

**B.E. ELECTRICAL AND ELECTRONICS  
ENGINEERING  
CURRICULUM & SYLLABI 2023  
(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)**

**Pollachi Main Road, Eachanari Post,  
Coimbatore- 641 021, India.**

**FACULTY OF ENGINEERING**

**DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY**

**REGULAR PROGRAMME**

**REGULATIONS 2023**

**CHOICE BASED CREDIT SYSTEM**

**These regulations are effective from the academic year 2023 – 2024 and applicable to the candidates admitted to B. E. / B. Tech. during 2023 - 2024 and onwards.**

**1. ADMISSION**

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

Should have passed the Higher Secondary Examination (10+2) 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)

**1.2 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 3<sup>rd</sup> and 4<sup>th</sup> 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.**

S. No.	Programme	Eligibility criteria
1.	B.E Bio Medical Engineering	<p>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.</p> <p><b>OR</b></p> <p>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.</p> <p><b>OR</b></p> <p>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)</p>
2	B. E. Civil Engineering	
3.	B. E. Computer Science and Engineering	
4.	B. E. Computer Science and Engineering (Cyber security)	
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	

### 1.3 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 Engineering
4. B. E. Computer Science and Engineering (Cyber Security)
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**

### **3.1 Full-Time:**

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

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

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

## **4. STRUCTURE OF PROGRAMMES**

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

- (i) General core courses comprising Mathematics, Basic Sciences, Engineering Sciences and Humanities.
- (ii) Core courses 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, project work, industrial visits, camps, etc.

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

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

## (V) Choice Based Credit System

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 availability of physical facilities, classroom availability and lab capacity. Registration of already requested courses by students in previous semester is not allowed.

**4.2** 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 weeks of field project/internship training during semester vacations	1

**4.3** In every semester, the curriculum shall normally have a blend of theory courses not exceeding 6 and practical courses not exceeding 4. However, the total number of courses per semester shall not exceed 9.

**4.4** 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

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

## 4.6 Value Added Course

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

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

## 5. DURATION OF THE PROGRAMME

**5.1** The prescribed duration of the programme shall be

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

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

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

## 6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

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

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

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

## **7. CLASS ADVISOR**

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

## **8. CLASS COMMITTEE**

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

- Clarifying the regulations of the degree programme and the details of rules therein particularly Clause 4 and 5 which should be displayed on Department Notice-Board.
- Informing the student representatives, the details of Regulations regarding 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.

**8.2** The class committee for a class under a particular branch is normally constituted by the Head of 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.

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

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

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

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

Management, the same shall be brought to the notice of the Registrar by the HOD through Dean.

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

## **9. COURSE COMMITTEE FOR COMMON COURSES**

Each common theory course offered to more than one discipline or group, shall have a “Course Committee” comprising all the teachers handling the common course with one of the 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**

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

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

### **THEORY COURSES:**

<b>S. No.</b>	<b>CATEGORY</b>	<b>MAXIMUM MARKS</b>
1.	Assignment	5
2.	Seminar *	5
3.	Attendance	5
4.	Test – I	8
5.	Test – II	8
6.	Test – III	9
<b>Continuous Internal Assessment: TOTAL</b>		<b>40</b>

\*Evaluation shall be made by a committee.



**PATTERN OF TEST QUESTION PAPER (Test I & II)**

INSTRUCTION	REMARKS
<b>Maximum Marks</b>	60
<b>Duration</b>	2 Hours
<b>Part- A</b>	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).
<b>Part- B</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
<b>Maximum Marks</b>	100
<b>Duration</b>	3 Hours
<b>Part - A</b>	Part A will be online Examination. 20 Objective type Questions, Covering all the 5 units. (20 x 1= 20 Marks) (Online Examination).
<b>Part- B</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).
<b>Part- C</b>	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
<b>Continuous Internal Assessment: TOTAL</b>		40

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

### **INTEGRATED THEORY AND PRACTICAL COURSES:**

The Continuous Internal Assessment for Integrated Theory and Practical Course is awarded for 40 Marks with mark split up similar to regular theory course. But Assignment and Seminar components are replaced by Observation and Record marks.

<b>S.No.</b>	<b>CATEGORY</b>	<b>MAXIMUM MARKS</b>
1.	Observation	5
2.	Record	5
3.	Attendance	5
4.	Test –I	8
5.	Test –II	8
6.	Test–III	9
<b>Continuous Internal Assessment :TOTAL</b>		<b>40</b>

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

### **10.3 ATTENDANCE**

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

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

### **10.4 PROJECT WORK/ INTERNSHIPS:**

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

### **10.5 CERTIFICATION COURSES:**

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

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

A candidate shall normally be permitted to appear for the ESE of any semester commencing from I semester if he/she has satisfied the semester completion requirements (Subject to Clause 5) and has registered for Examination in all courses of the semester. Registration is mandatory for Semester Examinations as well as arrear Examinations failing which the candidate will not be permitted to attend the next semester. A candidate already appeared for a subject in a semester and passed the Examination is not entitled to reappear in the same subject of the semester for improvement of grade.

## 12. END SEMESTER EXAMINATION

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

### PATTERN OF ESE QUESTION PAPER:

INSTRUCTION	REMARKS
<b>Maximum Marks</b>	100
<b>Duration</b>	3 Hours
<b>Part - A</b>	Part A will be online Examination. 20 Objective type Questions. Covering all the 5 units. <b>20*1= 20 Marks (Online Examination)</b>
<b>Part- B</b>	21 to 25 Two Mark Questions, uniformly covering the Five units of the syllabus. All the 5 Questions are to be answered. <b>(5 *2= 10Marks).</b>
<b>Part- C</b>	Question 26 to 30 will be of either or type, covering Five units of the syllabus. Each Question may have subdivision. <b>(5*14=70 Marks)</b>

## 13. PASSING REQUIREMENTS

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

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

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

The CIA marks obtained by the candidate in his/her first or subsequent appearance where

he/she secures a pass shall be retained by the office of the Controller of Examinations and considered valid for all remaining attempts till the candidate secures a pass in his/her ESE.

