmissionlosses.
10. Economic Dispatch in Power Systems with transmissionlosses.

Semester-VI

22BEEE612 POWER ELECTRONICS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

Course Objectives

- To introduce the application of electronic devices for conversion, control and conditioning of electricpower.
- To get an overview of different types of power semi–conductor devices and their switchingcharacteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers and basic topologics of DC–DC switchingregulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reductionmethods.
- To know the practical application for power electronics converters in conditioning the powersupply.
- Understand harmonic reductionmethods.

Course Outcomes (COs)

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

1.Classify the all power semiconductor devices.

2.Determine the characteristics of power semiconductor devices and passivecomponents, their practical application in powerelectronics.

3.Apply a practical exposure to operating principles, design and synthesis of different power electronic converters.

4. Importance of industrial control of power electronic circuits as well as safeelectrical connection and measurementpractices.

5. Analyze power electronics circuits

6. Apply power electronic circuits for different loads.

LIST OF EXPERIMENTS

1. Demonstrate the characteristics of SCR.

2.Demonstrate the characteristics of MOSFET.

3. Demonstrate the characteristics of IGBT.

4.Demonstrate the characteristics ofTRIAC

5.Implementation of single phase half controlled converter using SCR.

6.Implementation of single phase fully controlled convertor usingSCR

7.Implementation of DC-DC Boost convertor usingMOSFET.

8.Implementation of DC-DC Buck convertor using MOSFET.

9.Implementation of Single phase induction motor using PWM inverter.

10.Implementation of three phase induction motor using PWM inverter.

Semester-VI

22BEEE691	**MINI PROJECT**	**1H-0C**

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

End Semester Exam:3 Hours

Course Objectives

• To develop their own innovative prototype of ideas.
• To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the departmentand prepares a comprehensive mini project report after completing the work to thesatisfaction. The progress of the project is evaluated based on a minimum of two reviews. Thereview committee may be constituted by the Head of the Department. A mini project report isrequired at the end of the semester. The mini project work is evaluated based on oralpresentation and the mini project report jointly by external and internal examiners constitutedby the Head of the Department.

Course Outcomes (COs)

• On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

Semester-VII

22BEEE701 PROFESSIONAL ETHICS AND ENTREPRENEURSHIP DEVELOPMENT 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To enable the students to create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty and to appreciate the rights of others.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.
- To familiarize the student with professional rights and employee rights
- To imparts a good knowledge in weapons development.

Course Outcomes (COs)

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

1. Gain knowledge on human values
2. Apply ethics in society,
3. Discuss the ethical issues related to engineering
4. Realize the responsibilities and rights in the society
5. Understand about Computer Ethics
6. Gain knowledge on Corporate Social Responsibility

UNITI ENGINEERING ETHICS (9)

Senses of „Engineering Ethics" – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg"s theory – Gilligan"s theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNITII HUMAN VALUES (9)

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNITIII GLOBAL ISSUES (9)

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

UNITIV HISTORICAL DEVELOPMENT,PLANNING,ORGANISING (9)

Definition of Management – Management and Administration – Development of Management

Thought – Contribution of Taylor and Fayol – Functions of Management – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies and Planning Premises– Forecastin–Decision–making – Formal and informal organization – Organization Chart.

UNITV ENTREPRENEURSHIP DEVELOPMENT (9)

Entrepreneur –Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth– Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self- rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives, Start-up – History of the start-up terminology, 5 Steps from Concept to Start-up, Special Considerations – Business Incubators: Meaning, Definition, Services, Development and Types.

Suggested Readings

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi,2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi,2003
6. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford,2001
7. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi2013.
8. WorldCommunityServiceCentre,,,ValueEducation",Vethathiripublications,Erode,2011

web sources

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

Semester-VII

22BEEE702 ELECTRICAL DRIVES AND CONTROL 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts ofcontrollers.
- To understand the stable steady–state operation and transient dynamics of a motor–load system.
- To study and analyze the operation of the converter/chopper fed dc drive and to solve simple problems.
- To study and understand the operation of both classical and modern induction motordrives.
- To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motordrives.
- To analyze and design the current and speed controllers for a closed loop solid– state d.c motor drives.

Course Outcomes (COs)

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

1. Illustrate the role of power electronics in moderndrives.
2. Design the digital controller fordrives.
3. Identify the speed control techniques for ACdrives.
4. Select drive for particular application considering the present and future needs ofindustries.
5. Explain the Slip-Energy recoveryscheme.
6. Illustrate the industrialapplications.

UNIT – I SPEED CONTROL OFDCMOTORS (9)

Concept of Electric Drive – Classification of Electric Drives – Speed/Torque characteristics Braking methods –Methods of speed control – Ward Leonard drives –Semi, Full converter fed DC drives – Single, Two and Four quadrant operations –Dual converter fed DC drives

UNIT – II DIGITAL CONTROL OFDCMOTORS (9)

Digital technique in speed control of DC motors – Advantages – Limitations – Closed loop control of DC drives – Analog, Digital and Hybrid speed control –Microprocessor applications to control of DC motor.

UNIT – III SPEED CONTROL OFAC MOTORS (9)

Speed control of AC motors – Speed / Torque characteristics – Braking methods. AC -AC controller fed AC drives, Inverter fed AC drives, Frequency control, V/F control of induction and synchronous motor - Self control, Margin angle control and power factor control.

UNIT – IV ROTOR SIDE CONTROL OF FREQUENCY CONTROLLED INDUCTION MOTOR DRIVES (9)

Rotor side control of Slip ring Induction motor with thyristor chopper – Static control of Rotor resistance – Slip-Energy recovery scheme – Static Scherbius and Kramer systems – Applications of Microprocessor to AC motor speed control

UNIT – VINDUSTRIAL APPLICATIONS (9)

Choice of selection of motors – Electric drive applications – Steel rolling mills – Cement mills – Paper mills – Textile mills – Sugar mills – Coal mines – MachineTools.

SUGGESTED READINGS:

1. Dubey G.K "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2nd Ed. 2002.
2. Sen, P.C., "Thyristor DC Drives", Krieger Publishing Company1991
3. Vedam Subramaniam, "Electrical Drives and Applications", Tata McGraw Hill, New Delhi, 2nd 2010.
4. Murphy J.M.D., "Thyristor Control of AC Motors", Pergamon Press, NewYork,1973.
5. Krishnan R., "Electric Motor and Drives: Modeling, Analysis and Control", Pearson Education,NewDelhi,2001
6. Pillai S.K., "A First Course on Electrical Drives", Wiley Eastern Ltd., Bombay, 2nd Ed.2007.

Semester-VII

22BEEE703	**SMARTGRID**	**3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- To Study about Smart Gridtechnologies
- To Study about different smart meters and advanced meteringinfrastructure.
- To familiarize the power quality management issues in SmartGrid.
- To familiarize the high performance computing for Smart Gridapplications.
- To understand about different Distributed Generation Systems.
- To understand about different Energy Storagesystems.

Course Outcomes (COs)

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

1. Explain about DistributedGenerations.
2. Illustrate the power quality management in SmartGrids.
3. Classify the different types of smartmeters.
4. Importance of advanced meteringinfrastructure.
5. Identify the different storagedevices.
6. Recall the concept of reliability, stability and componentintegration.

UNIT I INTRODUCTION:SMART GRID AND EMERGINGTECHNOLOGIES (9)

Defining a smart grid – Characteristics of smart grid - Values of a smart grid – The economic Case – The environmental Case – Benefits to utilities – Benefits to consumers – Power system components – Power system protection: Traditional Vs Smart – Case study– Generation fundamentals – Traditional Generations – Distributed Generations – micro grid generation– Generator Protection – Challenges and Opportunities – Cost of smart grid – Government Regulations – Emerging Technologies - FACTS – optimizing integration systems – Multi generation buildings – Casestudy.

UNIT II SMART GRID: MODELS AND OPERATING PRINCIPLES (9)

Solar Photovoltaic models and grid Integration – Design of a 2 MVA PV station – DG system as part of utility power system – The smart grid PV - UPS DG system – Split DC Bus UPS – PV DG system – Island mode of operation – Parallel operation of Inverters – Power Quality. Wind turbine model and grid Integration – Micro turbine model & Grid Integration. Electric Vehicle model and GridIntegration.

UNIT III SMART GRID: DISTRIBUTEDGENERATIONSYSTEMS (9)

Power Converter System – Control System Development – Current limit and Saturation Control, Simulation using simulate and MATLAB. Inverter Parallel operation – Load

sharing control

Algorithm– Distributed Generation System and Newton Raphson method in power flow – Plant modeling and 3 phase 4 wire DG unit topology – Single distributed generation System –MIMO Linear system Stability robustness – PWM rectifier control –3 Phase AC – DC – AC topology.

UNITIV ENERGY STORAGEANDCOMMUNICATION (9)

State–of–the art storage devices – Battery types – Ultra capacitors based Energy Storage System – Flywheel – Wide Area Network – Substation Information System – Wireless Networks – Distribution Automation – AMI Networks – Utility monitoring and Control – Inter-system Coordination – Industrial systems – Consumer Residential Systems – Network Protection – Channel model Fundamental – Low, medium, High voltage, main Topologies – Residential and Business Indoor wiring Topologies – The Power line Channel model – Digital Transmission Techniques - Threats – IEC61850Considerations.

UNITV SMART GRID: RELIABILITY, STABILITY AND COMPONENT INTEGRATION (9)

Smart Grid Programming – Virtual Power Producer – Intelligent reconfigurationusing – Problems in distributed grids – Solutions. Integration of Mini – Micro generation in distribution Grids – Power supply Quality generic standards – Renewable Energies specific standards – Smart Grid stability analysis schemes – Supply guarantee and Power quality – Integration in power systems – Distributed Generation advantages andneeds.

SUGGESTED READINGS

1. Stuart Borlase "Smart Grid: Infrastructure, Technology andSolutions",CRCPress2012.
2. JanakaEkanayake,NickJenkins,KithsiriLiyanage,JianzhongWu,AkihikoYokoyama, "Smart Grid: TechnologyandApplications",Wiley2012.
3. VehbiC. Güngör ,Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol.7,No.4,November2011.
4. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang"SmartGrid –The New and Improved Power Grid: A Survey" ,IEEE Transaction on Smart Grids,vol.1 4,201 2. James Momohe "Smart Grid: Fundamentals of Design and Analysis,", Wiley-IEEE Press ,2012.

WEB LINKS

1. https://nptel.ac.in/courses/108/107/108107113/
2. http://npti.gov.in/smart-grid-technologies

Semester-VII

22BEEE751	**INTERNSHIP**	**0H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- A practice-oriented and 'hands-on' working experience in the real world or industry, and to enhance the student's learning experience.
- An opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organisational setting.
- An opportunity to further develop and enhance operational, customer service and other life-long knowledge and skills in a real world work environment.
- Pre-employment training opportunities and an opportunity for the company or organisation to assess the performance of the student and to offer the student an employment opportunity after his/her graduation, if it deems fit.

Course Outcomes (COs)

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

1. Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s;
2.Solve real life challenges in the workplace by analysing work environment and conditions, and selecting appropriate skill sets acquired from the course;
3.Articulate career options by considering opportunities in company, sector, industry, professional and educational advancement;
4.Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means;
5.Exhibit critical thinking and problem solving skills by analysing underlying issue/s to challenges;
6. Demonstrate the ability to harness resources by analysing challenges and considering opportunities;

Semester-VII

22BEEE791	**PROJECT WORK PHASE-I**	**6H-3C**

Instruction Hours/week: L:0T:0P:6 **Marks: Internal:40 External:60Total:100**

End Semester Exam:3 Hours

Course Objectives

• To develop the ability to solve a specific problem right from its identification and literature reviewtill the successful solution of the same. To train the students in preparing project reports and toface reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the departmentunder the guidance of a faculty member and prepares a comprehensive project report aftercompleting the work to the satisfaction of the supervisor. The progress of the project isevaluated based on a minimum of three reviews. The review committee may be constituted bythe Head of the Department. A project report is required at the end of the semester. The projectwork is evaluated based on oral presentation and the project report jointly by external andinternal examiners constituted by the Head of the Department.

Course Outcomes (COs)

• On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

Semester-VIII

22BEEE891 PROJECT WORK PHASE-II &VIVA-VOCE 16H-8C

Instruction Hours/week: L:0T:0P:16 **Marks: Internal:40 External:60Total:100**

End Semester Exam:3 Hours

Course Objectives

• To develop the ability to solve a specific problem right from its identification and literature reviewtill the successful solution of the same. To train the students in preparing project reports and toface reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the departmentunder the guidance of a faculty member and prepares a comprehensive project report aftercompleting the work to the satisfaction of the supervisor. The progress of the project isevaluated based on a minimum of three reviews. The review committee may be constituted bythe Head of the Department. A project report is required at the end of the semester. The projectwork is evaluated based on oral presentation and the project report jointly by external andinternal examiners constituted by the Head of the Department.

Course Outcomes (COs)

• On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PROFESSIONAL ELECTIVE COURSES

B.E Electrical and ElectronicsEngineering **2022-2023**

Semester-V

22BEEE5E01 ELECTRICAL MACHINE DESIGN 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To provide sound knowledge about constructional details and design of various electrical machines.
- To study mmf calculation and thermal rating of various types of electricalmachines.
- To design armature and field systems for D.C.machines.
- To design core, yoke, windings and cooling systems oftransformers.
- To design stator and rotor of inductionmachines.
- To design stator and rotor of synchronous machines and study their thermalbehaviour

Course Outcomes (COs)

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

1. Explain the construction of electricalmachines.
2. Define the various factors which influence the design: electrical, magnetic and thermal loading of electricalmachines
3. Apply the principles of electrical machinedesign
4. Construct the basic design of an AC and DC machine.
5. Utilize software tools to do designcalculations.
6. Assess the performance characteristics of electrical machines

UNIT I INTRODUCTION (9)

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT II TRANSFORMERS (9)

Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT III INDUCTIONMOTORS (9)

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor,

magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT- IV SYNCHRONOUS MACHINES (9)

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT V COMPUTER AIDED DESIGN(CAD) (9)

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

SUGGESTED READINGS

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons,1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBSLondon.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing,2006.
4. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan,1969.
5. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine DesignData Book", New Age International,1979.
6. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications,2008.
7. ElectricalmachinesandequipmentdesignexerciseexamplesusingAnsoft"sMaxwell2D machine designpackage.

Semester-V

22BEEE5E02 SENSOR AND TRANSDUCER 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

It deals with various types of sensors & transducers and their working principle.

- To understand concepts of transducer characteristics.
- It deals with Resistive transducers and its workingprinciple.
- To understand concepts inductive and capacitive transducers and its workingprinciple.
- It deals with some of the miscellaneoustransducers.
- It deals with applications oftransducers.

Course Outcomes (COs)

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

1.Justify the concept and working principle of different transducers and sensors.
2.Explain the transducers that will be utilized in the electrical industries.
3.Identify recent developments in transducerdomain.
4.Discover the knowledge for small technology up gradations in it.
5.Analyze the concept of resistive, inductive and capacitivetransducers.
6.Identify the applications oftransducer.

UNIT I INTRODUCTION OF TRANSDUCERS (9)

Transducer – Classification of transducers – Basic requirement of transducers.

UNIT II CHARACTERISTICS OF TRANSDUCERS (9)

Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs.

UNIT III RESISTIVE TRANSDUCERS (9)

Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications– Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer.

UNIT IV INDUCTIVE AND CAPACITIVE TRANSDUCER (9)

Self inductive transducer – Mutual inductive transducers– LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

UNIT V MISCELLEANEOUS TRANSDUCERS (9)

Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers.

SUGGESTED READINGS

1. Sawhney A.K, A Course in Electrical and Electronics Measurements and InstrumentationDhanpat Rai & Company Private Limited,2015.
2. Renganathan. S, Transducer Engineering, Allied Publishers, Chennai,2003.
3. Doebelin. E.A, Measurement Systems – Applications and Design, Tata McGraw Hill, New York, 2000.
4. Patranabis. D Sensors and Transducers PHI Learning Pvt. Ltd.,2003.
5. John. P, Bentley Principles of Measurement Systems III Edition, Pearson Education,2000.