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

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

#### **13.4 ONLINE COURSE(MOOC) COORDINATOR**

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

**13.4.1** 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**

**14.1** 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:

<b>Letter grade</b>	<b>Marks Range</b>	<b>Grade Point</b>	<b>Description</b>
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
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## 14.2 GRADE SHEET

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

- The list of courses enrolled during the semester and the grade scored,
- The Grade Point Average (**GPA**) for the semester and
- 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.

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

**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**.

## 14.3 REVALUATION

Revaluation and Re-totaling are allowed on representation. A candidate can apply for revaluation of his/her semester Examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Department and Dean. A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the Head of the Department and Dean. Revaluation is not permitted for Supplementary Examinations, Practical Examinations, Technical Seminars, In-plant Training and Project Work.

## 14.4 TRANSPARENCY AND GRIEVANCE COMMITTEE

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

## 15. ELIGIBILITY FOR AWARD OF DEGREE

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

- Successfully gained the required number of total credits as specified in the curriculum

corresponding to his/her programme within the stipulated time.

- No disciplinary action is pending against him/her.

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

## **16. CLASSIFICATION OF THE DEGREE AWARDED**

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

**16.2** A regular candidate or a lateral entrant is eligible to register for 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, if he / she fails in securing 20 additional credits but maintains CGPA of 7.5 and above is not eligible for Honors degree but eligible for First class with Distinction.

**16.3** A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses within the specified minimum number of semesters (vide Clause 5.1) plus one year (two semesters), securing CGPA of not less than **6.5** shall be declared to have passed the Examination in First Class.

**16.3** 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**

**17.1** 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.

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

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

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

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

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

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

## **18. PROVISION FOR AUTHORISED BREAK OF STUDY**

**18.1** Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed 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.

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

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

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

**18.5** If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Withdrawal' or 'Break of Study' (Clause 18 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.

## **23.KARPAGAM INNOVATION AND INCUBATION COUNCIL (KIIC)**

### **(A Section 8 Company)**

Based on the 2019 National Innovation and Startup Policy and the 2019–2023 Tamil Nadu Startup Policy, KIIC has recommended to the KAHE students who are affiliated with the KIIC that it be incorporated in the university Program Regulations 2023-24 and implement from this academic year.

### **23.1 Norms to Student Start-Ups**

- a) Any (UG/PG / (Ph.D.) Research scholars, student, right from the first year of their programme is allowed to set a startup (or) work part time/ full time in a startup or work as intern in a startup
- b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their programme is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation (case to case basis). Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC
- c) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.
- d) Students engaged in startups affiliated with the KIIC or those who work for them may be exempted from KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies Potential Students who have been incubated at KIIC may be permitted to take their University semester exams even if their attendance is below the minimum acceptable percentage, with the proper authorization from the head of the institution.  
(On case-to-case basis depends upon the applicability strength, societal benefits and quality of the Innovation and Subsequent engagement of the students with the/ her business)
- e) Any Students Innovators/entrepreneurs are allowed to opt their startup in place mini project /major project, /seminar and summer training etc. (In plant training, Internship, value added Course.). The area in which the student wishes to launch a Startup may be interdisciplinary or multidisciplinary.
- f) Student's startups are to be evaluated by Expert committee, formed by KIIC and KAHE.

### **23.2 Guide lines to award Credits/ Marks to a Student startup**

Student's startup stages are divided into five phases and these startup phases can be considered equally in place of the course title as mentioned below with the same credits allotted to the course title in a university curriculum.



<b>Sl. No.</b>	<b>Description/Startup phases</b>	<b>In place of the Subject / Course title</b>	<b>Grades/Credits /Marks</b>
<b>1</b>	<b>Idea stage/Problem Identification</b>	<b>Seminar</b>	<b>Same Marks/Credits can be awarded that are listed in the course title's curriculum for the respective startup phases.</b>
<b>2</b>	<b>Proof of Concept (POC) /Solution development</b>	<b>In-plant training /Internship</b>	
<b>3</b>	<b>Product Development (Lab scale) /Prototype Model/ Company Registered</b>	<b>Mini Project/ Value added Course</b>	
<b>4</b>	<b>Validation/Testing</b>	<b>Main Project phase I</b>	
<b>5</b>	<b>Business Model/Ready for Commercialization/Implementation</b>	<b>Main Project phase II</b>	

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS  
ENGINEERING  
FACULTY OF ENGINEERING  
UG PROGRAM (CBCS) – B.E –EEE (FULL TIME)  
(2023–2024 Batch and onwards)**

Course Code	Name of the course	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No	
			PO	PS O	L	T	P			CIA	ESE		Total
										40	60		100
SEMESTER I													
23BECC101	Professional Communicative English	HS	8,9,10,12	-	3	0	0	3	40	60	100	12	
23BECC102	Matrices and Calculus	BS	1,2,3,12	-	3	1	0	4	40	60	100	14	
23BECC103	Environmental Studies	BS	1,2,6,7,8,10,12	-	3	0	0	3	40	60	100	17	
23BEEE141	Physics for Electrical and Electronics Engineers	BS	1,2,9,10,12	-	4	0	2	5	40	60	100	20	
23BECC142	Programming in C	ES	1,2,3,4,9,10,12	2	4	0	2	5	40	60	100	23	
23BEEE111	Workshop Practices	ES	1,2,3,4 ,9,10,12	1	0	0	4	2	40	60	100	27	
23BEMC151	Design Thinking	MC	1,2,3,4,6,7,8,9,10,12	2	1	0	2	2	100	0	100	29	
23BEMC152	Sports and Yoga	MC	-	-	1	0	0	0	100	0	100	31	
23BEMC153	தமிழர் மரபும் பண்பாடும்	MC	-	-	1	0	0	0	100	0	100	33	
Semester Total					20	1	10	24	540	360	900		
SEMESTER II													
23BECC201A/ 23BECC201B / 23BECC201C	Graph Theory / Computational Methods for Engineers/Transforms and its Applications	BS	1,2,3,12	-	3	1	0	4	40	60	100	35/38/ 41	
23BEEE202	Electro Chemistry	BS	1,2,6,7,8,10,12	-	3	0	0	3	40	60	100	44	
23BEEE203	Fundamentals of Web Design	ES	1,2,3,4,5,9,10, 12	2	3	0	0	3	40	60	100	47	
23BEEE241	Electric Circuit Analysis	ES	1,2,3,4,8,9,10,12	1	3	1	2	5	40	60	100	50	
23BEEE242A/ 23BEEE242B	Data Structure and Algorithm /Object Oriented Programming with python	ES	1,2,3,4,9,10,12	2	4	0	2	5	40	60	100	53/56	
23BEEE211	Engineering Graphics	ES	1,2,3,4 8,10,12	1	2	0	2	3	40	60	100	59	
23BEMC251	Soft Skills	MC	-	-	1	0	0	0	100	0	100	62	
23BEMC252	Women Safety and Security	MC	-	-	1	0	0	0	100	0	100	63	
Semester Total					20	2	6	23	440	360	800		

Course Code	Name of the course	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No.
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER III												
23BEEE301A/23BEEE301B	Discrete Mathematics/Numerical Methods	BS	1,2,3,12	-	3	1	0	4	40	60	100	64/67
			1,2,3,12									
23BEEE302	Electrical Machines – I	PC	1,2,3,4,8,12	1.2	3	0	0	3	40	60	100	69
23BEEE303	Electromagnetic Field	PC	1,2,3,4,8,12	1	3	1	0	4	40	60	100	72
23BEEE341A/23BEEE341B	Java Programming/Object Oriented Programming	PC	1,2,3,4,8,9,10,12	2	3	0	2	4	40	60	100	75/78
23BEEE342	Electron Devices and Circuits	PC	1,2,3,4,8,9,12	1	3	0	2	4	40	60	100	81
23BEEE311	Electrical Machines Laboratory – I	PC	1,2,3,4,8,9,10,12	1,2	0	0	2	1	40	60	100	84
23BEMC351	Aptitude and Reasoning	MC	1,2,3,12	-	1	0	0	0	100	0	100	86
23BEMC352	Foreign Language	MC	-	-	1	0	0	0	100	0	100	88/89
23BEEE391	Field Project/Internship	PC	-	-	0	0	0	1	100	0	100	
Semester Total					17	2	6	21	540	360	900	
SEMESTER – IV												
23BEEE401A/23BEEE401B	Statistics and Optimization Techniques/Probability and Statistics	BS	1,2,3,12	-	3	1	0	4	40	60	100	90/93
			1,2,3,12	-								
23BEEE402	Electrical Machines – II	PC	1,2,3,4,8,12	1,2	3	0	0	3	40	60	100	96
23BEEE403	Linear Integrated Circuits	PC	1,2,3,4,8,12	1	3	0	0	3	40	60	100	98
23BEEE404	Digital Electronics	PC	1,2,3,4,8,12	1	3	0	0	3	40	60	100	100
23BEEE441	Measurements and Instrumentation	PC	1,2,3,4,6,8,10,12	1	3	0	2	4	40	60	100	103
23BEEE4E__	Program Elective - I	PE	-	-	3	0	0	3	40	60	100	
23BEEE411	Electrical Machines Laboratory-II	PC	1,2,3,4,8,9,10,12	1,2	0	0	2	1	40	60	100	106
23BEEE412	Analog and Digital Electronics Laboratory	PC	1,2,3,4,8,9,10,12	1,2	0	0	2	1	40	60	100	108
23BEMC451	Foundation of Entrepreneurship	MC	-	-	1	0	0	0	100	0	100	110
23BEMC452	Essence of Traditional Indian knowledge and Heritage	MC	-	-	1	0	0	0	100	0	100	112
Semester Total					20	1	6	22	520	480	1000	