WEBSITES

1. http://home.iitk.ac.in/~vyas/WILD/transducer.html
2. https://nptel.ac.in/courses/108105064/

Semester-VI

22BEEE6E01 DIGITAL SIGNAL PROCESSING 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To impart knowledge on processing of discretesignals
- To study discrete fourier transform and itsapplications.
- To design Finite Impulse Response (FIR)filter using windowfunction
- To introduce the concept of Infinite Impulse Response (IIR) filters for differentfrequencies
- To learnthe effect of finite word length in FIR filter design.
- To understand DSP architecture and itsalgorithms

Course Outcomes (COs)

At the end of this course, students will demonstrate the ability to

1. Interpret, represent and process discretesignals
2. Apply discrete Fourier transforms for LSIsystem
3. Design FIR Filter using windowfunctions
4. AnalyzeIIR filter for differentapplications
5. Identify the effects of finite word length while designingfilters
6. Choose different DSP architecture for variousapplications

UNIT I DISCRETE-TIME SIGNALSANDSYSTEMS (9)

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Samplingand reconstruction of signals - aliasing; Sampling theorem and Nyquistrate.

UNIT II Z-TRANSFORM (9)

z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inversez-transforms.

UNIT III : DISCRETE FOURIER TRANSFORM (9)

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Connvolution of signals, Fast Fourier Transform Algorithm, Parseval‟s Identity, Implementation of Discrete TimeSystems.

UNIT- IV DESIGN OF DIGITAL FILTERS (9)

Design of FIR Digital filters: Window method,Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations;Low-pass, Band-pass, Bandstop and High-pass filters.Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

UNIT V APPLICATIONS OF DIGITAL SIGNAL PROCESSING (9)

Correlation Functions and PowerSpectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, WienerFilter.

SUGGESTED READINGS

1.S. K. Mitra, “Digital Signal Processing: A computer based approach”, McGraw Hill, 2011.
2.A.V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, 3rd Edition Prentice Hall,2009.
3.J. G. Proakis and D.G. Manolakis, “Digital Signal Processing: Principles, Algorithms And Applications”, 4th Edition, Prentice Hall, 2007.
4.L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Pearson India, 2015.
5.J. R. Johnson, “Introduction to Digital Signal Processing”, PHI Learning, 2009.
6.D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, “Digital Signal Processing”, Wiley India Pvt Ltd, 2009.

WEB REFERENCES :

1. https://nptel.ac.in/courses/108/106/108106151/
2. https://studentsfocus.com/it6502-dsp-notes-digital-signal-processing-lecture-notes-cse-6th-sem-anna-university/

Semester-VI

22BEEE6E02 COMPUTER ARCHITECTURE 3H-3C

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

End Semester Exam:3 Hours

Course Objectives:

- To study about computerorganization.
- To understand about memoryorganization.
- To study about input outputdevices.
- To understand about 16 and 32 bitmicroprocessors,.
- the various representations of data, register transfer language for micro– operations and organization and design of a digitalcomputer.

Course Outcomes(COs)

At the end of this course, students will demonstrate the ability to

1.Reproduce the concepts of microprocessors, their principles and practices.

2.Describe efficient programs in assembly language of the 8086 family of microprocessors.

3.Point out a modern computer system and be able to relate it to real examples.

4.Discover the programs in assembly language for 80286, 80386 and MIPS processors in realand protectedmodes.

5.Compute embedded applications using ATOMprocessor.

UNIT I INTRODUCTION TO COMPUTER ORGANIZATION (9)

Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

UNIT II MEMORY ORGANIZATION (9)

System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, OpticalDisks.

UNIT III INPUT –OUTPUT ORGANIZATION (9)

Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Expressbus.

UNIT IV 16 AND 32 MICROPROCESSORS (9)

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in80x86

UNIT V PIPELINING **(9)**

Introduction to pipelining, Instruction level pipelining(ILP),compiler techniques for ILP,Data hazards, Dynamic scheduling,Dependability, Branch cost, Branch on instruction Prediction, Influenceset.

SUGGESTED READINGS

1.V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", 5th Edition, McGraw Hill, 2001.
2.B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3.J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
4.W. Stallings, "Computer organization", 9th Edition, PHI, 2012.
5.P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann,2012.
6.N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall,2004

WEB REFERENCES

1. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
2. https://www.smartzworld.com/notes/computer-organization-pdf-notes-co/

Semester-VI

22BEEE6E03 **SPECIAL ELECTRICAL MACHINES** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- To expose the students to the concepts of special electrical machines and analyze their performance and to impart knowledgeon
- Construction and performance of synchronous reluctancemotors.
- Principle of operation and performance of stepping motors.
- To study the knowledge on construction and operation of permanentmagnet
- brushless D.C.motors.
- To study the real time need of specialmachines
- Construction, principle of operation and performance of switched reluctance motors, permanent magnet synchronousmotors.

Course Outcomes(COs)

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

1.Analyze and design controllers for special Electrical Machines.
2.Show the construction and operation of stepper motor.
3.Explain the concept of construction and operation of stepper switched reluctance motors.
4.Illustrate construction and operation of permanent magnet brushless D.C. motors.
5.Summarize construction and operation of permanent magnet synchronous motors.
6.Determine a special Machine for a particular application.

UNIT I SYNCHRONOUSRELUCTANCEMOTORS (9)

Constructional features – Types – Axial and radial air gap motors – Operating principle – Reluctance – Phasor diagram – Characteristics – Vernier motor – Driver circuits – Applications of AC motors.

UNIT IISTEPPINGMOTORS (9)

Construction and Principle of operation – Types: Permanent Magnet, Hybrid and Variable reluctance motor – Single and multi stack configurations – Theory of torque predictions – Dynamic Characteristics – Driver circuits – Applications of stepper motors.

UNIT III SWITCHEDRELUCTANCEMOTORS (9)

Construction and Principle of operation – Torque prediction – Power controllers – Non– linear analysis – Microprocessor based control – Characteristics – Driver circuits.

UNIT IV PERMANENT MAGNET BRUSHLESSDCMOTORS (9)

Construction and Principle of operation – Electronic Commutator – Difference between electronic and Mechanical Commutator – Types of PMBLDC motors – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control – Applications of DC motors.

UNIT V PERMANENT MAGNETSYNCHRONOUSMOTORS (9)

Construction and Principle of operation – EMF and torque equations – Torque-speed characteristics – Reactance – Phasor diagram – Power controllers –Volt-ampere requirements of Converter – Self, Vector and Current controlschemes.

SUGGESTED READINGS

1. P.P.Acarnley, Stepping Motors, A Guide to Modern theory and practice Peter Peregrines, London,2002
2. B K Bose, Modern Power Electronics & AC, Pearson,2002
3. Sen.P.C, Principles of Electrical Machines and Power Electronics, John willey & Sons, Second edition,2008

Semester-VI

22BEEE6E04 HIGH VOLTAGE ENGINEERING 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To understand the various types of over voltages in power system and Protectionmethods.
- To study about generation of over voltages inlaboratories.
- To know about measurement of overvoltages.
- To study about the nature of Breakdown mechanism in solid and liquid gaseousdielectrics.
- To study about the discussion on commercialinsulates.
- To study about testing of power apparatus and insulationcoordination.

Course Outcomes (COs)

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

1.Explain the over voltage phenomenon in electrical power systems.
2.Distinguish the various breakdown mechanisms of different dielectrics.
3.Identify the appropriate methods for high voltage and current generation.
4.Illustrate the measurement principles to figure the values of high voltage and current.
5.Determine the testing of various apparatus in hv lab.
6.Explain the concept of switching and lighting.

UNIT I BREAKDOWN IN GASES (9)

Properties of Dielectrics - Gaseous breakdown in uniform and non-uniform fields - Townsend‟s Theory – Streamer Mechanism – Corona discharges – Vacuum breakdown - Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics – Partial Discharges – Applications and Maintenance of Dielectrics.

UNIT II GENERATION OF HIGH VOLTAGES (9)

Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT- III MEASUREMENTS OF HIGH VOLTAGES AND CURRENTS (9)

Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT IV LIGHTNING AND SWITCHING OVER-VOLTAGES (9)

Lightning overvoltage: Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges– Switching overvoltage: Causes of surges and its effects on power system – Protection against overvoltage – Surge diverters – Surge modifiers – Estimation of Overvoltage – Reflection and

Refraction of Travelling waves - Insulation Coordination.

UNIT V HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS AND HIGH VOLTAGE LABORATORIES (9)

Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

SUGGESTED READINGS

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", 5th Edition, Tata McGrawHill Publishing Co. Ltd., New Delhi, 2013.

2. E.Kuffel and W.S. Zaengl, J.Kuffel, "High voltage EngineeringFundamentals", Newness, 2nd Edition, Elsevier, New Delhi,2005.

3. Rakosh Das Begamudre, "High Voltage Engineering, Problems and Solutions", NewAge International Publishers, New Delhi,2010

4. Hugh M. Ryan, "High Voltage Engineering and Testing", 2nd Edition, The Institution ofElectrical Engineers, London, United Kingdom,2001.

5. Various IS standard for HV Laboratory Techniques andTesting.

6. L.L.Alston, "High Voltage Technology", Oxford University Press, 1st IndianEdition,2011.

7. C.L.Wadhwa, "High Voltage Engineering", New Age International Publishers, 3rdEdition,2010.

8. Mazen Abdel Salam, Hussein Anis, Ahdab A-Morshedy and Roshday Radwan, "HighVoltage Engineering –Theory &Practice", 2nd Edition, Marcel Dekker, Inc.,2010.

9. Subir Ray, "An Introduction to High Voltage Engineering", 2nd Edition, PHI LearningPrivate Limited, New Delhi, 2011.

10. M. Khalifa, "High Voltage Engineering-Theory and Practice", Marcel Dekker, Inc. NewYork and Basel,1990.

11. Dieter Kind and Kurt Feser, "High Voltage Test Techniques", Reed Educational and Professional Publishing Ltd. (Indian Edition), New Delhi,2001.

Semester-VI

22BEEE6E05 OBJECT ORIENTED PROGRAMMING 3H-3C

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

End Semester Exam:3 Hours

Course Objectives:

The goal of this course is for students:

- To analyze Object Oriented Programming concepts and basic characteristics ofC++
- To design problem solutions using Object OrientedTechniques.
- To infer the principles of packages, inheritance andinterfaces
- To define exceptions and use I/O streams
- To develop a C++ application with threads and genericsclasses
- To design and build simple Graphical UserInterfaces

Course Outcomes(COs)

Uponcompletionofthiscourse, thestudent willbeableto

1. Utilize a simple Java programming environment, compile programs and interpret compilererrors.
2. Distinguish and use the fundamentaldatatypes.
3. Design classes and organize the mintopackages.
4. Utilize the basic datastructures.
5. Comparethebasic searchandsortalgorithms.
6. Applyappropriatedata structureand algorithm tosolve aproblem.

UNITI INTRODUCTION (9)

Procedure-Oriented Programming System - Object-Oriented Programming System - Comparison ofC++with C - Object-Oriented Terms and Concepts - Object-Oriented Languages – Differencesbetween Procedural and Object-Oriented Programming - Merits and Demerits of Object-OrientedMethodology. Structure of a C++ Program–Data Types - Operators in C++ - Control Structures -Functions in C++.

UNIT II CLASSESAND OBJECTS (9)

Introduction to Classes and objects - Member Functions and Member Data - Objects and Functions - Objects and Arrays - Name Spaces - Nested Classes - Dynamic Memory Allocation and Deallocation- Constructors and Destructors.

UNIT III INHERITANCEANDPOLYMORPHISM (9)

Introduction - Base Class and Derived Class Pointers - Function Overriding - Base Class Initialization- Protected Access Specifier - Deriving by Different Accessing specifiers - Different Kinds ofInheritance - Order of Invocation of Constructors and Destructors - Virtual Functions - Mechanism ofVirtual Functions - Pure Virtual Functions - Virtual Destructors and Constructors.

UNIT IV OPERATOR OVERLOADINGANDTEMPLATES (9)

Operator Overloading - Overloading of various Operators - Type Conversion - New Style Casts andthe typed Operator - Function Templates - Class Templates - The Standard Template Library (STL).

UNIT V EXCEPTION HANDLING ANDCASE STUDIES (9)

Introduction - C-Style Handling of Error-generating Code - C++-Style Solution - the try/ throw/ catchConstruct - Limitations of Exception Handling. Case Studies: String Manipulations - Building classesor matrix operations

Total Hours : 45

SUGGESTED READINGS :

1. BalagurusamyE. ,"Object Oriented Programming with C++",3rd Edition, Tata McGraw Hill,2007
2. Paul Deitel and Harvey Deitel, "C++ How to Program", 9th Edition, Pearson Education Limited,2014.
3. SouravSahay, "Object Oriented Programming with C++", Oxford University Press,2006.
4. Joyce Farrell, "Object Oriented Programming using C++", Cengage Learning, 2001.
5. Deitel and Deitel, "C++, How To Program", Pearson Education, Fifth Edition,2005
6. Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", Wiley, 7th Edition, 2004

WEBSITES:

1. https://nptel.ac.in/courses/106105151/
2. https://nptel.ac.in/courses/106101208/
3. https://nptel.ac.in/courses/106102064/
4. https://nptel.ac.in/courses/106/106/106106127/

Semester-VII

22BEEE7E01 POWER PLANT ENGINEERING 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To learn the economics connected with power generation.
- To understand the measurements of various parameter in power plantandtheir control.
- To study about Power plantinstrumentation
- To acquire knowledge of renewable powersystem
- To study about technologies of distributedsystem
- To study layout and working of thermal, nuclear and hydropowerplants.

Course Outcomes(COs)

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

1. Develop the knowledge about distributed generation, boiler turbine monitoringsystem.
2. Illustrate the working of thermal powerplant.
3. Explain the working of Gas powerplant.
4. Define importance of Hydro powerplant.
5. Measure the cost and tariff ofenergy
6. Illustrate the working of Nuclear and diesel powerplant.

UNIT I ECONOMICS OFPOWER GENERATION (9)

Choice of power plant; Load management; Number and size of generating unit; Cost of electrical energy; All types of tariff – Calculation – Power factor improvement.

UNIT II THERMALPOWERPLANT (9)

Plant layout; Selection of site – Types of thermal power plants; Steam power plant based on fossil fuels; Thermal power plant equipment: Boiler, economizer, super heater, condenser, combustion chamber and gas loops, turbines, auxiliaries; Instrumentation and control; Heat balance.

UNIT III GASPOWERPLANT (9)

Open and close cycles; Regeneration; Inter–cooling and reheating; Steam – gas power plant; Combined cycle power plant ; Plant protection ; Instrumentation and Control; Plant management; Plant layout; Optimized Generation; Load flow.

UNIT IV HYDROPOWERPLANT (9)

Mass curve and storage capacity; Classification; Components; Turbines – Characteristics and their selection; Governor; Plant layout and design; Auxiliaries; Underground, automatic, remote controlled, and pumped storage plants. Optimized Generation.

UNIT V NUCLEAR AND DIESEL – ELECTRICPOWER PLANTS (9)

Nuclear reactors and fuels; Radioactivity; Mass defect and binding energy;Chain

reaction; Materials used in nuclear plants; Types of reactors. Diesel–electric Power Plant: Fields of use; Sub–systems; Starting and stopping; Heat balance; Plant layout and design; Remote operation;Auxiliaries.

SUGGESTED READINGS

1. Black and Veatch, Power Plant Engineering, CBS Publishers & Distributors,2005
2. Gupta, B. R., Generation of Electrical Energy, S . C h a n d P u b l i s h i n g , N e w D e l hi 14thEdition, 2012
3. Deshpande, M. V., Elements of Power Station Design , PHI Learning Pvt. Ltd. – reprint,2010

Semester-VII

22BEEE7E02 **ELECTRIC HYBRID VEHICLES** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- To study the basic concepts of electric hybridvehicles.
- To study the various drive traintopologies
- To Study about power flowcontrol
- To study about various drives used in hybridvehicles
- To study about energy storage system for hybridvehicle.
- To study about energy managementstrategies

Course Outcomes (COs)

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

1.Summarize the history and environmental importance of hybrid and electric vehicles.

2.Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.

3.Analyze the different motor drives used in Hybrid ElectricVehicles.

4.Design and develop basic schemes of electric vehicles and hybrid electricvehicles.

5.Compare the different Energy Storagedevices.

6.Identify the different Energy Management Strategies.

UNIT I INTRODUCTION **(9)**

History of hybrid and electric vehicles, social and environmental importance of hybrid and electricvehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRIDELECTRICDRIVE-TRAINS **(9)**

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flowcontrol in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRICPROPULSIONUNIT **(9)**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control ofDC Motor drives, Configuration and control of Induction Motor drives, configuration and control ofPermanent 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 energystorage 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 differentenergy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES (9)

Introduction to energy management strategies used in hybrid and electric vehicles, classification ofdifferent energy management strategies, comparison of different energy management strategies,implementation issues of energy management strategies.