Course code	Name of the course	Category	Outcomes & Specific Outcomes		Instruction hours / week			Credit(s)	Maximum Marks			PAGE NO
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER – V												
23BEEE501	Transmission and Distribution	PC	1,2,3,4,8, 12	1,2	3	0	0	3	40	60	100	113
23BEEE502	Control Systems	PC	1,2,3,4,5,8,12	1,2	3	0	0	3	40	60	100	116
23BEEE503	Microprocessors and Microcontrollers	PC	1,2,3,4,5,8,12	1,2	3	0	0	3	40	60	100	119
23BEEE504	Network Architecture and Security	PC	1,2,3,4,6, 8,9,10,12	2	3	0	0	3	40	60	100	121
23BEEE5E__	Program Elective - II	PE	-	-	3	0	0	3	40	60	100	
23BEEE5E__	Program Elective - III	PE	-	-	3	0	0	3	40	60	100	
23BEEE511	Control Systems Laboratory	PC	1,2,3,4,5,8,9,10, 12	1,2	0	0	2	1	40	60	100	123
23BEEE512	Microprocessors and Microcontrollers Laboratory	PC	1,2,3,4,5,8,9,10, 12	1,2	0	0	2	1	40	60	100	125
23BEMC551	Cyber Security	MC	-	-	1	0	0	0	100	0	100	127
23BEEE591	Field Project/Internship	PC	-	-	0	0	0	1	100		100	
Semester Total					19	0	4	21	520	480	1000	
SEMESTER – VI												
23BEEE601	TQM and Professional Ethics	HSM	6,8,9,10,11,12	-	3	0	0	3	40	60	100	129
23BEEE602	Power System Analysis	PC	1,2,3,4,9,12	1,2	3	1	0	4	40	60	100	131
23BEEE603	Power Electronics	PC	1,2,3,4,7,8,11,12	1,2	3	0	0	3	40	60	100	133
23BEEE6E__	Program Elective - IV	PE	-	-	3	0	0	3	40	60	100	
23BEEE6E__	Program Elective - V	PE	-	-	3	0	0	3	40	60	100	
23B___OE__	Open Elective-I	OE	-	-	3	0	0	3	40	60	100	
23BEEE611	Power Systems Laboratory	PC	1,2,3,4,5,8,9,10, 12	1,2	0	0	2	1	40	60	100	135
23BEEE612	Power Electronics Laboratory	PC	1,2,3,4,8,9,10,12	1,2	0	0	2	1	40	60	100	137
23BEMC651	Universal human values	MC	-	-	1	0	0	0	100	0	100	139
23BEEE691	Mini project	MC	-	-	0	0	2	1	100	0	100	
Semester Total					19	1	6	22	520	480	1000	

Course Code	Name of the course	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER VII												
23BEEE701	Electrical Drives and control	PC	1,2,3,4,8,12	1,2	3	0	0	3	40	60	100	141
23BEEE702	Power System Protection and Switchgear	PC	1,2,3,4,6,7,8,11,12	1,2	3	0	0	3	40	60	100	143
23BEEE703	Smart Grid	PC	1,2,3,4,5,6,7,8,12	1,2	3	0	0	3	40	60	100	145
23BEEE7E_ _	Program Elective -VI	PE	-	-	3	0	0	3	40	60	100	
23BEEE7E_ _	Program Elective -VII	PE	-	-	3	0	0	3	40	60	100	
23B_ _ _OE_ _	Open Elective-II	OE	-	-	3	0	0	3	40	60	100	
23BEEE791	Project Work Phase-I	PROJ	1,2,3,4,5,6,7,8,9,10.11,12	1,2	0	0	8	4	80	120	200	147
Semester Total					18	0	8	22	320	480	800	
SEMESTER VIII												
23BEEE891	Project Work Phase-II	PROJ	1,2,3,4,5,6,7,8,9,10.11,12	1,2	0	0	16	8	80	120	200	148
Semester Total					0	0	16	8	80	120	200	
Program Total					133	7	62	163	3480	3120	6600	

**TOTAL CREDITS: 163**

# PROFESSIONAL ELECTIVE COURSES

SEMESTER IV												
Course Code	Course Title	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
23BEEE4E01	Power Plant Engineering	PE	1,2,3,4,6,7,8	2	3	0	0	3	40	60	100	149
23BEEE4E02	Sensor and Transducer	PE	1,2,3,4	1,2	3	0	0	3	40	60	100	151
23BEEE4E03	Signals and Systems	PE	1,2,3,4,5,11,12	1,2	3	0	0	3	40	60	100	153
23BEEE4E04	Design and Analysis of Algorithms	PE	1,2,3,4,6,8,12	1,2	3	0	0	3	40	60	100	156
SEMESTER V												
Course Code	Course Title	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
23BEEE5E01	Electrical Machine Design	PE	1,2,3,4,5,12	1,2	3	0	0	3	40	60	100	159
23BEEE5E02	Embedded Systems	PE	1,2,3,4,5,9,10,12	1,2	3	0	0	3	40	60	100	161
23BEEE5E03	High Voltage Engineering	PE	1,2,3,4,5,8,11,12	1,2	3	0	0	3	40	60	100	163
23BEEE5E04	Renewable Energy Systems	PE	1,2,3,4,5,6,7,8,9,11,12	1,2	3	0	0	3	40	60	100	166
23BEEE5E05	Electrical Energy Conservation and Management	PE	1,2,3,4,5,6,7,10,12	1,2	3	0	0	3	40	60	100	168
23BEEE5E06	Web Application Development	PE	1,2,3,4,5,8,9,10,12	1,2	3	0	0	3	40	60	100	171
23BEEE5E07	Low-code Application Development	PE	1,2,3,4,5,8,9,10,12	2	3	0	0	3	40	60	100	174
23BEEE5E08	Advanced Algorithms	PE	1,2,3,4,9,10,12	1	3	0	0	3	40	60	100	176

SEMESTER VI												
Course Code	Course Title	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
23BEEE6E01	Special Electrical Machines	PE	1,2,3,4,5,8,9,12	1,2	3	0	0	3	40	60	100	179
23BEEE6E02	MEMS and NEMS	PE	1,2,3,4,5	2	3	0	0	3	40	60	100	181
23BEEE6E03	Bio Medical Instrumentation	PE	1,2,3,4,5	2	3	0	0	3	40	60	100	183
23BEEE6E04	Under Ground Cable Engineering	PE	1,2,3,4,7,8,10,11	2	3	0	0	3	40	60	100	185
23BEEE6E05	Communication Engineering	PE	1,2,3,4,9,12	2	3	0	0	3	40	60	100	188
23BEEE6E06	Digital Signal Processing	PE	1,2,3,4,9	1,2	3	0	0	3	40	60	100	191
23BEEE6E07	Advanced Web Frameworks	PE	1,2,3,4,5,8,9,10,12	2	3	0	0	3	40	60	100	194
23BEEE6E08	Programmable Logic Controller And its Applications	PE	1,2,3,4,9,10,12	2	3	0	0	3	40	60	100	197
SEMESTER VII												
Course Code	Course Title	Category	Outcomes & Specific Outcomes		Instruction hours/week			Credits	Maximum Marks			PAGE NO
			PO	PSO	L	T	P		CIA	ESE	Total	
									40	60	100	
23BEEE7E01	Industrial Automation	PE	1,2,3,4,5,8,9,10	1,2	3	0	0	3	40	60	100	199
23BEEE7E02	Substation Engineering and Automation	PE	1,2,3,4,5,6,7,8,9,12	1,2	3	0	0	3	40	60	100	201
23BEEE7E03	Power System Operation and Control	PE	1,2,3,4,8,10,12	1,2	3	0	0	3	40	60	100	204
23BEEE7E04	Power Quality and Management	PE	1,2,3,4,7,8,12	1,2	3	0	0	3	40	60	100	206
23BEEE7E05	VLSI	PE	1,2,3,4,5	2	3	0	0	3	40	60	100	208
23BEEE7E06	Internet of Things	PE	1,2,3,4,5,8,9,12	2	3	0	0	3	40	60	100	210
23BEEE7E07	HVDC And FACTS	PE	1,2,3,4,5	1,2	3	0	0	3	40	60	100	212
23BEEE7E08	Hybrid Electric Vehicles	PE	1,2,3,4,5,6,7,9	1,2	3	0	0	3	40	60	100	214

**LIST OF OPEN ELECTIVES**  
**COURSE OFFERED BY OTHER DEPARTMENT**

SUB. CODE	TITLE OF THE COURSE	CATE GORY	PO	PSO	L	T	P	C	CIA	ESE	TOTAL	PAGE NO
<b>ARTIFICIAL INTELLIGENCE AND DATA SCIENCE</b>												
23BTADOE01	Fundamentals of Data Science	OE	1,2,3,4,5,6,9,11,12	2	3	0	0	3	40	60	100	216
23BTADOE02	Fundamentals of Artificial Intelligence	OE	1,2,3,4,6,12	2	3	0	0	3	40	60	100	218
23BTADOE03	Internet Programming	OE	1,2,3,4,5,6,9,12	2	3	0	0	3	40	60	100	220
23BTADOE04	Robotics and Automation	OE	1,2,3,4,5,6,9,11,12	2	3	0	0	3	40	60	100	222
<b>BIOMEDICAL ENGINEERING</b>												
23BEBMEOE01	Human Anatomy and Physiology	OE	1,2,3,4,9,10,12	-	3	0	0	3	40	60	100	224
23BEBMEOE02	Artificial Organs and Implants	OE	1,2,3,4,9,10,12	-	3	0	0	3	40	60	100	226
<b>BIO TECHNOLOGY</b>												
23BTBTOE01	Basic Bioinformatics	OE	1,2,3,5,6,12	-	3	0	0	3	40	60	100	228
23BTBTOE02	Fundamentals of Nano Biotechnology	OE	1,3,4,5,6,8,12	-	3	0	0	3	40	60	100	230
<b>CIVIL ENGINEERING</b>												
23BECEOE01	Housing, Plan and Management	OE	1,2,3,4,5,6,9,11,12	-	3	0	0	3	40	60	100	232
23BECEOE02	Building Services	OE	1,3,4,5,6,12	-	3	0	0	3	40	60	100	234
23BECEOE03	Repair and rehabilitation of structures	OE	1,2,3,4,5,6,9,11,12	-	3	0	0	3	40	60	100	236
23BECEOE04	Computer-Aided Civil Engineering Drawing	OE	1,2,4,5,6,7,9,11,12	-	3	0	0	3	40	60	100	238
23BECEOE05	Contracts Management	OE	1,2,4,5,6,7,9,12	-	3	0	0	3	40	60	100	240
23BECEOE06	Air and Noise Pollution and Control	OE	1,2,4,5,6,7,9,11,12	-	3	0	0	3	40	60	100	243
<b>COMPUTER SCIENCE ENGINEERING (CYBER SECURITY)</b>												
23BECYOE01	Basics of Cyber Crime and Cyber Security	OE	1,2,3,4,6,12	-	3	0	0	3	40	60	100	245
23BECYOE02	Basics of Cyber Forensics	OE	1,2,3,4,5,6,12	-	3	0	0	3	40	60	100	247
23BECYOE03	Cyber Laws and Intellectual Property Rights	OE	1,2,3,4,6,12	-	3	0	0	3	40	60	100	249
23BECYOE04	Block chain and Cyber Security	OE	1,2,3,4,5,6,12	-	3	0	0	3	40	60	100	251