Suggested Readings

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applicationswith Practical Perspectives", John Wiley & Sons,2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies",Springer,2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel CellVehicles: Fundamentals, Theory, and Design", CRC Press,2004.
4. T. Denton, "Electric and Hybrid Vehicles", Routledge,2016.

Websites

1.https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics2.https://swayam.gov.in/nd1_noc20_ee18/preview
3.https://nptel.ac.in/courses/108103009/

Semester-VII

22BEEE7E03 BIOMEDICAL INSTRUMENTATION 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

• The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance

• To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Methods of different transducers used.

• To introduce the student to the various sensing and measurement devices of electricalorigin.

• To provide the latest ideas on devices of non–electricaldevices.

• To bring out the important and modern methods of imagingtechnique.

• To provide latest knowledge of medical assistance / techniques and therapeuticequipment.

Course Outcomes (COs)

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

1. Illustrate the bio potentials and itspropagations.
2. Illustrate different electrode placement for various physiologicalrecordings
3. Design bio amplifier for various physiologicalrecordings
4. Explain various technique for non-electrical physiogicalmeasurements
5. Demonstrate different biochemical measurementtechniques.
6. Explain the applications of BMIsystems.

UNIT I PHYSIOLOGY ANDTRANSDUCERS (9)

Cell and its structure – Action and resting potential – Potential propagation of action potential – Sodium pump – Nervous system – CNS – PNS – Nerve cell – Synapse – Cardio pulmonary system– Physiology of heart and lungs – Circulation and respiration – Transducers – Different types –Piezo electric, ultrasonic, resistive, capacitive and inductive transducers – Selection criteria.

UNIT II ELECTRO –PHYSIOLOGICALMEASUREMENTS (9)

Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – differential, chopper, Isolation and Pre-amplifiers. ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms.

UNIT III NON–ELECTRICAL PARAMETER MEASUREMENTS (9)

Measurement of blood pressure – Cardiac output – Cardiac rate – Heart sound – Respiratory rate – Gas volume – Flow rate of CO2, O2 in exhaust air – pH of blood, ESR and GSR measurements – Plethysmography.

UNIT IV MEDICAL IMAGING AND PATIENTMONITORINGSYSTEM (9)

X–ray machine – Radiographic and fluoroscopic techniques – Computer Tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety.

UNIT V ASSISTING ANDTHERAPEUTICEQUIPMENT (9)

Pacemakers – Defibrillators – Ventillators – Nerve and muscle stimulators – Diathermy – Heart-Lung machine – Audio meters – Dializers.

SUGGESTED READING

1 Leslie Cromwell, Fred J Weibell, Erich APfeifferBio–Medical Instrumentation and Measurements PearsonEducation, India 2002

2 Khandpur,R.S Handbook of Bio–Medical instrumentation Tata McGraw Hill Publishing Co.Ltd.,India 2003.

3. Arumugam,M Bio–Medical Instrumentation AnuradhaAgencies,Kumbakonam 2003

4. Webster,J MedicalInstrumentation John Wiley and Sons,New York 1995

5. Rajarao.C. andGuha,S.K Principles of Medical Electronics andBio–medicalInstrumentation Universities Press IndiaLtd., India 2000

6. Khandpur,R.S Biomedical Instrumentation: Technology and Applications McGraw–Hill Education,Europe 2004

Semester-VII

22BEEE7E04 ELECTRICAL ENERGY CONSERVATION AND MANAGEMENT 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To gain the knowledge about energy managementScenario.
- To deals various form of energy.
- To understand the basic principles of energyaudit.
- To understand the concepts of electric motor andlosses.
- To understand the basic concepts in economic analysis in energymanagement.
- To discuss the concept of Energy Efficiency in IndustrialSystems.

Course Outcomes (COs)

At the end of this course, students will demonstrate the ability to

1.Identify and reproduce the current energy scenario and importance of energy conservation.

2.Explain the concepts of energy management.

3.Analyse the methods of improving energy efficiency in different electrical systems.

4.Summarize the basic concepts in economic analysis in energy management.

5.Elaborate the concepts of electric motor andlosses.

6.Summarize the concept of Energy Efficiency in IndustrialSystems.

UNIT I EnergyScenario (9)

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and itsfeatures.

UNIT II Basics of Energy and its various forms (9)

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units andconversion.

UNIT III Energy Management&Audit (9)

Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance

diagrams.

UNIT IV Energy Efficiency inElectricalSystems (9)

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficientmotors.

UNIT V Energy Efficiency inIndustrialSystems (9)

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of coolingtowers.

SUGGESTED READINGS

1. GuidebooksforNationalCertificationExaminationforEnergyManager/Energy Auditors Book-1, General Aspects (availableonline).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (availableonline).
3. Energy Management: Conservation and Audits, 1st Edition, Kindle Edition, CRC Press, (28 July 2020).
4. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 2003.
5. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org).

WEB REFERENCES

1. https://www.sciencedirect.com/topics/engineering/energy-conservation2.http://www.faadooengineers.com/threads/44370-Free-Download-Energy-Audit-and-Management-Notes

Semester-VII

22BEEE7E05 COMMUNICATION ENGINEERING 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To introduce the fundamental techniques of analog, digital and datacommunication.
- To explain satellite and fibre optic communication and Networkingsystems.
- To understand basic signals, analog modulation, demodulation and radioreceivers.
- To explain the characteristics and model of transmissionmedium.
- To introduce different methods of analog communication and theirsignificance
- To introduce Digital Communication methods for high bit ratetransmission

Course Outcomes (COs)

At the end of the course the student will be to

1. Summarize the different modulation systems.
2. Explain transmission lines and losses.
3. Compare the various media for digital communication.
4. Explain the data communication.
5. Elaborate the concept of network protocol.
6. Summarize the Optical Fibre Communication.

UNIT I MODULATION SYSTEMS (9)

Time and frequency domain representation of signals, amplitude modulation and demodulation, frequency modulation and demodulation, super heterodyne radio receiver. Frequency division multiplexing. Pulse width modulation.

UNIT II TRANSMISSION MEDIUM (9)

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise.

UNIT III DIGITAL COMMUNICATION (9)

Pulse code modulation, time division multiplexing, digital T–carrier system. Digital radio system. Digital modulation: Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

UNIT IV DATA COMMUNICATION AND NETWORK PROTOCOL (9)

Data Communication codes, error control. Serial and parallel interface, telephone network, data modem, ISDN, LAN, ISO–OSI seven layer architecture for WAN.

UNIT V SATELLITE AND OPTICAL FIBRE COMMUNICATION (9)

Orbital satellites, geostationary satellites, look angles, satellite system link models, satellite system link equations. Advantages of optical fibre communication – Light propagation through fibre, fibre

loss, light sources and detectors.

SUGGESTED READING

1.Wayne Tomasi Electronic Communication Systems Pearson Education New Delhi 2002.
2.Roy Blake Electronic Communication Systems Thomson Delmar , New Delhi 2002.
3.William Schweber Electronic CommunicationSystems Prentice Hall of India, New Delhi.2002
4.Kennedy, G. Electronic Communication Systems Prentice Hall of India, New Delhi.2002
5.Miller, M. Modern ElectronicCommunication Prentice Hall of India, New Delhi.2003.
6.John G Proakis and Masoud Salehi Communication Systems Engineering Prentice Hall of India, New Delhi.2001

WEB REFERENCES

1. www.complextoreal.com/tutorial.htm
2. www.discogs.com/artist/Nephlim+Modulation+Systems

Semester-VIII

22BEEE8E01 **INDUSTRIAL AUTOMATION** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- To study and gain knowledge about various sensors.
- To study and gain knowledge about controllers.
- To demonstrate the PLC.
- To gain knowledge about SCADA.
- To know about advanced control techniques.
- To study about new controller design.

Course Outcomes (COs)

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

1. Understand the concept ofsensors,
2. Understand the concept ofactuators
3. Analyse the various tuningcontrollers
4. Analyse the various advanced control techniques used in industrial automation.
5. Build and experiment with PLC based SCADA systems for various industrial applications.
6. Analyze & explain different functions of PLC.

UNIT I SENSORS,ACTUATORS **(9)**

Sensors, Actuators and Signal conditioning Sensors: Displacement sensors, Force sensors,Ultrasonic sensors, Temperature sensors, Pressure sensors etc Actuators:Dcmotors, Servo motors, Stepper motors, Piezoelectric actuators, Pneumatic actuatorsetc. Signal Conditioning: Filtering, Amplifying,Isolation,ADC,DAC, Sensor protection circuits, Signal transmission and noise suppression, Estimation of errors and calibration.

UNIT II CONTROLLER TUNING **(9)**

PI controller ,PD controller,PID controller and tuning methods:Ziegler Nicholstuning method, Cohen coon tuning method, Implementation of PID controllers (digital and analog).

UNIT III PLC **(9)**

PLC(Programmablelogiccontrollers):Overview,operationandarchitecture,PLCprogramming, Application examples. DCS (Distributed control systems): Overview, Advantages, Functional requirements of Distributed control systems, Communication for distributed control

UNIT IV SCADA **(9)**

Application examples SCADA (supervisory control and data acquisition): Introduction to SCADA, SCADA system components, architecture and communication, SCADA applications, Introduction to PLC.

UNIT V ADVANCED CONTROL TECHNIQUES (9)

Feed forward control, Ratio control,Cascade control,Adaptive control,Duplexor split range control, Override control,internal modecontrol.

SUGGESTED READINGS

1. KrishnaKant Computer-Based Industrial Control 2nd edition Prentice Hallof IndiaLtd2003.
2. Stephanopoulous Chemical Process Control–TheoryandPractice Prentice Hall of IndiaLtd2014
3. Noble, David. Forces of production: A social history of industrial automation.Routledge, 2017.
4. Introduction to programmable logic controller by Gary dunning, Thomson Asia PteLtd. Publication, Singapore, Third Edision,2016.

WEB LINKS

1. https://nptel.ac.in/courses/108105088/
2. https://www.automationprogram.com/

Semester-VIII

22BEEE8E02 **EMBEDDED SYSTEMS** **3H-3C**

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

End Semester Exam:3 Hours

Course Objectives

- To provide a clear understanding on the basic concepts of embedded system design and its applications to variousfields.
- Building Blocks of EmbeddedSystem
- Introduction to Embedded softwareTools
- Bus Communication protocol, Input/outputinterfacing.
- Various scheduling concepts for process &basics of Real time operatingsystem.
- Discussions through Phases of development of embeddedproducts.

Course Outcomes

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

1. Illustrate the concept of embedded system, microcontroller, different componentsof microcontroller and their interactions.
2. Develop embedded solutions with programmingenvironment.
3. Importance of Embeddednetworking.
4. Define the key concepts of embedded systems such as I/O, timers, interruptsand interaction with peripheraldevices.
5. Summarize the basic concept of RTOS based embedded systemdesign.
6. Elaborate the Embedded SystemApplication.

UNIT I INTRODUCTION TOEMBEDDEDSYSTEMS (9)

Introduction to Embedded Systems – The build process for embedded systems- Structural units for an Embedded microcontroller , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock-- IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, Boundary Scan

UNIT II EMBEDDED NETWORKING (9)

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols -RS232 standard – RS485 – USB Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits

UNIT III INTERRUPTS SERVICE MECHANISM AND DEVICE DRIVERS (9)

Programmed-I/O busy-wait approach without interrupt service mechanism-ISR concept-interrupt sources – multiple interrupts – context and periods for context switching, interrupt latency and deadline – Introduction to Device Drivers

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN (9)

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Pre-emptive and non-pre-emptive scheduling, Task communication-shared memory, message passing-, Inter process Communication– synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of commercial Real time Operating systems: Vx Works, цC/OS-II, RT Linux

UNIT V EMBEDDED SYSTEM APPLICATION WITH DEVELOPMENT (9)

Case Study: Washing Machine- Automotive Application-Embedded Product Development Life Cycle, Objective, Need, and different Phases & Modelling of the EDLC.

Suggested Readings

1. Rajkamal, „Embedded system-Architecture, Programming, Design‟,TMH,2011.
2. Peckol, “Embedded systemDesign”,JohnWiley&Sons,2010
3. Shibu.K.V, “Introduction to Embedded Systems”, Tata McGrawHill,2009
4. LyaB. Das,” Embedded Systems”,PearsonEducation,2010.
5. ElicaWhite, "MakingEmbedded Systems‟,0"ReillySeries,SPD,2011
7. Dave, “Embedded Systems: Concepts Design and Programming,1stedition,Pearson Education,2015.
8. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier,2006
9. JonathanW.Valvano,„EmbeddedMicrocomputerSystemsRealtimeInterfacing‟, Cengage learning , 3rd edition,2012
10. Han-Way Huang, ”Embedded system Design using C8051”, CengageLearning,200

Semester-VIII

22BEEE8E03 POWER SYSTEM OPERATIONAND CONTROL 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

• To model the power system under steady state operatingcondition

•To understand and apply iterative techniques for power flowanalysis

•To model and carry out short circuit studies on powersystem

•To model and analyze stability problems in powersystem

•To study the monitoring and control of a powersystems.

•To study the basics of power systemeconomics.

Course Outcomes (COs)

At the end of this course, students will demonstrate the ability to

1. Summarize the system load characteristics and loadcurve.
2. Identify the stability constraints in a synchronousgrid.
3. Determine the different methods to control the voltage, frequency.
4. Illustrate the concept of Unit commitment andconstraints.
5. Discuss the monitoring and control of a power system.
6. Identify the Various operating states in powersystem..

UNITI INTRODUCTION (9)

System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor Control, LFC, EDC, AVR, system voltage control, security control.

UNIT II REAL POWER -FREQUENCY CONTROL (9)

Fundamentals of speed governing mechanism and modeling: Speed-load characteristics – Load sharing between two synchronous machines in parallel; concept of control area, LFC control of a single-area system: Static and dynamic analysis of uncontrolled and controlled cases, Economic Dispatch Control. Multi-area systems: Two-area system modeling; static analysis, uncontrolled case; tie line with frequency bias control of two-area systemderivation.

UNIT III REACTIVEPOWER–VOLTAGECONTROL (9)

Typical excitation system, modeling, static and dynamic analysis, stability compensation; generation and absorption of reactive power: Relation between voltage, power and reactive power at a node; methods of voltage control: Injection of reactive power. Tap-changing transformer, numerical problems - System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAr injection of switched capacitors to maintain acceptable voltage profile and to minimize transmissionloss.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH (9)

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost. Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients) Base point and participation factors. Economic dispatch controller added to LFC control.

UNIT V COMPUTER CONTROL OF POWERSYSTEMS (9)

Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, inextremis and restorative. State transition diagram showing various state transitions and control strategies.

SUGGESTED READINGS

1. Allen J Wood and Bruce F Wollenberg, Power Generation, Operation and Control, John Wiley and Sons, Inc..2003

2. Kothari, D.P. and Nagrath, I.J.,, Modern Power System Analysis, Tata McGraw HillPublishing Company Limited, New Delhi.3rd Edition,2003

3. Kundur, P, Power System Stability and Control, Tata McGraw Hill Publications,2010.

Semester-VIII

22BEEE8E04 POWER QUALITY AND MANAGEMENT 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

•To understand the concept of series and shuntcompensation.

•To classify the different types of thyristor based FACTScontroller.

•To understand the Voltage Source Converter Based (FACTS)Controllers.

•To summarize ions of FACTScontrollers.

•To know about the power quality problems in distributionsystems.

•To understand the concept of DSTATCOM in Distribution Systems.

Course Outcomes (COs)

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

1. Interpret the various classes of power quality problems and power qualitystandards.

2. Classify the sources of voltage sags and its mitigationtechniques.

3. Identify the various cases of over voltages and its mitigationmethods.

4. Recognize the harmonic effects in powersystem.

5. Illustrate the harmonics measurements techniques.

6.Summarize the smart power qualitymonitors.

UNIT – I POWER QUALITY AND ITS STANDARDS (9)

Terms and definitions - General classes of power quality problems - Concepts of transients - Short duration and long duration voltage variations - Voltage imbalance - Waveform distortions -Voltage fluctuations Power frequency variations - Power quality standards: IEEE, IEC and CBEMA curve.

UNIT – II VOLTAGE SAGS AND INTERRUPTIONS (9)

Sources of sags and interruptions - Estimating voltage sag performance - Thevenin's equivalent source Analysis and calculation of various fault conditions - Estimation of sag severity - Mitigation of voltage sags Active series compensators - Static transfer switches and fast transfer switches.

UNIT – III OVER VOLTAGES AND MITIGATIONS (9)

Sources of over voltages - Capacitor switching - Lightning - Mitigation of voltage swells - Surge

arresters Power conditioners - Lightning protection - Shielding - Line arresters - Protection of transformers and cables - Devices for controlling harmonic distortion - Passive and active filters.

UNIT – IV HARMONICS AND ITS EFFECTS (9)

Harmonic distortion - Voltage and current distortions - Harmonics versus Transients - Power system quantities under non-sinusoidal conditions - Harmonic sources from commercial and industrial loads Locating harmonic sources - Power system response characteristics - Effect of harmonics - Inter-harmonics-Resonance.

UNIT – V POWER QUALITY MEASURING INSTRUMENTS (9)

Power quality monitoring - Flicker meters - Disturbance analyzer - Spectrum and Harmonic analyzer – Data chart recorders - Smart power quality monitors - Introduction to computer analysis tools - Intelligent system for power quality monitoring.

Suggested Readings

1. Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso and H. Wayne Beaty, "Electrical Power Systems Quality", 3 rd edition, Tata McGraw Hill, 2012.
2. Bhim Singh, Ambrish Chandra and Kamal Al-Haddad, "Power Quality Problems and Mitigations Techniques", 2nd edition, John Wiley,2015.
3. Math H.J.Bollen, "Understanding Power Quality Problems: Voltage Sags andInterruptions", IEEE Press, New York,2011.
4. Arrillaga.J, Watson.N.R and Chen.S, "Power System Quality Assessment", 3 rd edition, John Wiley and Sons Ltd., England,2011.
5. Beaty H. Wayne, McGranaghan and Mark, "Electrical Power Systems Quality", 3 rd edition, 2012.

Web Links

1.https://nptel.ac.in/courses/108/106/108106025/ 2.https://nptel.ac.in/courses/108/107/108107114/

Semester-VIII

22BEEE8E05 PROGRAMMABLE LOGIC CONTROLLER AND ITS APPLICATIONS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To understand the basics of PLCs
- To know about the PLC programming.
- To understand about the Registers and PLC functions.
- To summarize the data handling functions.
- To understand the concept of PID principles.
- To know about the analog PLC functions.

Course Outcomes (COs)

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

1. Classify the different types of programmable logiccontrollers.
2. Summarize the process controlsystems.
3. Design PLC based system for processcontrol.
4. Identify the various timers, counters, fault and interrupt systems.
5. Define and design a PLC based process control system, its software/hardwaredesign.
6. Develop a PIDprinciples.

UNIT I INTRODUCTION (9)

PLC Basics PLC system,I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected toI/O modules.

UNIT II PLC PROGRAMMING (9)

PLC Programming input instructions,outputs,operational procedures, programming examples using contacts and coils.Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT III REGISTERS AND PLC FUNCTIONS (9)

PLC Registers:Characteristics of Registers module addressing holding registers input registers, Output registers. PLC Functions Timer functions and industrial applications counters, counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT IV DATA HANDLING FUNCTIONS (9)

Data handling functions:SKIP, Master control Relay Jump Move FIFO,FAL, ONS, CLR and Sweep functions and their applications.Bit Pattern and changing a bit shift register,sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT V PID PRINCIPLES (9)

Analog PLC operation:Analog modules and systems Analog signal processing multibit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID
functions

SUGGESTED READINGS

1. JR Hackworth and F.D Hackworth – Jr Programmable Logic Controllers – Programming Method and Applications, Pearson,2006
2. JohnWebb and Ronald A Reiss ProgrammableLogic Controllers – Principle andApplications Fifth edition,PHI,2002.
3. W.Bolton, Programmable Logic controller, Elsevier Newnes Publications,Fourth Edition,2006.

Semester-VIII

22BEEE8E06 INTERNET OF THINGS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To Study about Internet of Things technologies and its role in real timeapplications.
- To introduce the infrastructure required forIoT
- To provide insight about the embedded processor and sensors required forIoT
- To familiarize the accessories and communication techniques forIoT.
- To familiarize the different platforms and Attributes forIoT.
- To know about practical applications.

Course Outcomes (COs)

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

1. Summarize the concept of Internet ofThings.
2. Illustrate the architecture of internet ofthings.
3. Define different protocols and wireless technologies forIoT.
4. Determine the embedded processors for IoT.
5. Apply applications of IoT in home Automation.
6. Identify the different applications inIoT.

UNIT I INTRODUCTION TO INTERNET OF THINGS (9)

Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers , Business drivers, Typical IoT applications , Trends and implications.

UNIT II IOT ARCHITECTURE (9)

IoT reference model and architecture -Node Structure – Sensing, Processing, Communication, Powering, Networking – Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy, beacons

UNIT-III PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT (9)

PROTOCOLS : NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell.

Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary Systems-Recent trends.

UNIT-IV EMBEDDED PROCESSORS FOR IOT (9)

Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability. Embedded processors for IOT: Introduction to Python programming -Building IOT with RASPERRY PI and Arduino

UNIT-V CASE STUDIES **(9)**

Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense.

SUGGESTED READINGS

1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet ofThings",Universities Press2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi " The Internet of Things",Wiley,2016.
3. Samuel Greengard, " The Internet of Things", The MIT press,2015
4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.
5.Jean- Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: TheNext Internet" Morgan Kuffmann Publishers,2010.
6. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wileyand sons, 2014

Semester-VIII

22BEEE8E07 HVDC AND FACTS 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

- To understand the fundamentals of FACTSControllers,
- To know the importance of controllable parameters and types of FACTS controllers &their benefits
- To study about combinedcompensators.
- To study HVDC Transmissionsystem
- To understand the control aspects of HVDCSystem.
- To understand about voltage source converter based HVDC systems.

Course Objectives(COs)

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

1. Choose proper FACTS controller for the specific application based onsystem requirements
2. Analyze the control circuits of Shunt Controllers, Series controllers &Combined controllers for various functions viz.
3. Analyze the concept of Transient stability Enhancement, voltage instabilityprevention and power oscillation damping
4. Compare EHV AC and HVDC system and to describe various types of DClinks
5. Describe various methods for the control of HVDCsystems
6. Define the power flow analysis in AC/DCsystems

UNIT I FACTSCONCEPTS (9)

Reactive power control in electrical power transmission, principles of conventional reactive power compensators. Introduction to FACTS, flow of power in AC parallel paths, meshed systems, basic types of FACTS controllers, definitions of FACTS controllers, brief description of FACTS controllers.

UNIT II STATIC SHUNT AND SERIES COMPENSATORS (9)

Shunt compensation – objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators – SVC, STATCOM, SVC and STATCOM comparison. Series compensation – objectives of series compensation, thyristor switched series capacitors (TCSC), static series synchronous compensator (SSSC), power angle characteristics, and basic operating control schemes.

UNIT III COMBINED COMPENSATORS (9)

Unified power flow controller (UPFC) – Introduction, operating principle, independent real and reactive power flow controller and control structure. Interline power flow controller (IPFC), Introduction to Active power filtering, Concepts relating to Reactive power compensation and harmonic current compensation using Active power filters.

UNIT IV HVDC TRANSMISSION (9)

HVDC Transmission system: Introduction, comparison of AC and DC systems, applications of DC transmission, types of DClinks, Layout of HVDC Converter station and various equipments. HVDC Converters, analysis of bridge converters with and without overlap, inverter operation, equivalent circuit representation of rectifier and inverter configurations

UNIT V CONTROL OF HVDC SYSTEM (9)

Principles of control, desired features of control, converter control characteristics, power reversal, Ignition angle control, current and extinction angle control. Harmonics introduction, generation, ac filters and dc filters. Introduction to multiterminal DC systems and applications, comparison of series and parallel MTDC systems, Voltage Source Converter based HVDC systems.

Suggested Readings

1. Hingorani,L.Gyugyi,„ConceptsandTechnologyofFlexibleACTransmissionSystem‟,IEEE Press New York, 2000 ISBN –0780334588.
2. Padiyar, K.R., „HVDC transmission systems‟, Wiley Eastern Ltd.,2010.
3. Song,Y.H.andAllanT.Johns,„FlexibleACTransmissionSystems(FACTS)‟,Institution ofElectrical Engineers Press, London,1999.
4. MohanMathurR.andRajivK.Varma,„Thyristor–based FACTS controllers for Electrical Transmission systems‟, IEEE press, Wiley Inter science ,2002.
5. PadiyarK.R.FACTScontrollersforTransmissionandDistributionsystems‟New Age International Publishers, 1st Edition,2007.
6. Enrique Acha, Claudio R.Fuerte-Esqivel, Hugo Ambriz-Perez, CesarAngeles-Camacho 2007(digital).

OPEN ELECTIVES

Artificial Intelligence and Data Science **2022-2023**

22BTADOE01 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE 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 understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- 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.

Course outcomes(COs):

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

1. Use appropriate search algorithms for any AI problem
2. Represent a problem using first order and predicate logic
3. Provide the apt strategy to program a new game/ problem
4. Design different search strategies for a problem
5. Design applications using fuzzy logic.
6. Apply and Understand the basic artificial intelligence tool

UNIT I **(9)**

Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II **(9)**

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, in ferencing, monotonic and non monotonic reasoning. Introduction to prolog.

UNIT III **(9)**

Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.

UNIT IV **(9)**

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alpha-beta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning

UNIT V **(9)**

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models

SUGGESTED READINGS

1.Elaine Rich &Kevin Knight ,"Artificial Intelligence", Mc-GrawHill,Third Edition, 2017.

2.Dan W.Patterson,"Introduction to AI & Expert System, PHI, 2020.

3."Artificial Intelligence" by Luger (Pearson Education) , 2020.

4.Russel&Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2020.

WEBSITES:

1. https://nptel.ac.in/courses/112/103/112103280/

2. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artificial-intelligence

22BTADOE02 FUNDAMENTALS OF DATA SCIENCE 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 the basic concepts of Data Science and data life cycle
- To understand the theoretical and mathematical aspects of Data Science models
- To learn common random variables and their uses, and with the use of empirical distributions
- To obtain the knowledge in data management tools
- To explore the major techniques for data science

Course outcomes(COs):

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

- Understand the key concepts in data science, including tools and approaches.
- Understand the concepts in data collection, sampling and probabilistic models
- Understand the various techniques in data science
- Apply the mathematical formulation of machine learning and statistical models to visualize the data in various methods.
- Apply a suitable data science technique to solve an information analytics problem.
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

UNIT I (9)

The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre-processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT II (9)

Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

UNIT III (9)

Data Normalization (z-values, transforms) –Random processes –Data Management: Tools for Data Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

UNIT IV **(9)**

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse–Machine Learning- Supervised Learning, Unsupervised Learning.

UNIT V **(9)**

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non commercial cloud service providers.

SUGGESTED READINGS

1. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, fourth Edition, 2020.
2. Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.
3. MurtazaHaider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition, 2015.
4. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O‟Reilly Publication, First Edition, 2017.
5. Dawn Griffiths, Head First Statistics, O‟Reilly Publication, First Edition, 2008.

WEBSITES:

1. https://www.inferentialthinking.com/chapters/intro
2. https://www.openintro.org/stat/
3. https://swayam.gov.in/nd1_noc20_cs36/preview
4. https://swayam.gov.in/nd1_noc19_cs60/preview
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002- introduction-to-computational-thinking-and-data-science-fall-2016/

22BTADOE03 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 Elaborate on the principles of web page development

Course outcomes(COs):

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

- Learn the advanced concepts &techniques of the Internet and Java.
- Analyze the requirements for and create and implement the principles of web page development
- Understand the concepts of PERL
- Implement client side programming using java applets
- Generate internet telephony based upon advanced concepts
- Develop applications on internet programming based on java applets and scripts

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 II HTML (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.

SUGGESTED READINGS

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”, 7th Edition, 2018.
3. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2018.
4. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI Learning, Delhi, 2019.

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/

22BTADOE04 ROBOTICS AND AUTOMATION 3H-3C

Instruction Hours/week: L:3 T:0 P:0Marks: 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 functional elements of Robotics
- To impart knowledge on the forward and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce about hydraulics system
- To introduce the concept of automation

Course outcomes(COs):

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

- Understand basic concept of robotics and automation in robotics industries.
- Apply computer vision concepts in robotics.
- Analyze instrumentation systems and their applications.
- Analyze the working of a hydraulic system
- Evaluate various approaches in robotics and automation and choose suitable methods.
- Evaluate and have a clear view of advanced robotics system.

UNIT I **(9)**

Introduction – Actuators – Sensors – Rigid body – coordinate systems – Kinematics – Forward Kinematics & Inverse Kinematics – Velocity Kinematics – Angular velocity – Linear velocity – Singularity – Force and torque

UNIT II **(9)**

Dynamics – Mobile Robots – Planning and Control – Path & Trajectory planning – Probabilistic Roadmaps – Localization.

UNIT III **(9)**

Basics of probability – Kalman Filtering – Extended Kalman – Particle filter – Localization – Computer Vision – Vision Based Controls.

UNIT IV **(9)**

Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors – Fluid accessories

UNIT V **(9)**

Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders

SUGGESTED READINGS :

1. **"**Robot Modeling and Control**",** Mark W. Spong, Seth Hutchinson and Vidyasagar. M, Wiley Publishers, Second Edition, 2020.
2. "Robot Building for Beginners", David Cook, Apress Publishers, Third Edition, 2015.
3. "Industrial Automation and Robotics", Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
4. "Industrial Robotics", Groover. M.P, Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017
5. "Embedded Systems & Robotics", Ghoshal. S, Cengage Learning, First Edition, 2009.
6. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

WEBSITES:

1. www.nptel.ac.in/courses/112/101/112101099/
2. www.nptel.ac.in/courses/112/101/112101098/
3. www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial
4. www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots
5. www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

22BEBMEOE01 HUMAN ANATOMY AND PHYSIOLOGY 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 all the organelles of an animal cell and their function.
- To perceive structure and functions of the various types of systems of human body.
- To outline about eye, ear and Endocrine glands of human
- To learn organs and structures involving in system formation and functions.
- To understand all systems in the human body.
- To infer basic understanding of the inter connection of various organ systems in human body

Course outcomes(COs):

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

1.Explain basic structure and functions of cells and its organelles 2.Demonstrate about an atomy and physiology of various organ systems 3.Illustrate eye, ear and Endocrinegl and so human
4.Explain the interconnect of various organ systems in human body 5.Enlighten organs and structures involving in system formation and functions. 6.Elucidate special sense sin the human body.

UNIT I CELL (9)

Structure of Cell– Organelles and description–Function of each component of the cell– Membranepotential–Action Potential–Generation and Conduction –Electrical Stimulation. Blood Cell– Composition –Origin of RBC–Blood Groups–Estimation of RBC, WBC and Platelet-Tissues and its functions-.Homeostasis - Tissue: Types – Specialized tissues – functions

UNIT II CARDIACANDNERVOUSSYSTEM (9)

Heart, Major blood vessels– Cardiac Cycle – ECG-Conducting system of heart--importance of blood groups – identification of blood groups- Nervous Control of Heart-Cardiac output– Coronary and Peripheral Circulation–Structure and function of Nervous tissue–Neuron-

Synapse-Reflexes-Receptors-Brain- Brainstem-Spinalcord–Reflexaction.

UNIT III RESPIRATORY SYSTEM AND MUSCULO SKELETAL SYSTEM (9)

Physiological aspects of respiration–Trachea andlungs -Exchange of gases–Regulation of Respiration - Disturbance of respiration function -Pulmonary function test-Types of respiration - Oxygen and carbon dioxide transport and acid base regulation-Muscles-tissue-types-structure of skeletal muscle-types of muscle and joints.

UNIT IV DIGESTIVE,EXCRETORY AND LYMPHATIC SYSTEM (9)

Organisation of GI System, Digestion and absorption –Movements of GI tract–Intestine-Liver-Pancreas- Structure of Nephron–Mechanism of Urine formation–Urine Reflex–Skin and SweatGland–Temperature regulation, Lymphatic: Parts and Functions of Lymphatic systems– Types of Lymphatic organs and vessels.

UNIT V EYE, EAR&ENDOCRINE GLANDS (9)

Optics of Eye–Retina–Photochemistry of Vision–Accommodation-Neurophysiology of vision–EOG, Physiology of internal ear–Mechanism of Hearing–Auditory Pathway, Hearing Tests–Endocrine-Pituitary and thyroid glands.