COMPUTER SCIENCE AND ENGINEERING												
23BEC SOE01	Internet Of Things	OE	1,2,3,4,5,9,11,12	2	3	0	0	3	40	60	100	254
23BEC SOE02	Machine Learning	OE	1,2,3,4,6,12	2	3	0	0	3	40	60	100	256
23BEC SOE03	Blockchain Technologies	OE	1,2,3,5,6,12	2	3	0	0	3	40	60	100	258
23BEC SOE04	Cloud Computing	OE	1,2,3,4,5,6,12	2	3	0	0	3	40	60	100	260
ELECTRONICS AND COMMUNICATION ENGINEERING												
23BEE COE01	Real Time Embedded Systems	OE	1,2,3,4,5,8	2	3	0	0	3	40	60	100	262
23BEE COE02	Consumer Electronics	OE	1,2,3,4,5	1	3	0	0	3	40	60	100	264
FOOD TECHNOLOGY												
23BTFTOE01	Processing of Food Materials	OE	1,2,3,4,5,6,8,9,10,11	-	3	0	0	3	40	60	100	266
23BTFTOE02	Nutrition and Dietetics	OE	1,2,3,4,8,9,10,11	-	3	0	0	3	40	60	100	268
23BTFTOE03	Ready to eat foods	OE	1,2,3,4,8,9,10,11,12	-	3	0	0	3	40	60	100	270
23BTFTOE04	Agricultural Waste and Byproducts Utilization	OE	1,2,3,4,6,7,8,9,10,11	2	3	0	0	3	40	60	100	272
23BTFTOE05	Design of Food process equipment	OE	1,2,3,4,6,8,9,10,11	-	3	0	0	3	40	60	100	275
MECHANICAL ENGINEERING												
23BEME OE01	Battery Management System	OE	1,2,3,4,10,12	2	3	0	0	3	40	60	100	277
23BEME OE02	Industrial Safety and Environment	OE	1,2,3,4,10, 12	-	3	0	0	3	40	60	100	279
23BEME OE03	Non-destructive Testing	OE	1,2,3,10, 12	-	3	0	0	3	40	60	100	281
23BEME OE04	Operation Research	OE	1,2,3,4 ,12	2	3	0	0	3	40	60	100	283
SCIENCE AND HUMANITIES												
23BESHOE01	Mass communication	OE	8,9,10,12	-	3	0	0	3	40	60	100	285
23BESHOE02	Fuzzy mathematics	OE	1,2,3 ,12	2	3	0	0	3	40	60	100	287
23BESHOE03	Materials science	OE	1,2,12	-	3	0	0	3	40	60	100	289
23BESHOE04	Green Chemistry	OE	1,2,6,7,8,10,12	-	3	0	0	3	40	60	100	292
FACULTY OF PHARMACY												
23BP804ET	Pharmaceutical Regulatory Science-Theory	OE	3	-	3	0	0	3	40	60	100	295
23BP809ET	Cosmetic Science- Theory	OE	3	-	3	0	0	3	40	60	100	297

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT												
23MBAPOE301	Organisational behaviour	OE	6,7,8	-	3	0	0	3	40	60	100	299
23PHPOE301	Material characterization	OE	1,2,3,4,5,10	-	3	0	0	3	40	60	100	301
23PHPOE302	Numerical methods and programming	OE	1,2,5,12	-	3	0	0	3	40	60	100	303
23CAPOE301	Robotics process automation	OE	1,2,3,4,9,10	-	3	0	0	3	40	60	100	306
23BCPOE301	Nutrition and dietetics	OE	1,2,11	-	3	0	0	3	40	60	100	308
23CSPOE301	Cyber forensics	OE	1,2,3,4,12	-	3	0	0	3	40	60	100	310
23CMPOE301	Personal finance and planning	OE	7,8,9,10,11,12	-	3	0	0	3	40	60	100	312
23CHEOE301	Chemistry in everyday life	OE	1,2,3,6,7,12	-	3	0	0	3	40	60	100	314
23MBPOE301	Fermentation technology	OE	1,2,3,11,12	-	3	0	0	3	40	60	100	316
23EGPOE301	English for competitive examinations	OE	9,10,12	-	3	0	0	3	40	60	100	318
23BTPOE301	Sericulture	OE	1,2,3,4,7,12	-	3	0	0	3	40	60	100	320

COURSES OFFERED TO OTHER DEPARTMENT												
23BEEEOE01	Hybrid Electric Vehicles	OE	1,2,3,4,5,6,7	1,2	3	0	0	3	40	60	100	
23BEEEOE02	Renewable Energy Systems	OE	1,2,3,4,5,6,7,8,9,10,11,12	1,2	3	0	0	3	40	60	100	

**PROGRAM OUTCOMES:** On successful completion of the programme,

PO#	PROGRAM OUTCOMES
1	<b>Engineering knowledge:</b> Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
2	<b>Problem analysis:</b> Identify and formulate Electrical and Electronics Engineering problems from research literature and be able to analyze the problem using first principles of Mathematics and Engineering Sciences.
3	<b>Conduct investigations of complex problems:</b> Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into account public health and safety and the social, cultural and environmental issues.
4	<b>Design/development of solutions:</b> 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 significant conclusion.
5	<b>Modern tool usage:</b> 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.
6	<b>The Engineer and society:</b> 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.
7	<b>Environment and sustainability:</b> Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for Sustainable Development.
8	<b>Ethics:</b> Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
9	<b>Individual and teamwork:</b> Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
10	<b>Communication:</b> 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.
11	<b>Project management and finance:</b> Demonstrate the acquisition of the body of engineering knowledge, insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.
12	<b>Life-long learning:</b> Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

**PROGRAMME SPECIFIC OUTCOMES:**

PSO#	PROGRAMME SPECIFIC OUTCOMES
1	<b>Foundation of Electrical Engineering:</b> Ability to understand the principles and working of electrical components, circuits, systems and control that are forming a part of power generation, transmission, distribution, utilization, conservation and energy saving. Students can assess the power management, auditing, crisis and energy saving aspects.
2	<b>Computing and Research Ability:</b> 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#	PROGRAMME EDUCATIONAL OBJECTIVES
PEO1	Have successful technical and professional careers in their chosen fields such as circuit theory, Field theory, control theory and computational platforms.
PEO2	Engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics and their applications in power engineering.

**MAPPING:**

PEO\PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
PEO1	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
PEO2	✓	✓	✓	✓	✓	✓		✓		✓			✓	✓

## SEMESTER-I

23BECC101

PROFESSIONAL COMMUNICATIVE ENGLISH

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:**

- Extend the communicative competence of learners.
- Develop usage of language effectively in academic /work contexts
- Make use of Language skills in Reading and Writing
- Use language efficiently in expressing their opinions via various media.
- Enhance inter-personal communication skills.