SUGGESTED READINGS

1. Equity Edition Anatomy and Physiology : Volume 2 of 3. Lulu.com,2014
2. William F. Ganong Review of Medical Physiology Mc Graw Hill, New Delhi, 26th Edition 2019
3. Arthur C. Guyton, Text book of Medical Physiology, Elsevier Saunders, 12th Edition,2011

Semester-VII

22BEBMEOE02 ARTIFICIAL ORGANS AND IMPLANTS 3H-3C

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

EndSemesterExam:3Hours

Course Objectives

The goal of this course is for students

- To have an overview of artificial organs &transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution
- To study about various blood interfacing implant
- To study about soft tissue replacement and hard tissue replacement
- To learn about various implants

Course outcomes(COs):

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

1. Understand of artificial organs &transplants
2. Know the principles of implant design with a case study
3. Explain the implant design parameters and solution in use
4. Know about various blood interfacing implants
5. Understand about soft tissue replacement and hard tissue replacement
6. Know about various implants.

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS (9)

ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration – Evaluation process. TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individual organs –kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLES OF IMPLANT DESIGN (9)

Principles of implant design - body response to implants, Clinical problems requiring implants for solution, The missing organ and its replacement, Tissue engineering, scaffolds, Biomaterials, Regenerative medicine & Stem cells.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION (9)

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. Limb prosthesis, Externally Powered limb Prosthesis

UNIT IV BLOOD INTERFACING IMPLANTS (9)

Neural and neuromuscular implants, Heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, Prosthetic cardiac valves, Artificial kidney-dialysis membrane and artificial blood.

UNIT V IMPLANTABLE MEDICAL DEVICES AND ORGANS (9)

Gastrointestinal system, Dentistry, Soft tissue replacement & Hard tissue replacement – sutures, surgical tapes, adhesive, percutaneous implants, internal fracture fixation devices, joint replacements. Maxillofacial and craniofacial replacement, Recent advancement and future directions.

SUGGESTED READINGS

1. Park J.B Biomaterials Science and Engineering| Plenum Press 2011.
2. J D Bronzino Biomedical Engineering handbook Volume II CRC Press 2010.
3. RS Khandpur Hand book of Biomedical Instrumentation Tata McGraw Hill, 2016.

22BTBTOE01 **BIOREACTOR DESIGN** **3H-3C**

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

Course Objectives:

- Impart basic knowledge in bioprocess Engineering
- Design the bioreactors for various operations.
- Discuss the principle and working of heat transfer equipments.
- Extend the knowledge in principle of heat transfer inside a bioreactor
- Construct the equipments used in mass transfer operations.
- Illustrate the equipments used in separation process.

Course Outcomes(COs)

After completing the course,the students will be able to

- Summarize the basic concepts in bio process Engineering.
- Design the bioreactors for various operations.
- Develop the heat transfer equipments for bioprocess engineering.
- Construct the equipments used in mass transfer operations.
- Categorize the equipments used in separation process.
- Describe the applications of bio reactors.

UNITI:INRODUCTION TO BIOPROCESS ENGINEERING (9)

Introduction – Biotechnology and Bioprocess Engineering- Biologists and Engineers Differ intheir approach to research-How Biologists and Engineers work Together- Bioprocesses: Regulatory constraints.

UNITII:REACTOR DESIGN (9)

Design of Air lift fermentor,Bubble column reactor and Continuous stirred tank reactor.

UNITIII:HEAT TRANSFER EQUIPMENTS (9)

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, Long tube vertical evaporator and Forced circulation evaporator.

UNITIV:MASS TRANSFER EQUIPMENTS (9)

Design of Bollmann extractor, Fractionating column, Packed tower and Spray tray absorber.

UNITV:SEPARATION EQUIPMENTS (9)

Design of Plate and frame filter press, Leaf filter, Rotary drum filter, Disc bowl centrifuge, Rotary drum drier and Swenson–walker crystallizer.

SUGGESTED READINGS:

1.James Edwin Bailey, DavidF.Ollis (2015) Biochemical Engineering Fundamentals, Second Edition.McGraw-Hill Education (India) private limited.

2.DonW.Green,Robert H.Perry(2008).Chemical Engineer Handbook.The McGraw- HillCompanies,Inc.

3. Pauline.M.Doran(2015).BioprocessEngineeringPrinciplesSecondEdition.AcademicPress.

B.Tech Biotechnology

22BTBTOE02 FOOD PROCESSING AND PRESERVATION 3H-3C

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

Course Objectives

- Discuss the scope and importance of food processing.
- Impart basic knowledge indifferent food processing methods carried out in the food tech companies.
- Explain the methods of food preservation by cooling.
- Tell the concepts of preservation methods for fruits.
- Create deeper understanding on preservation methods for vegetables.
- Extend the brief knowledge in food conservation operations and packaging methodologies.

Course outcomes(COs):

After completing the course,the students will be able to

- Describe the scope and importance of food processing.
- Outline the various processing methods for foods.
- Describe the methods of food preservation by cooling.
- Summarize the preservation methods for fruits and vegetables.
- Extend the knowledge in food conservation operations.
- Understand the types and materials used for packaging.

UNITI:SCOPEANDIMPORTANCEOFFOODPROCESSING (9)

Properties of food - Physical, thermal, mechanical, sensory.Raw material Preparation - Cleaning,sorting,grading, peeling.

UNITII:PROCESSINGMETHODS (9)

Heating-BlanchingandPasteurization.Freezing-Dehydration-canning-additives-fermentation-extrusion cooking-hydrostatic pressure cooking-dielectric heating-microwave processing and aseptic processing–Infrared radiation processing-Concepts and equipment used.

UNITIII:FOODCONVERSION OPERATIONS AND FOOD PACKAGING (9)

Sizereduction – Fibrous foods, dry foods andliquidtheoryandfoods–equipments-membraneseparation- filtration-equipment and application. Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

UNITIV:FOODPRESERVATIONBYCOOLING (9)

Refrigeration,FreezingTheory,freezingtimecalculation,methodsfreezingoffreezingequipments, freeze drying, freeze concentration, thawing, effect of low temperatureon food.

Wateractivity,methods to control water activity.

UNIT V:PRESERVATIONMETHODSFORFRUITS ANDVEGETABLES (9)

Design of Plate and frame filter press, Leaf filter, Rotary drum filter, Disc bowl centrifuge, Rotary drum drier and Swenson–walker crystallizer.

SUGGESTEDREADINGS:

1.R.PaulSingh,DennisR.Heldman(2014).Introductiontofoodengineering. Academicpress.

2.P.Fellows.(2017).Foodprocessingtechnologyprinciplesandpractice,FourthEdition.Woodhe adpu blishing Ltd.

3.M.A.Rao,SyedS.H.Rizvi,AshimK.Datta.(2014).Engineeringpropertiesoffoods.CRCpress.

4.B.Sivasankar.(2002).Foodprocessingandpreservation.PHIlearningPvt.Ltd.

5.Ranganna, S. (2000). Handbook of canning and aseptic packaging. Tata McGraw-Hill Publishing Company..

6.Sharma, M., Goyal, M. R., &Birwal, P. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Volume 5: Emerging Techniques for Food Processing, Quality, and Safety Assurance. CRC Press.

22BTBTOE03 BASIC BIOINFORMATICS 3H-3C

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

EndSemesterExam:3 Hours

Course Objectives

- Elaorate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylo genetic trees for revolution.
- Discuss the 3Dstructure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.
- Extend the brief knowledge in Microarray data analysis.

Course Outcomes(COs)

After completing the course,the students willbeable to

1. Summarize the basic concepts and importance of Bio informatics in varioussectors.
2. Demonstrate thesequen cealignment tool in bioinformatics.
3. Construct the phylogenetic trees forevolution.
4. Analyze the three dimensional protein structure and classification using various tools.
5. Illustrate the protein secondary structure prediction by comparative modeling.
6. Extend the knowledge inmicroarray technology and applications of bioinformatics invarious sectors.

UNITI:OVERVIEW OF BIOINFORMATICS (9)

Aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities.The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Dataacquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & proteinexpression data; protein interaction data. Databases – contents, structure & annotation: file formats;annotatedsequencedatabases; miscellaneous databases.

UNITII:RETRIEVALOFBIOLOGICALDATA (9)

Data retrieval with Entrez& DBGET/ LinkDB; data retrieval with SRS (sequence retrievalsystem).Searching sequence databases by sequence similarity criteria: sequence similarity searches;amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III:PHYLOGENETICS (9)

Introduction to Phylogenetics, Molecular Evolution and Molecular Phylogenetics, Phylogenetic tree, Forms of Tree Representation, Rooted and un-rooted trees, Phylogenetic Tree Construction

Methods: Distance based methods- NJ, UPGMA PGMA , cladistics & ontology; building phylogenetic trees; evolution of macro molecular sequences.Sequence annotation:principles ofgenome annotation;annotation tools&resources.

UNITIV:STRUCTURALBIOINFORMATICS (9)

Protein sequence data-bases- SwissProt/ TrEMBL, PIR, Sequence motif databases -Pfam, PROSITE, Protein structure databases, Protein Data Bank-SCOP, CATH, KEGG, Chembank, Sequence, structure and function relationship. Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure&function;obtaining,viewing&analyzingstructuraldata;structuralalignment;classificatio nof proteins of known three-dimensional structure; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNITV:MICROARRAYDATAANALYSIS (9)

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling &SAGE.Bioinformatics in pharmaceutical industry:informatics & drug discovery; pharma informatics resources. Basic principles of computing in computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

SUGGESTEDREADINGS:

1. DanEkraneMichaelLRayme.(2004).FundamentalconceptsofBioinformatics.PearsonEducation.
2. AndreasDBaxevanisB.F.FranchisOuellette.(2004).Bioinformatics:Apracticalguidetotheanaly sis ofgenesandproteins. Wiley-Interscience.
3. DavidW.Mount.(2004).SequenceandGenome Analysis.ColdSpringHarborLaboratory.
4. JonathanPevsner.(2015).Bioinformaticsand functionalgenomics. wiley-Liss.
5. MichaelJKoernberg.(2016).MicroarrayDataAnalysis:Methodsandapplications.HumanaPress
6. Rastogi, S. C., ParagRastogi, and NamitaMendiratta(2013). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt. Ltd.,

22BTBTOE04 FUNDAMENTALS OF NANO BIOTECHNOLOGY 3H-3C

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

EndSemesterExam:3 Hours

Course Objectives

- Impart the skills in the field of nano biotechnology and its applications.
- Acquire knowledge in the nanoparticles and its significance invarious fields.
- Extend the knowledge in types and application of nanoparticles in sensors.
- Define the concepts of biomaterials through molecular self assembly.
- Equip tudents with clinical applications of nan odevices.
- Describe deeper understanding of the socio-economic issues in nano biotechnology.

Course Outcomes(COs)

After completing the course,the students will be able to

1. Develop skills in the field of nano biotechnology and its applications.
2. Summarize the nanoparticles and itssignificance invarious fields.
3. Extend the knowledge in types and application of nano particles insensors.
4. Define the concepts of biomaterials through molecular self assembly.
5. Outline the clinical applications of nano devices.
6. Describe the socio-economic issues in nano biotechnology.

UNIT I:INTRODUCTION (9)

Introduction to Nanotechnology and nanobiotechnology: Properties at nanoscale, Scope and Overview, Length scales , Importance of Nanoscale and Technology,History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, ; General synthesis methods of nanoscale materials; top down and bottom up approaches; Silicon basedTechnology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions,Understanding advanced capabilities,Nanotechnology in Different,Fields:Nano biotechnology, Materials, Medicine,Dentalcare.

UNITII:NANOPARTICLES (9)

Introduction,TypesofNanoparticles,TechniquestoSynthesizeNanoparticles,Characterizationof Nanoparticles,Applications,ToxiceffectsofNanomaterials,SignificanceofNanoparticlesNanofa brications-MEMS/NEMS,AtomicForceMicroscopy,Self assembled monolayers Dip-penNanolithography, Soft Lithography, PDMS Molding, Nano Particles,Nanowiresand Nanotubes. X-ray diffraction technique; Scanning Electron Microscopy with EDX; Transmission Electron Microscopy including high-resolution imaging;

UNITIII:MEDICAL NANOTECHNOLOGY (9)

Nanomedicine,NanobiosensorandNanofludics.Nanocrystalsinbiologicaldetection,Electrochemical DNAsensorsandIntegratedNanolitersystems.Nano-BiodevicesandSystems.Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivodrugdelivery-Future nanomachine. Case study on drug delivery of gold nanoparticles against breast cancer.

UNITIV:NANOBIOTECHNOLOGY (9)

Nanoscale devices for drug delivery: micelles for drug delivery; targeting; bioimaging; microarray and genome chips; Clinical applications of nanodevices. Artificial neurons.Real-time nanosensors- Applications in cancerbiology. Nanomedicine. Synthetic retinyl chips based on bacterio rhodopsins.High through put DNA sequencing with nanocar bontubules.Nanosurgical devices.

UNITV:ETHICALISSUESINNANOTECHNOLOGY (9)

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With EspecialReference to Nanomedicine, Nanomedicine Applied inNonmedical Contexts, Social Issues Relatingto Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology andFutureSocio-economicchallenges.

SUGGESTEDREADINGS:

1. Niemeyer,C.M.andMirkin,C.A(2005).Nanobiotechnology:Concepts,ApplicationsandPerspectives.Wiley-VCH.
2. Goodsell,D.S.(2004).Bionanotechnology.JohnWileyandSons,Inc.
3. Shoseyov,O. andLevy,I (2008).Nanobiotechnology:BioinspiredDevices andMaterials oftheFuture.HumanaPress.
4. Bhushan,B.(2017).SpringerHandbookofNanotechnology.Springer-VerlagBerlinHeidelberg.
5. FreitasJrR.A(2006)Nanomedicine. LandesBiosciences.
6. Kohler,M.andFritzsche,W.(2008).Nanotechnology–AnIntroductiontoNanostructuringTechniques.Wiley-VCH.
7. Niemeyer, C. M., and CA Mirkin, C. A., (2010); NanoBiotechnology II – More concepts, and applications. First edition, Wiley –VCH publications

Semester-

22BECEOE01 **Housing Plan and Management** **3H-3C**

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

End SemesterExam:3Hours

Course Objectives

1.To examine the role and tasks of basic housing policies and building bye laws.

2.Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors.

3.Analyze the Innovative construction methods and Materials.

4.Analyze city management strategies and strengthen the urban governance through a problem solving approach.

5.To know the Importance of basic housing policies and building bye laws.

6.To use Housing Programmes and Schemes.

Course Outcomes(COs)

After completing the course,the students will be able to

1.Know the Importance of basic housing policies and building byelaws

2.Use Housing Programmes and Schemes

3.Plan and Design of Housing projects

4.Examine Innovative construction methods and Materials

5.Know Housing finance and loan approval procedures

6.Understand Construction as well as managing techniques

UNITI: INTRODUCTION TO HOUSING (9)

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings,Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing,Housing Laws at State level,Bye-laws at Urban and Rural Local Bodies–levels Development Control Regulations,Institutions for Housing at National,State and Locallevels

UNITII: HOUSING PROGRAMMES (9)

Basic Concepts, Contents and Standards for Housing Programmes Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public,Private and Non-Government Organizations.

UNITIII: PLANNING AND DESIGN OF HOUSING PROJECTS (9)

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units(Design Problems)

UNITIV: CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS (9)

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers –Concept,Functions and Performance Evaluation

UNITV:HOUSING FINANCE AND PROJECT APPRAISAL (9)

Appraisal of Housing Projects–Housing Finance, Cost Recovery–Cash Flow Analysis,Subsidy and Cross Subsidy,Pricing of HousingUnits,Rents,Recovery Pattern(Problems).

SUGGESTED READINGS

1. MeeraMehtaandDineshMehta,MetropolitanHousingMarkets,SagePublicationsPvt.Ltd.,New Delhi,2002.
2. FrancisCherunilamandOdeyarDHeggade,HousinginIndia,HimalayaPublishingHouse,Bombay,2001.

REFERENCES

1.Development ControlRulesforChennaiMetropolitanArea,CMA,Chennai,2002.

2.UNCHS,NationalExperienceswithShelterDeliveryforthePoorestGroups,UNCHS(Habitat),Nairobi,2000.

Semester-

22BECEOE02 **BUILDING SERVICES** **3H- 3C**

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

End SemesterExam:3Hours

Course Objectives

1. Defining and identifying of engineering services systems in buildings.
2. The role of engineering services systems in providing comfort and facilitating life of users of the building.
3. The basic principles of asset management in a building & facilities maintenance environment
4. Importance of Fire safety and its installation techniques.
5. To understand Electrical system and its selection criteria
6. To use the Principles of illumination & design

Course Outcomes(COs)

After completing the course,the students will be able to

1. Machineries involved in building construction
2. Understand Electrical system and its selection criteria
3. Use the Principles of illumination &design
4. Know the principle of Refrigeration and application
5. Importance of Fire safety and its install at ion techniques
6. Know the principle behind the installation of building services and to ensure safety inbuildings.

UNITI: MACHINERIES **(9)**

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators –Laboratory services–Gas,water,air and electricity

UNITII: ELECTRICALSYSTEMSINBUILDINGS **(9)**

Basics of electricity – Single / Three phase supply – Protective devices in electricalinstallations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiringsystems and their choice – Planning electrical wiring for building – Main and distribution boards –Transformers and switchgears–Layout of substations

UNITIII: PRINCIPLESOFILLUMINATION&DESIGN **(9)**

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis oflight – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP – Classification of lighting –Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature –Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features

required and minimum level of illumination required for physically handicapped and elderly in building types.

UNITIV:REFRIGERATIONPRINCIPLES&APPLICATIONS (9)

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensibleheat–Latentheatoffusion,evaporation,sublimation–saturationtemperature–Superheated vapour–Subcooledliquid–Pressuretemperaturerelationshipforliquids–Refrigerants–Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors –Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings–Protection against fire to be caused by A.C.Systems

UNITV:FIRESAFETY INSTALLATION (9)

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildingslike non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems.Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers –Automatic sprinklers

SUGGESTED READINGS

1. E.R.Ambrose, "Heat Pumps and Electric Heating",John and Wiley and Sons,Inc., NewYork,2002.
2. Hand book for Building Engineers inMetricsystems,NBC,NewDelhi,2005.
3. PhilipsLightinginArchitecturalDesign,McGraw-Hill,NewYork,2000.
4. A.F.C.Sherratt,"Air conditioning and Energy Conservation",The Architectural Press, London,2005.NationalBuilding Code.

22BECEOE03 **REPAIR AND REHABILITATION OF STRUCTURES** **Semester-3H- 3C**

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

End SemesterExam:3Hours

Course Objectives

1. To learn various distress and damages to concrete and masonry structures
2. To know the influence of corrosion in durability of structures
3. To understand the importance of maintenance of structures
4. To study the various types and properties of repair materials
5. To learn various techniques involved in demolition of structures
6. To Assessing damage of structures and various repair techniques

Course Outcomes(COs)

After completing the course,the students will be able to

1. Various distress and damages to concrete and masonry structures
2. Durability of structures and corrosion mechanism
3. The importance of maintenance of structures, types and properties of repair materials etc
4. Assessing damage of structures and various repair techniques
5. the various types and properties of repair materials
6. Modern technique and equipment being adopted for the demolition of structures

UNITI:INTRODUCTION (9)

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors.

UNITII: DURABILITYOFSTRUCTURES (9)

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking,measurements for corrosion-methods of corrosion protection, corrosion inhibitors,corrosion resistant steels,coatings,cathodic protection.

UNITIII: MAINTENANCEANDREPAIRSTRATEGIES (9)

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of MaintenancePreventive measures on various aspects Inspection, Assessment procedure for evaluating a damagedstructurecauses ofdeterioration-testingtechniques.

UNITIV:MATERIALSFORREPAIR (9)

Special concretes and mortar, concrete chemicals, special elementsfor accelerated strength gain,Expansive cement, polymer concrete, sulphurinfiltrated concrete,Ferro cement, Fibre reinforcedconcrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and drypack,vacuumconcrete.

UNITV: TECHNIQUESFORREPAIRANDREPAIROFSTRUCTURES (9)

Non-destructive Testing Techniques, Corrosion protection techniques ,Gunite and Shotcrete Epoxyinjection, Mortar repairfor cracks, shoring andunderpinning. Repairs to overcomelowmemberstrength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposureEngineereddemolitiontechniquesfordilapidatedstructures -case studies.

SUGGESTED READINGS

1.Denison Campbell, Allen and Harold Roper,"Concrete Structures,Materials, Maintenance and Repair",Longman Scientific and Technical UK,1991.

2.AllenR.T.&Edwards S.C,Repair of Concrete Structures,Blakie and Sons,UK,1987

3.ShettyM.S.,"ConcreteTechnology–TheoryandPractice",S.ChandandCompany,2008.

4.Ravishankar.K.,Krishnamoorthy.T.S,"StructuralHealthMonitoring,Repairand

5.Rehabilitation of Concrete Structures", Allied Publishers, 2004.

6.Gambhir.M.L.,"ConcreteTechnology",McGrawHill,2013

7.R.K. Rajput,EngineeringMaterials, S. Chand&CompanyLtd., 2000.

8.M.S.Shetty,ConcreteTechnology(TheoryandPractice),S.Chand &CompanyLtd.,2003.

9.SustainableConstruction:GreenBuildingDesignandDelivery.ThirdEdition,CharlesJ.Kibert,NewYork:JohnWiley&Sons,2012.

10. WorkingTowardSustainability:EthicalDecisionMaking inaTechnologicalWorld,CJKibertetal,NewYork:JohnWiley&Sons,2011.

22BECEOE04 **COMPUTER-AIDED CIVIL ENGINEERING DRAWING** **Semester-3H- 3C**

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

End SemesterExam:3Hours

Course Objectives:

- Develop Parametric design and the conventions of formal engineeringdrawing
- Produce and interpret 2D & 3Ddrawings
- Communicate a design idea/concept graphically/visually
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineeringartifact.
- To Communicate a design idea/concept graphically/visually

Course Outcomes(COs)

After completingthecourse,thestudentswillbeableto

1. Develop Parametric design and the conventions of formal engineeringdrawing
2. Produce and interpret 2D & 3Ddrawings
3. Communicate a design idea/concept graphically/visually
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineeringartifact
6. Planning and designing of structures

UNIT I:INTRODUCTION (9)

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings toshow information concisely and comprehensively; optimal layout of drawings and Scales; Introductiontocomputeraideddrawing,co-ordinate systems, reference planes.Commands:Initial settings,Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks.Drawing presentation norms and standards.

UNIT II:SYMBOLSANDSIGN CONVENTIONS (9)

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols,welding symbols;dimensioning standards.

UNIT III:MASONRYBONDS (9)

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV:BUILDINGDRAWING (9)

Terms, Elements of planning building drawing, Methods of making line drawing and detaileddrawing.Site plan, floor plan, elevation and section drawing of small residential buildings.Foundationplan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes toimprove clarity.

UNIT V:PICTORIALVIEW **(9)**

Principles of isometrics and perspective drawing.Perspective view of building,Software's

SUGGESTED READINGS

1. Venugopal(2007),"EngineeringDrawingandGraphics+AUTOCAD",NewAgeInternationalPvt .Ltd.,
2. SubhashCSharma&GurucharanSingh(2005),"CivilEngineeringDrawing",StandardPublishers
3. (Correspondingsetof)CADSoftwareTheoryandUserManuals.
4. MalikR.S.,Meo,G.S.(2009)CivilEngineeringDrawing,ComputechPublicationLtdNewAsian.
5. Sikka,V.B.(2013),ACourseinCivilEngineeringDrawing, S.K.Kataria&Sons.
6. AjeetSingh(2002),"WorkingwithAUTOCAD 2000withupdatesonAUTOCAD200I",Tata-McGraw-HillCompanyLimited,NewDelhi

Semester-

22BECEOE05 **CONTRACTS MANAGEMENT** **3H-3C**

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

EndSemesterExam:3 Hours

Course Objectives

- To have developed a more detailed appreciation for construction planning and scheduling
- To apply their learned knowledge as it pertains to upper level construction management skills and procedures.
- To evaluate the best practices associated with the development of contract parameters.
- To understand the legal aspects of acts governing the contracts
- To discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- To understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

Course Outcomes(COs)

After completing the course,the students will be ableto

1. Apply project Procurement management concepts in a project environment.
2. Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
3. Evaluate the best practices associated with the development of contract parameters.
4. Understand the legal aspects of acts governing the contracts
5. Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
6. Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

UNITI:CONTRACT MANAGEMENT (9)

Introduction,ImportanceofContracts,OverviewofContractManagement,OverviewofActivities in Contract Management; Planning and People- Resource Management; Types of Contracts,Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Noticeto proceed, rights and duties of various parties,noticestobe given,Contract DurationandPrice.

UNITII: CONTRACT PARAMETERS (9)

Performanceparameters;Delays,penaltiesandliquidateddamages;ForceMajeure,Suspensionand Termination.Changes&variations,Noticesundercontracts;ConventionalandAlternative Dispute Resolution methods.

UNITIII: VARIOUSACTSGOVERNINGCONTRACTS (9)

Contract Administration and Payments-Contract Administration,Payments;Contract Management in Various Situations- Contract Management in NCB Works, Contract

Management in ICB Works Contracts,Contract of Supply of Goods-Design,Supply and Installation Contracts,Contract Management in Consultancy,

UNITIV: BIDPROCESS AND BIDE VALUATION (9)

Bidprocess,important points inatenderdocument,andunbalancedcontracts.Materialcovered includes: Request For Proposal and problems Different types of proposals Design Conditionsand Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

UNITV:MANAGING RISKS AND CHANGE (9)

Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution,Integrity in Contract Management;Managing Performance-Introduction,Monitoring and Measurement.

SUGGESTED READINGS:

1. R.K. Rajput,EngineeringMaterials, S. Chand&CompanyLtd., 2000.
2. M.S.Shetty,ConcreteTechnology(TheoryandPractice),S.Chand &CompanyLtd.,2003.
3. SustainableConstruction:GreenBuildingDesignandDelivery.ThirdEdition,Ch arlesJ.Kibert,NewYork:JohnWiley&Sons,2012.
4. WorkingTowardSustainability:EthicalDecisionMaking inaTechnologicalWorld,CJKibertetal,NewYork:JohnWiley&Sons,2011.
5. Varghese,P.C.,"BuildingConstruction",PrenticeHallIndia,2007.
6. NationalBuildingCode, BureauofIndianStandards, NewDelhi,2017.
7. Chudley,R.,ConstructionTechnology,ELBSPublishers,2007.
8. Peurifoy,R.L.ConstructionPlanning,MethodsandEquipment,McGrawHill,2011
9. Nunnally,S.W.ConstructionMethodsandManagement,PrenticeHall,2006
10. Jha,KumarNeeraj.,ConstructionProjectmanagement,Theory&Practice,PearsonEducati onIndia,2015
11. Punmia, B.C., Khandelwal, K.K., Project Planning With PERT and CPM,Laxmi Publications, 2016.

Semester-

22BECEOE06 AIR AND NOISE POLLUTION AND CONTROL 3H-3C

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

End SemesterExam:3Hours

Course Objectives:

1. To impart knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends
2. To induce operational considerations under the processing and control monitoring.
3. To apply sampling techniques of gaseous contaminants.
4. To control noise pollution by specific measurements, standard and preventive measures.
5. To enable to evaluate the behavior of air pollutants.
6. To have knowledge about appropriate control measures of air pollution

Course Outcomes(COs)

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

1. Have knowledge about appropriate control measures of air pollution.
2. To apply sampling techniques and suggest suitable air pollution prevention equipment's and techniques for various gaseous and particulate pollutants.
3. Have knowledge about the air pollution monitoring and modeling.
4. Understand causes of air pollution and Analyze different types of air pollutants.
5. Evaluate air pollutant behavior in the atmosphere.
6. Enable to evaluate the behavior of air pollutants.

UNITI:INTRODUCTION (9)

Structure and composition of Atmosphere–Sources and classification of airpollutants-Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of airPollutants on the atmosphere, Soil & Water bodies– Long- term effects on the planet– GlobalClimateChange,OzoneHoles–AmbientAirQualityandEmissionStandards– AirPollutionIndices-EmissionInventories.

UNITII: AIR POLLUTION MONITORING AND MODELLING (9)

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects ofmeteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles andstack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques – Air PollutionClimatology.

UNITIII: CONTROL OF PARTICULATE CONTAMINANTS (9)

Factors affecting Selection of Control Equipment–Gas Particle Interaction,–Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring –Costing of APC equipment–Case studies for stationary and mobile sources.

UNITIV:CONTROL OF GASEOUS CONTAMINANTS (9)

Factors affecting Selection of Control Equipment–Working principle,Design and performance equations of absorption ,Adsorption, condensation, Incineration, Bioscrubbers, Biofilters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment –Case studies for stationary and mobile sources.

UNITV: AUTOMOBILE AND NOISE POLLUTION (9)

Vehicular Pollution:Automobile emission-Types of emissions-Exhaust emissions,evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollutionandits control.

SUGGESTED READINGS

1. AnjaneyuluD,“Airpollutionandcontroltechnologies”,AlliedPublishers,Mumbai,2002.
2. KhitoliyaRK,“EnvironmentalPollution”,2/e,S.ChandPublishing,2012.
3. RaoC.S,“Environmentalpollutioncontrolengineering”,WileyEasternLtd.,NewDelhi,1996.
4. Rao M.N,andRaoH.V.N,“AirPollutionControl” Tata-McGraw-Hill,NewDelhi,1996.
5. DavidH.FLiu, BelaG.Liptak,“AirPollution”, LewisPublishers,2000.
6. Mudakavi,JR,“PrinciplesandPracticesofAirPollutionControlandAnalysis”IKInternational,2010.
7. AirPollutionact, India,1998.

22BECDOE01 INTRODUCTION TO 3D MODELLING AND ANIMATION 3H-3C

Instruction Hours/week: L:3T:0P: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 provide skills in 3D Modelling
- To gain knowledge in creating animation
- To practice with Max tool to design objects
- To understand the key features of design 3D models
- To understand the computer animation
- To understand the setting up of key frames and object properties.

Course Outcomes(COs)

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

1. Understand theComputer-based2D,3DAnimation& Getting Started with Max
2. Apply thekeyframesandcontrollerstodesign3D models
3. create the animation objects with simulation and effects
4. understand the Computer-based 4objects spline
5. create the animation objects with modeling with patches
6. apply and understand the basic animation technique

UNIT I **(9)**

Computer-based Animation-Definition of Computer-based Animation-Basic Types of Animation: Real Time - Non-real time -Definition of Modeling - Creation of 3D objects - 2D Splines & Shapes& compound object- Understanding 2D Splines & shape - Extrude & Bevel 2D object to 3D- Understanding Loft & terrain - Modeling simple 4 objects with splines.

UNIT II **(9)**

Modelling- Understanding morph- scatter- conform- connect compound objects- blobmesh- Boolean-Pro Boolean & procutter compound object. 3D Modelling -Modeling with Polygons- using the assets tracking- deforming surfaces & using the mesh modifiers- modeling with patches & NURBS

UNIT III **(9)**

Keyframe Animation -Creating Keyframes- Auto Keyframes- Move & Scale Keyframe on the timeline- Animating with constraints & simple controllers- animation Modifiers & complex controllers- function curves in the track view- motion mixer etc.

UNIT IV **(9)**

Simulation & Effects -Bind to Space Warp object- Gravity- wind- displace force object- deflectors- FFD space warp- wave- ripple- bomb- Creating particle system through parray-

understanding particle flow user interface- how to particle flow works- hair & fur modifier- cloth & garment maker modifiers etc. Getting Started with Max-Exploring the Max Interface- Controlling & Configuring the Viewports-

UNIT V **(9)**

Customizing the Max Interface & Setting Preferences-Working with Files- Importing & Exporting- Selecting Objects & Setting Object Properties- Duplicating Objects- Creating & Editing Standard Primitive & extended Primitives objects- Transforming objects- Pivoting- aligning etc.

SUGGESTED READINGS :

1. Lance Flavell Beginning Blender: Open Source 3D Modeling, Animation, and Game Design Apress 2010
2. Michael E. Mortenson 3D Modeling, Animation, and Rendering Create space 2010
3. Oliver Villa Learning Blender: A Hands- On Guide to Creating 3D Animated Characters"Addition Wesley Learning Second Edition 2014
4. Michael G.3D Modelling and Animation Igi Publishing 2011

WEBURLs:

1. www.web.iit.edu/sites/web/files/departments/academic-affairs/academic-resource-center /pdfs/3dsmax_interface.pdf
2. 2.www.dl.softgozar.com/Files/Ebook/3D_Animation_Essentials_Softgoza r.com.pdfwww. nptel.ac.in/courses/106/102/106102065/
3. www.tutorialspoint.com/3ds_max_for_beginners_3d_modeling_fundamentals/index.asp

22BECDOE02 DIGITAL PHOTOGRAPHY 3H-3C

Instruction Hours/week: L:3T:0P: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 understand the basics of film and photography techniques.
- To familiarize the concepts of image transportation in digital platforms.
- To impart knowledge in digital capture and digital camera.
- To enhance skills in scanning and image editing.
- To enhance capturing and scanning skills
- To describe the concepts of digital manipulation and digital output.