**COURSE OUTCOMES:**

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

- Identify new words by employing vocabulary building techniques.
- Build correct sentence structures and grammatical patterns in oral and written communication
- Construct business letters, proposals and E-Mail communication.
- Adopt the skills of planning, structuring, and delivery techniques in group discussions and presentations.
- Follow leadership, work ethics and management principles..

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO3	-	-	-	-	-	-	-	2	2	3	-	2	-	-
CO4	-	-	-	-	-	-	-	3	2	3	-	2	-	-
CO5	-	-	-	-	-	-	-	3	2	3	-	3	-	-
Avg.	-	-	-	-	-	-	-	2	2	3	-	2.4	-	-

**3-Strong; 2-Medium; 1-Low**

**UNIT I VOCABULARY BUILDING****(9)**

Word formation process - One word Substitutes – Homophones – Homonyms – British and American vocabulary – Punctuation marks and capitalization

**UNIT II FUNDAMENTALS OF ENGLISH GRAMMAR****(9)**

Subject –verb agreement (Concord) – If-conditionals - Modal verbs - Question types (Why, Yes or No & Question tag), Prepositions- Articles

**UNIT III LANGUAGE SKILLS (READING AND WRITING)****(9)**

Reading (Skimming & Scanning) - Reading Methods (SQ3R) – Writing -Business Letters (Job Application Letter & Resume Preparation, sales letter, Quotation letter) – E- Mail communication & etiquettes – Business Proposals ( Structure & Types)

**UNIT IV PROFESSIONAL SKILLS****(9)**

Interview skills – Dos and Don'ts of an Interview, Group Discussion – Dos and Don'ts of GD, Presentation skills – Planning, structuring and Delivering Techniques

**UNIT V INTERPERSONAL SKILLS****(9)**

Personality development –Conflict management, Team work, Leadership Principles, Negotiation skills

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

**TOTAL: 45 Hours****TEXT BOOKS:**

1. Raman. Meenakshi, Sharma. Sangeeta (). Professional English. Oxford university press. New Delhi.
2. SanjayKumar, Pushpalata, (2011), Communication skills, 1<sup>st</sup> Edition Oxford Press.
3. Ashraf Rizvi M, Effective Technical Communication, McGraw Hill Education, First Edition, 2013.

## SEMESTER-I

23BECC102

MATRICES AND CALCULUS

4H-4C

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the student with the differential calculus of multivariable functions. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals.
- To make the students acquire sound knowledge in techniques of solving linear ordinary differential equations.
- To provide knowledge about the concepts of partial differential equation with constant coefficients.

**COURSE OUTCOMES:**

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

- Make use of orthogonal transformation to reduce the quadratic form to canonical form.
- Utilize differential calculus of multivariable to optimization problems.
- Apply multiple integrals for finding area and volume.
- Solve the  $n^{\text{th}}$  order Ordinary Differential Equations(ODE) and Homogeneous equation of Euler's type.
- Solve the  $n^{\text{th}}$  order Partial Differential Equations.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.8	1.8	1	-	-	-	-	-	-	-	-	1	-	-

**3-Strong; 2-Medium; 1-Low**

**UNIT I MATRICES****(12)**

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

**UNIT II DIFFERENTIAL CALCULUS OF MULTIVARIABLE FUNCTIONS****(12)**

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

**UNIT III MULTIPLE INTEGRALS****(12)**

Proper and Improper integrals - Bernoulli’s extension formula – Double integrals – Change of order of integration – Double integrals in polar coordinates – Area using double integrals – Evaluation of Triple Integrals

**UNIT IV ORDINARY DIFFERENTIAL EQUATIONS****(12)**

Linear differential equation of second and higher order with constant coefficients – Euler-Cauchy linear differential equation – Method of Variation of parameters.

**UNIT V PARTIAL DIFFERENTIAL EQUATIONS****(12)**

Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of partial differential equations.

**TOTAL: 45+15****TEXT BOOKS:**

1. Grewal B S, “Higher Engineering Mathematics”, Khanna Publishers, Forty Fourth Edition, 2018.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, Tenth Edition, 2017.

**REFERENCE BOOKS:**

1. George Brinton Thomas and Ross L Finney, “George Brinton Thomas and Ross L Finney”, Pearson Publishers, Ninth edition, 2002.
2. Shepley L. Ross, “Differential Equations”, Wiley Publisher, Third edition, 2007.
3. Victor Henner, Tatyana Belozerovala and Mikhail Khenner, “Ordinary and Partial Differential Equations”, A K Peters/CRC Press, First Edition, 2013.



**WEBLINKS:**

1. <https://archive.nptel.ac.in/courses/111/108/111108157/>
2. <https://nptel.ac.in/courses/111107108>
3. <https://archive.nptel.ac.in/courses/111/104/111104125/>
4. <https://nptel.ac.in/courses/111108081>
5. <https://nptel.ac.in/courses/111108144>

## SEMESTER-I

23BECC103

ENVIRONMENTAL STUDIES

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- Create the awareness about environmental problems among people.
- Develop an attitude of concern for the environment.
- Motivate public to participate in environment protection and improvement.
- To gain a variety of experiences and acquire a basic understanding of environment and it's associated problems.
- Relate critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

**COURSE OUTCOMES:**

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

- Outline the ecological processes supporting the life system.
- Infer the importance of environment and the impact of human activities on natural resources.
- Explain the levels and values of biodiversity and its conservation.
- Summarize the problems of environmental pollution and its control measures.
- Interpret the remediation methods for social issues and degraded environment..