Course Outcomes(COs)

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

1. Define and explain the general function of digital photography,digital camera and image editing.
2. Apply the functional knowledge of photographic history and theory
3. Identify the relationship of photography to the visual disciplines, and its influence on culture.
4. Apply the functional knowledge of representation of images.
5. Working experimental and manipulative techniques, candid and contrived imagery
6. Work in experimental technique for documentary photography, archival processing,and inter pretive studies.

UNIT I (9)

Introduction to Digital Photography: Understanding film and paper photography - Learning about the digital revolution – Digital photography over film photography - Computers as photographic tools. Digital Basics: Raster and Vector method - Representation of digital image.

UNIT II (9)

Digital Platform: Hardware and System Software - Windows Operating System - Concept of Internet - Image transportation. Digital Capture: Digital Image formation - Capturing Method: Digital camera – Scanner – Frame grabber.

UNIT III (9)

Digital camera: Understanding how digital cameras work – Digital camera types: Floppy Disc type, Flash Card type, Hard Disc type – Overview of current digital cameras.

UNIT IV (9)

Scanning: Scanners as input devices- Working of a Scanner– Scanning procedure – Scanning resolution. Image editing: Image editing through image editing softwares like Adobe Photoshop – Adjustment of Brightness, Contrast, Tonal and Colour Values

UNITV (9)

Experimenting with Level and Curve. Image size – Resolution – Selection tools and techniques – History – Retouching tools – Layers – Photo mounting techniques – Incorporation of text into picture. Digital Manipulation - Digital Output.

SUGGESTED READINGS :

1. Scott Kelby The Digital Photography Book Pearson Education,Second Edition,2020
2. Tom Ang Digital Photography MasterclassDorling Kindersley Limited,First Edition 2013
3. Ken Browar The Art of Movement Running Press,First Edition 2016
4. Michelle BogrePhotography as Activism Images for Social Change Focal Press,First Edition 2012

WEBURLs:

1. www.photography.tutsplus.com/
2. www.cs.princeton.edu/courses/archive/fall13/cos429/lectures/02-imaging.pdf
3. www.format.com/magazine/resources/photography/still-life-photography-ideas-and- tips
4. www.deepmlblog.wordpress.com/2016/01/03/how-to-break-a-captcha-system/

22BECDOE03 MOBILE APPLICATION DEVELOPMENT 3H-3C

Instruction Hours/week: L:3T:0P: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 develop knowledge about mobile application development.
- To understand the building blocks of mobile apps.
- To gain knowledge about graphics and animations in mobile apps.
- To know about testing of mobile apps.
- To learn the advantages and limitations of development frameworks.
- To understand more about how to distribute apps on mobile market place.

Course Outcomes(COs)

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

1. Define, understand and explain the overview of android with its states and lifecycle.
2. Apply the mobile applications for e-marketing in Android and iPhone.
3. Analyze mobile databases and various types of testing.
4. Develop the simple android applications.
5. Evaluate alternative mobile frameworks, and contrast different programming platforms.
6. Implement the android applications in different field with modern tools.

UNIT I (9)

Introduction to Digital Photography: Understanding film and paper photography - Learning about the digital revolution – Digital photography over film photography - Computers as photographic tools. Digital Basics: Raster and Vector method - Representation of digital image. Mobility landscape – Mobile platforms – Mobile apps development – Overview of android platform – Setting up the mobile app development environment along with an emulator – A case study on mobile app development.

UNIT II (9)

App user interface designing – Mobile UI resources (Layout, UI elements, Draw- able, Menu) – Activity – States and life cycle – Interaction amongst activities – App functionality beyond user interface – Threads, async task, services – States and lifecycle, Notifications, Broadcast receivers.

UNIT III (9)

Telephony and SMS APIs – Native data handling – On-device file I/O – Shared preferences – Mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). Graphics and animation – Custom views – Canvas – Animation APIs – Multimedia – Audio/video playback and record – Location awareness and native hardware access (sensors such as accelerometer and gyroscope).

UNIT IV **(9)**

Debugging mobile apps – White box testing – Black box testing and test automation of mobile apps – JUnit for android, robotium and monkey talk. Versioning – Signing and packaging mobile apps – Distributing apps on mobile market place. Introduction to objective C – iOS features

UNIT V **(9)**

UI implementation – Touch frameworks – Location aware applications using core location and map kit – Integrating calendar and address book with social media application – Using WIFI – iPhone market place – Drawbacks on iOS over Android – Various stores available in online market – Configuration of mobile app – Online ecommerce transaction – E-booking transaction.

SUGGESTED READINGS

1. AnubhavPradhan and Anil V Deshpande, Composing Mobile Apps Wiley,First Edition 2020.
2. Barry Burd,Android Application Development All-in-one for Dummies, John Wiley, First Edition 2012

WEB URLs:

1. www.impetus.com/mobility
2. www.cise.ufl.edu/~helal/classes/f10/notes/intro_to_mobile.ppt
3. www.diva– portal.org/smash/get/diva2:626531/FULLTEXT01.pdf
4. www.law.fsu.edu/library/databases/ppt/Androidapps.ppt
5. www.infosys.com/flypp/resources/Documents/mobile-application-testing.pdf

22BECSOE01 INTERNET OF THINGS 3H-3C

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

End SemesterExam:3Hours

Course Objectives:

The goal of this course is for the students:

- To understand the basics of Internet of Things
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things
- To understand the concepts of Web of Things
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing
- To understand the IOT protocols

Course Outcomes(COs)

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

1. Identify and design the new models for various applications using IoT
2. Explain the underlying architectures and models in IoT.
3. Analyse different connectivity technologies for IoT.
4. Develops implement applications using Arduino/RaspberryPi.
5. Analyze and design different models for network dynamics
6. Apply data analytics techniques to IoT.
7. Study the needs and suggest appropriate solutions for Industrial applications.

UNITI ARCHITECTURESANDMODELS (9)

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer,Communications Network Layer, Applications and Analytics Layer – IoT Data Management andCompute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, SmartObjects, Sensor networks. Middleware for IoT: Overview – Communication middleware for IoT – IoTInformationSecurity

UNITII CONNECTIVITY (9)

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – ApplicationTransportMethods.

UNITIII SYSTEM DEVELOPMENT (9)

Design Methodology – Case study – Basic blocks of IoT Interfaces, Linux, Setting up, Programming–Arduino–Other IoT Devices.Device – Raspberry Pi

Board,

UNIT IV DATA ANALYTICS AND IOT SECURITY (9)

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics –Network Analytics Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

UNITV IOT IN INDUSTRY (9)

Manufacturing, Architecture, Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, Usecases– Transportation,Architecture,Usecases.

TEXTBOOKS:

1. HonboZhou,TheInternetofThingsintheCloud:AMiddlewarePerspective,CRCPress,2013
2. Dieter Uckelmann; Mark Harrison,Florian Michahelles,Architecting the Internetof Things,Springer,2011
3.DavidEasleyandJonKleinberg,Networks,Crowds,andMarkets:ReasoningAboutaHighlyConnectedWorld,Cambridge UniversityPress-2010
3. OlivierHersent,OmarElloumiandDavidBoswarthick,TheInternetofThings:Applicationstothe SmartGridandBuildingAutomation,Wiley-2012
4. OlivierHersent,DavidBoswarthick,OmarElloumi,TheInternetofThings– KeyapplicationsandProtocols,Wiley,2012

WEBSITES:

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lec1.pdf
2. https://nptel.ac.in/courses/106105166/
3. https://nptel.ac.in/courses/108108098/

22BECSOE02 MACHINE LEARNING 3H-3C

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

End SemesterExam:3Hours

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(COs)

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

1. Distinguish between, supervised, unsupervised and semi-supervised learning
2. Apply the appropriate machine learning strategy for any given problem
3. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
4. Design systems that uses the appropriate graph models of machine learning
5. Modify existing machine learning algorithms to improve classification accuracy / efficiency
6. 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

SUGGESTED READINGS :

1. Michael Bowles, "Machine Learning in Python-Essential Techniques for Predictive Analysis", Second Edition, 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
4. EthemAlpaydin,"Introduction to Machine Learning",3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press,2014
5. Tom M Mitchell,"MachineLearning",FirstEdition,McGrawHillEducation, 2013.
6. 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/

22BECSOE03 BLOCK CHAIN TECHNOLOGIES 3H-3C

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

End SemesterExam:3Hours

Course Objectives:

The goal of this course is for the students to:

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work
- To securely interact with them
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their projects.
- Introduce application areas, current practices, and research activity

Course Outcomes(COs)

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

1. Understand the design principles of Bitcoin and Ethereum.
2. Understand the Nakamoto consensus.
3. Understand the Simplified Payment Verification protocol.
4. List and describe differences between proof-of-work and proof-of-stake consensus.
5. Interact with a blockchain system by sending and reading transactions.
6. Design, build and deploy a distributed application.
7. Evaluate the security, privacy, and efficiency of a given blockchain system.

UNIT I: BASICS (9)

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. **Cryptography:** Hash function, Digital Signature - ECDSA(Elliptic Curve Digital Signature Algorithm), Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II: BLOCKCHAIN (9)

Introduction, Advantage over the conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III: DISTRIBUTED CONSENSUS (9)

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization, and alternate.

UNIT IV: CRYPTOCURRENCY (9)

History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO(Decentralized Autonomous Organization), Smart Contract, GHOST(Greedy Heaviest Observed Subtree), Vulnerability, Attacks, Sidechain, Namecoin

UNIT V: CRYPTOCURRENCY REGULATION (9)

Stakeholders, Roots of Bitcoin, Legal Aspects-Crypto currency Exchange, Black Market, and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Tutorial & Practical: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

SUGGESTED READINGS :

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (2016).
2. 2.Andreas M.Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain" O'Reilly, Media;2 edition(2017).
3. Andreas M. Antonopoulos,Gavin Wood "Mastering Ethereum: Building Smart Contracts and DApps" O'Reilly Media; 1 edition (13 November 2018).
4. Don Tapscott, Alex Tapscott "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies" Penguin; 01 edition (10 May 2016)
5. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
6. Dr.Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger", Yellow paper.2014.
7. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

WEBSITES:

1. https://swayam.gov.in/nd1_noc20_cs01/preview.
2. https://hyperledger.github.io/composer/latest/introduction/introduction.html.
3. https://ethereumbuilders.gitbooks.io/guide/content/en/index.html.

22BEECOE01 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(COs)

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

1. Understand the basic concepts of neural networks and its applications in various domains
2. Gain knowledge about learning process in Neural Networks
3. Design using Adaptive Resonance Theory (ART) technique
4. Describe steps in annealing process
5. Acquire knowledge on SOM concepts

UNITI INTRODUCTION TO NEURAL NETWORKS (9)

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 (9)

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCEPTION (9)

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 (9)

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 (9)

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. SatishKumarNeural Networks: A Classroom Approach TMH 2008
3. Rajasekaran.S, VijayalakshmiPai.G.A Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and Applications PHI, New Delhi 2003.
4. LaureneFausettFundamentals of Neural Networks: Architectures, Algorithms, and Applications Pearson/Prentice Hall 1994
5. Wasserman P.DNeural Computing Theory & PracticeVan Nortrand Reinhold1989.
6. Freeman J.A, S kapura D.M Neural networks, algorithms, applications, and programming techniques AdditionWesley2005.

Web links

1. https://nptel.ac.in/courses/117105084/
2. https://www.geeksforgeeks.org/adaptive-resonance-theory-art/

22BEECOE02 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 launchingof satellite
- To study the concept of radar communication

Course Outcomes(COs)

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

1. Understand past, present and future trends in mobile communication.
2. Explain how uplink and downlink is done in mobile phone
3. Distingiush various standards in use for wireless communication
4. Demonstrate some basic application of GPS.
5. Appreciate launching mechanism of satellite
6. Gain knowledge about RADAR working and its applications

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION (9)

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 (9)

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 (9)

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 (9)

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 (9)

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.

22BTFTOE01 PROCESSING OF FOOD MATERIALS 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,

- Explain the milling, extraction and manufacture of tremendous products from cereals,pulses and oilseeds
- Summarize the production and processing methods of fruits andvegetables
- Discuss the chemical composition, processing, production, spoilage and quality of milk and milkproducts
- Outline the overall processes involved in the production of meat, poultry and fishproducts
- Review the production and processing methods of plantation and spiceproducts

Course Outcomes(COs)

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

1. Discuss the basics of food processing.
2. Demonstrate the various processing technologies involved in fruits and vegetables,dairy, cereals, meat, fish, egg and plantation products.
3. Infer the basics on microbiology of food products.
4. Describe the process of manufacture of various food products.
5. Recognize various methods of preservation of food.
6. Express the possible arena of entrepreneurial activity related to food products.

Unit I - CEREAL, PULSES AND OIL SEEDS TECHNOLOGY (9)

Rice milling, Pulse milling, Wheat milling – Recent trends in milling process- Oil extraction – different methods in oil extraction - Methods of manufacture ofBread - differentprocessesofmanufacture-typesofbreads-buns,biscuits,cakesandcookies-Pastaproducts - Tortilla - Method of manufacture.

Unit II - FRUITS AND VEGETABLE PROCESSING (9)

Production of Fruits and vegetables in India, Maturity standards, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing- Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates.

Unit III - DAIRY PROCESSING (9)

Basicdairyterminology,composition,Generaltestsatreception,DairyProcessing-Methodof manufacture of Standardized, toned and double toned milk, milk powder - Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Icecream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage ofmilk – Major pathogens, Plant construction, Sanitation management, Cleaning equipment.

Unit IV - MEAT, POULTRY AND FISH PROCESSING (9)

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Common pathogens, Sanitation management, Sanitizers for meat & poultry plants, Fish and other Marine Products Processing, Sources of sea food contamination.

Unit V - PLANTATION PRODUCT TECHNOLOGY (9)

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric. By products from plantation crops and spices.

SUGGESTED READINGS:

1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles andPractices. International Book Distributing Co. Lucknow. 3rd Edition.2010.
2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post- harvest Technology: Marcel Dekker Press. USA. 1st Edition.2003.
3. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi.23rd impression.2016.
4. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.

22BTFTOE02 NUTRITION AND DIETETICS 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 explain the basic concepts of food and nutrition.
- To define the overall classification, function, and source of carbohydrates, lipids and proteins.
- To recite the availability, source, deficiency and physiological role of fat- and water-soluble vitamins.
- To outline the role of health and nutritional importance of micro and macrominerals.
- To discuss the recent trends and developments innutrition.

Course Outcomes(COs)

Upon successful completion of this, students will be able to

1. Recognize the basics in the area of nutritional assessment in health and disease
2. Evaluate the biological functions of various macromolecules in terms of food and health.
3. Select the balanced diet for healthy life to avoid or prevent the deficiencydisorders.
4. Choose an appropriate diet, products that prevent vitamin deficiencydisorders.
5. Identify the proper foods rich in minerals to live a healthylife.
6. Design the diet with the recent concepts of human nutrition to prevent / treat thedreadful diseases.

UNIT I - HUMAN NUTRITION (9)

Six classes of nutrients - Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality - Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II - BIOMOLECULES (9)

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Properties of fats and oils, Refined & Hydrogenated fats process. Proteins - Definitions, Classification, Function, Amino Acids, Sources of Proteins, Texturized proteins.

UNIT III - VITAMINS (9)

Physiological role, bio-availability, requirements, sources and deficiency of Fat-Soluble Vitamins:VitaminA,VitaminD,E&K.*f*Watersolublevitamins:VitaminC,Thiamine,Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12,VitaminB6. Stability under different food processing conditions.

UNIT IV – MINERALS AND WATER (9)

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride - Chemistry and physical properties of free, bounded and entrapped water, water activity, quality parameters of drinking and mineral water.

UNIT V - RECENT TRENDS IN NUTRITION (9)

Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods Health foods and novel foods, organically grown foods, personalized nutrition, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

SUGGESTED READINGS:

1. SunetraRoday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018. (ISBN-13:9780199489084)
2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1st Edition, 2017. (ISBN:9780128052570)
3. Ashley Martin. Nutrition and Dietetics. Syrawood Publishing House. 1st Edition, 2016. (ISBN:9781682860588)
4. Robert E. C. Wildman. Handbook of Nutraceuticals and Functional Foods. CRC Press, 2nd Edition, 2016. (ISBN-10:9781498770637)
5. Srilakshmi.B.NutritionScience.NewAgeInternationalPvt.Ltd,Publishers.6thEdition.2017. (ISBN-13:9789386418883)

22BTFTOE03 READY TO EAT FOODS 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,

- Outline the current status of snack foodIndustry
- Describe the production, processing and marketing trends of potato and tortillachips
- Outline the overall processing ofpopcorn
- Explain the production and processing of fruits involved in snack foodpreparation
- Summarize the sensory analysis methods and packaging techniques of snackfoods

Course Outcomes(COs)

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

1. List the various manufacturing process in snack foodindustries
2. Acquire knowledge about current production and marketing status of Snackfoods
3. Elucidate the advantages of SensoryEvaluation
4. Packaging technologies in Snack FoodIndustries
5. Demonstrate the equipments involved in the snack productionprocesses
6. Use flavorings in the popcornindustries

UNIT I- INTRODUCTION TO SNACK FOODS (9)

Introduction- Types – processing methods - Nutrition- Quality and standards for snack foods - GHP and GMP for snack food industries - Outline of snack food industry - Domestic Snack Food Market-Global Market.

UNIT II-POTATO AND TORTILLA CHIPS PROCESSING (9)

Potato Production- selection and grading of potato - Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials- Processing steps-Equipment involved-Reconstitution of Dry Maize Flour-Unit operations - Nutritional properties of potato and tortilla chips.

UNIT III-POPCORN PROCESSING (9)

Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipments-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

UNIT IV-FRUIT BASED SNACKS (9)

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits – Nutritions and health benefits of fruit snacks.

UNIT V SENSORY EVALUATION AND PACKAGING (9)

Introduction- importance of sensory evaluation – Analytical methods-Sensory methods-Sensory Aspect of Processing- Limitations of sensory evaluation- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing-Labelling requirements - Current Issues in Snack Foods Packaging

SUGGESTED READINGS:

1. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Instituteof Industrial Research, Delhi. 2nd Edition 2013.
3. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys BooksLtd. 2008.
4. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition2001.
5. Panda, H. The Complete Technology Book on Snack Foods, National Instituteof Industrial Research, Delhi. 2nd Edition 2013.
6. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys BooksLtd. 2008.

22BTFTOE04 AGRICULTURAL WASTE AND BYPRODUCTS UTILIZATION 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 categorize the types of agricultural wastes
- To outline the production and utilization of biomass
- To explain the various parameters considered to be important in the designing of biogas units
- To discuss the methods employed in the production of alcohol from agricultural wastes/ byproducts
- To summarize the overall aspects involved in the production of paperboards and particleboards from agriculturalwastes

Course Outcomes(COs)

Upon successful completion of this, students will be able to,

1. List and classify the types of agricultural wastes
2. Collect and generate number of value added products from agriculturalwastes
3. Recall the techniques involved in the production and utilization of biomass
4. Assess the various parameters considered to be important in the designing of biogas units
5. Illustrate the various methods employed in the production of alcohol from the byproductsof agriculturalwastes
6. Choose the appropriate materials to produce paperboards and particleboards from agricultural wastes

UNIT I-TYPES OF AGRICULTURAL WASTES (9)

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, properties of agricultural waste- storage and handling - rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II-BIOMASS PRODUCTION AND UTILIZATION (9)

Biomass– types– production and utilization Technologyusedfortheutilizationofagriculturalwastes:BiomassGasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat andSteam from Sugarcane Leaf andBagasse.

UNIT III -BIOGAS DESIGN AND PRODUCTION (9)

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogasplant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe),

Selection and Design of biogasplant.

UNIT IV -PRODUCTION OF ALCOHOL FROM WASTE MATERIALS (9)

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNITV-PRODUCTION OF PAPERBOARD AND PARTICLEBOARDS FROM AGRICULTURALWASTE

Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps-Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

SUGGESTED READINGS:

1.EfthymiaAlexopoulou. Bioenergy and Biomass from Industrial Crops on Marginal Lands. Elsevier, 1st Edition, 2020. (ISBN:9780128188644).

2.NavanethaKrishnarajRathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1st Edition, 2019. (ISBN:9780128179529).

3.SimonaCiuta,DemetraTsiamis,MarcoJ.Castaldi.GasificationofWasteMaterials.Academic Press, 1st Edition, 2017. (ISBN:9780128127162).

4.Nicholas E. Korres, Padraig O'Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1st Edition, 2013. (ISBN-13:9780415698405).

5.Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1st Edition, 2011. (ISBN-13:9781849025.

22BTFTOE05 DESIGN OF FOODPROCESSEQUIPMENT 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 is for students to,

•Emphasis the types of materials used in the food processing equipments.

•Discuss about the materials and designing of different storage vessel.

•Explain the importance of reaction vessel and their deskining techniques.

•Explain the materials and designing of heat exchanger and evaporators.

•Discuss the importance of dryers in food processing industries.

Course Outcomes(COs)

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

1.Point out the materials suitable for the construction of equipments.

2.List out the vessels used for the food storage.

3.Categorize the different types of reaction vessel used for different purposes.

4.Understand the importance of heat exchanger in the designing of food processing equipments.

5.Understand the significance of dryers in food processing.

6.Understand the basic for design and develop equipments used in food Processing operations.

Togaintechnicalknow-howaboutthematerialrequirementsanddesignofvariousequipments needed in Foodindustries.

Unit I - MATERIALS (9)

Metals and non-metals, design of pressure vessels – cylindrical shell –internal and external pressure - under continued loadings. Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes Numerical problem and design of pressure vessel.

Unit II - STORAGE VESSELS (9)

Design of storage vessels – Rectangular Tank without stiffeners –with stiffeners – shell design – Numerical problem and design. Design of agitators and baffles. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;

Unit III - REACTION VESSELS (9)

Design of Reaction vessels – materials -classification – jackets-Design of vessel shell with half coil – Design of vessel shell with jacket – Numerical problem and design. Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

Unit IV - HEAT EXCHANGERS (9)

Design of Heat exchangers – types – materials – Design pressure and temperature- shell design – tubes - Numerical problem. -Design of Equipment. Evaporator: Materials of concentration – types –design- consideration – Design of agitators – power requirements – Design based on

Torque – criticalspeed.

Unit V – DRYERS **(9)**

Types - General considerations – Design of Tray dryer, Rotary Dryer, fluidized bed dryer, spray dryer, vacuum dryer, microwave dryer – Material Balance, Thermal energy Requirements , electrical energy Requirements, Performance Indices

SUGGESTED READINGS:

1. Maroulis Z.B. and Saravacos G.D. Food Process Design, Marcel Dekker Inc. ISBN- 0824743113,2003.
2. Joshi M.V, "Process Equipment Design", Macmillan IndiaLtd.,1985
3. Coulson ,J.M. and Richardson, J. F,"Chemical Engineering " Butterworth-Heinemnn Elsevier, ISBN-0750644451,2002

22BEMEOE01 COMPUTER AIDED 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

- To apply basic concepts to develop construction(drawing)techniques.
- To ability to manipulate drawings through editing and plotting techniques.
- To understand geometric construction and Produce template drawings.
- To understand and demonstrate dimensioning concepts and techniques.
- To understand Section and Auxiliary Views.
- To become familiar with Solid Modelling concepts and techniques.

Course Outcomes(COs)

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

1. Apply basic concepts to develop construction (drawing) techniques.
2. Ability to manipulate drawings through editing and plotting techniques.
3. Understand geometric construction and Produce template drawings.
4. Understand and demonstrate dimensioning concepts and techniques
5. Understand Section and Auxiliary Views
6. Become familiar with Solid Modelling concepts and techniques.

UNIT I OVERVIEW OF CAD SYSTEMS (9)

Conventional and computer aided design processes-advantages and disadvantages. Subsystems of CAD CAD hardware and software, analytical and graphics packages, CAD work stations. Networking of CAD systems.

UNIT II INTERACTIVE COMPUTER GRAPHICS AND GRAPHICS TRANSFORMATIONS (9)

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives- display transformation in Two- and Three Dimensional graphics concepts,Graphical input technique,Geometric transformations,Visual Realism,Computer animation, customizing graphics software

UNIT III GEOMETRIC MODELING (9)

Wireframe,surface,NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, Boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation (B-rep) Constructive Solid Geometry(CSG) and Analytical Solid Modeling (ASM)

UNITIV PARAMETRIC DESIGN AND OBJECT REPRESENTATION (9)

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric representation of analytic and synthetic curves. Parametric representation of surfaces and solids-

manipulations.

UNITV PRODUCT DESIGN AND DEVELOPMENT (9)

Automated 2D drafting - basics, mating conditions – Types of translators (IGES, STEP, ACIS and DXF). Mass property calculations.

SUGGESTED READINGS

1. Vera B Anand, Computer Graphics and Geometric Modeling for Engineers,1st edition, John Wiley & Sons,NewYork, 2000
2. Radhakrishnan P and Subramanyan S,CAD/CAM/CIM,2ndedition,NewAgeInternationalPvt.Ltd,2008
3.IbrahimZeid,CAD/CAMTheoryandPractice,2ndedition,McGrawHill Inc.,NewYork,2009
4.BarryHawhes,The CAD/CAMProcess,1stedition,PitmanPublishing,London,2007(digital)
5. William M Newman and Robert Sproul, Principles of Interactive Computer Graphics,1stedition,McGrawHill Inc., New York,2001
6. RaoSS,OptimizationTechniques,1stedition,WileyEastern,New Delhi,2006.

22BEMEOE02 INDUSTRIAL SAFETY AND ENVIRONMENT 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

1. To recognize and evaluate occupational safety and health hazards in the workplace.
2. To determine appropriate hazard controls following the hierarchy of controls.
3. To analyses the effects of workplace exposures,injuries and illnesses,fatalities.
4. To prevent incidents using the hierarchy of controls,effective safety and health management systems and task- oriented training.
5. To teach student the concept of Industrial Safety &provide useful practical knowledge for work place safety.
6. To prevent or mitigate harm or damage to people,property,or the environment.

Course Outcomes(COs)

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

1. Recognize and evaluate occupational safety and health hazards in the workplace.
2. Determine appropriate hazard controls following the hierarchy of controls.
3. Analyze the effects of workplace exposures,injuries and illnesses,fatalities.
4. Prevent incidents using the hierarchy of controls, effective safety and health management systems and task- oriented training.
5. Understand the concept of Industrial Safety &provide useful practical knowledge for work place safety.
6. Prevent or mitigate harmor damage to people,property,ortheenvironment.

UNIT I CONCEPTS (9)

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee-budgeting for safety.

UNIT II TECHNIQUES (9)

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection,safety sampling, Safety Audit.

UNIT III ACCIDENTINVESTIGATIONANDREPORTING (9)

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accidentprevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process

Response to accidents,India reporting requirement,Planning document,Planning matrix,Investigators Kit,functions of investigator,fourtypesofevidences,Recordsofaccidents,accidentreports

UNIT IV SAFETYPERFORMANCEMONITORING (9)

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities,temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severityincidence,incidentrate,accidentrate,safety“t” score,safetyactivityrate– problems.

UNIT V SAFETYEDUCATIONANDTRAINING (9)

Importance of training-identification of training needs-training methods – programme, seminars, conferences,competitions – method of promoting safe practice - motivation – communication - role of government agenciesand private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters,safetydisplays,safetypledge,safetyincentivescheme,safetycampaign– DomesticSafetyandTraining.

SUGGESTED READINGS

1. AccidentPreventionManualforIndustrialOperations,3rdedition,N.S.C.Chicago,2010(digital).
2. Heinrich H.W. “Industrial Accident Prevention”, 2ndedition, Tata McGraw-Hill Company, NewYork, 1941.
3. KrishnanN.V,Safety Management in Industry, 1stedition,Jaico Publishing House, Bombay,1997.
4. JohnRRidley,SafetyatWork,3rdedition,Elsevier,2014
5. RolandP.Blake,IndustrialSafety,2ndedition,PrenticeHall,Inc.,NewJersey,1973
6. LMDeshmukh,Industrialsafetymanagement,1stedition,TATAMcGrawHill,2005.

22BEMEOE03 NON-DESTRUCTIVE TESTING 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 main objectives of this course are to introduce the concept of non-destructive testing among the students and make them understand various types of non-traditional practices available for manufacturing industry.
- To provide in-depth knowledge on various techniques of non-destructive testing.
- To provide an overview of destructive and non-destructive tests and state their applications
- To study the features of NDT techniques for various products and to understand the established NDE techniques and basic familiarity of emerging NDE techniques.
- To expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs.
- To facilitate the understanding of standard application area of NDET

Course Outcomes(COs)

Student will be able to

1. Understand the codes, standards and specifications related to NDT.
2. Classify the destructive and non-destructive tests and state their applications.
3. Develop NDT techniques for various products.
4. Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
5. Acquire sound knowledge of established NDE techniques and basic familiarity of emerging NDE techniques.
6. Make use of standards application area of NDET

UNIT I INTRODUCTION (9)

Properties of Engineering Materials – Types of Defects – Surface and Sub-Surface of a component – Characteristics of Ferrous, Non-ferrous and Alloys. Classification of Destructive testing and Non-Destructive testing – Uses and applications. Codes, Standards and Specifications of NDT (ASME, ASTM, AWS etc.). Importance and Scope of NDT, Non-destructive testing methods

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION (9)

Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - Apparatus required for LPT - An Illustration of Penetrant Testing, Application, Advantages and Disadvantages of Penetrants Testing.

Introduction to Magnetic Particle Inspection – MPT equipments and devices - An Illustration of Magnetic Particle Inspection, Application, Advantages and Disadvantages of Magnetic Particle Crack Detection.

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION (9)

Introduction to Ultrasonic Flaw Detection, UT equipments and devices, An Illustration of Ultrasonic Flaw Detection, Application, Advantages and Disadvantages of Ultrasonic Flaw Detection. Principle of Radiography Inspection, RT equipments and devices Radiation sources, uses of x-rays and gamma rays Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety from Radiation.

UNIT IV EDDY CURRENT TESTING AND VISUAL TESTING METHODS (9)

Introduction to Eddy Current Testing. ECT equipments and devices, An Illustration of Eddy Current Testing Equipment, Application, Advantages and Disadvantages of Eddy Current Testing. Introduction to visual testing method, Equipments required for VT - An Illustration of visual testing method, Application, Advantages and Disadvantages of visual testing method.

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS (9)

Inspection of Raw Products, Inspection for In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Automobile component Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

SUGGESTED READINGS

1.Sadashiva.M – Non - Destructive Testing Paperback – 15 July 2021.
2.Ramachandran.S and Anderson.A - Non-Destructive Testing – Kindle Edition - 2018
3.J. Prasad and C. G. Krishnadas Nair - Non-Destructive Test and Evaluation of Materials Hardcover – 1 July 2017.
4.Lari and Kumar - Basics of Non - Destructive Testing Paperback – 1 January 2013.
5.Ravi Prakash – Non - Destructive Testing Techniques Hardcover – 1 January 2010.
6.Louis Cartz - Non - destructive Testing - 1st Edition, ASM International, Almere, Netherland, 2007(digital).

COURSES OFFERED TO OTHER DEPARTMENT

ELECTRICAL AND ELECTRONICS ENGINEERING

B.E Electrical and Electronics Engineering **2022-2023**

22BEEEOE01 ELECTRIC HYBRID VEHICLE 3H-3C

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

Course Objectives

- To understand the basic concepts of electric hybrid vehicle.
- To gain the knowledge about electric propulsion unit.
- To know the concept of Hybrid Electric Drive-Trains.
- To gain the knowledge about different Energy Management Strategies.
- To study about the efficiency manipulation in drives.
- To understand and gain the knowledge about various energy storage devices.

Course Outcomes:

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

1. Summarize the history and environmental importance of hybrid and electric vehicles.
2. Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.
3. Analyze the different motor drives used in Hybrid Electric Vehicles.
4. Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
5. Compare the different Energy Storage devices.
6. Identify the different Energy Management Strategies.

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 Standards media – 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.

Web Links

1.https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics
2.https://swayam.gov.in/nd1_noc20_ee18/preview
3.https://nptel.ac.in/courses/108103009/

21BEEEOE02 RENEWABLE ENERGY RESOURCES 3H-3C

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

Course Objectives

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
- To study about solar energy collectors and its storages
- To study about the inter connected system in wind power
- To understand the basic principles fuel cell, Geo thermal power plants.
- To gain the knowledge about hydro energy.

Course Outcomes

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

1. Summarize the Energy Scenario in India.
2. Identify the various applications in solar energy.
3. Compare the different types of wind machines.
4. Understand the concept of Hydro Energy.
5. Acquire knowledge about the ocean energy.
6. Explain 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 2001.

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.

Web Links

1. https://nptel.ac.in/courses/103/107/103107157/
2. https://nptel.ac.in/courses/121/106/121106014/
3. https://nptel.ac.in/courses/108/108/108108078/