**CO-PO MAPPING:**

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

3-Strong; 2-Medium; 1-Low

## **UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES& 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, Grass and Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

## **UNIT II NATURAL RESOURCES - RENEWABLE AND NON 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 AND ITS 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, industrial and e-wastes. Role of an individual in prevention of pollution. Case studies.

## **UNIT V SOCIAL ISSUES AND THE ENVIRONMENT (9)**

Concept of sustainability and sustainable development. Water conservation -Rain water 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: 45**

**TEXT BOOKS:**

1. Anubha Kaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
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 University Press.

**REFERENCE BOOKS:**

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

## SEMESTER-I

23BEEE141 PHYSICS FOR ELECTRICAL AND ELECTRONICS ENGINEERS  
(THEORY & LAB.)

6H-5C

Instruction Hours/week:L:4 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- Understand the fundamentals of electrons flow and band structure.
- Inculcate the characteristics of electronic materials through basics.
- Divulge knowledge on the basics of semiconducting materials for diode applications.
- Understand the basics of laser and optical fiber with appropriate applications.
- Impart the basic knowledge of new semiconducting material for engineering applications.

**COURSE OUTCOMES:**

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

- Apply the basics of free electron theory for classification of materials
- Identify the types of semiconductors and its carrier concentration using Hall effect
- Utilize magnetic properties for finding B - H Curve
- Outline the basics of crystals, structures and its defects
- Illustrate the properties of low dimensional materials and its fabrication methods.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO2	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO3	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg.	2.6	1.6	-	-	-	-	-	-	1.2	1.6	-	1	-	-

3-Strong; 2-Medium; 1-Low

## **UNIT I ELECTRONIC THEORY OF SOLIDS**

**(9)**

Classical free electron theory, Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory - Fermi- Dirac distribution function- Density of states in metals and energy band diagrams, 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.

## **UNIT II SEMICONDUCTORS**

**(9)**

Properties of semiconductor, Types: Intrinsic and extrinsic semiconductors – Intrinsic carrier concentration, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift- Hall Effect – Determination of Hall coefficient – Applications

## **UNIT III MAGNETIC AND DIELECTRIC MATERIALS**

**(9)**

Magnetic moment, magnetic dipoles - magnetic permeability and susceptibility, types of magnetic materials – Ferro-magnetism, 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.

## **UNIT IV LASER AND FIBER OPTICS**

**(9)**

LASER: Introduction - characteristics - Einstein's co- efficient derivation Principle of laser action- population inversion- pumping methods -Types of laser - Nd: YAG, CO<sub>2</sub> - Applications of LASER in industry and medicine.

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

## **UNIT V 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: Fabrication technique (Chemical vapour deposition, Pulsed laser deposition), Properties and its applications – Carbon nanotubes: Properties and applications.

**Total: 45**

### **TEXT BOOKS:**

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, (2015).
2. J Donald Neamen, Dhrubus Biswas Semiconductor Physics and Devices, McGraw Hill Education; 4 editions, (2017).
3. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, Wiley Publishers, (2006).

## REFERENCE BOOKS:

1. Leszek Malkinski, Advanced Magnetic Materials, Published by InTech, (2012).
2. Michael Shur, Physics of Semiconductor Devices, Published by Pearson Education; First edition, (2019).
3. Kulkarni, SulabhaK, Nanotechnology: Principles and Practices, Springer International Publishing, (2015).
4. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
5. Fiber Optics and Optoelectronics, R P Khare, Oxford, 2012

## JOURNALS

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

## 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](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/MIT6_012F09_lec01.pdf)

## (ii) LABORATORY

### LIST OF EXPERIMENTS – PHYSICS (Any 6 Experiments)

1. Determination of Band gap of a semiconductor.
2. Characteristics of photo diode.
3. Determination of Hall Coefficient and carrier type for semi-conducting Materials.
4. Carey Foster Bridge - Determination of specific resistance of a given coil of wire
5. Determination of magnetic materials using B-H Curve.
6. Calculation of wavelength of Semiconductor Laser.
7. Study of I-V characteristics of solar cell.
8. Determination of resistivity of four probe method.
9. Study of I-V Characteristics of P-N Junction diode.

**Total: 30**

**SEMESTER-I****23BECC142****PROGRAMMING IN C****6H-5C****(Theory & Lab)****Instruction Hours/week:L:4 T:0 P:2****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****(i) THEORY****COURSE OBJECTIVES:**

- To interpret problem solving using C.
- To apply the concept of arrays and strings.
- To identify the functions of C Language.
- To apply the concept of pointers.
- To develop C Programs using user defined function and file handling.

**COURSE OUTCOMES:**

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

- Apply algorithmic solutions to computational problems using C.
- Solve problems using arrays and strings.
- Build modular applications in C using functions.
- Categorize dynamic memory management operators along with pointers.
- Develop an applications using sequential and random access file processing.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO4	3	3	2	1	-	-	-	-	2	2	-	2	-	1
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	1
Avg.	3	2.4	1.4	1	-	-	-	-	2	2	-	2	-	1

**3-Strong; 2-Medium; 1-Low**



## **UNIT I INTRODUCTION**

**(9)**

An overview of computers and programming - Understanding computer systems - Programming logic - Steps in program development – Algorithm - Using pseudocode and flowchart – types of programming languages – Compiler – Interpreter – Linker - Introduction to C – Structure of C program - Identifiers and Keywords - Data types - Constants and variables - Type conversion – Operators - Expressions. Formatted and Unformatted Input/Output functions - Control structures

## **UNIT II ARRAYS AND STRINGS**

**(9)**

Arrays in C - Declaring and initializing arrays in C - Defining and processing 1D and 2D arrays - Inserting and deleting elements of an array - Strings - Defining and initializing strings - Processing of string - Character arithmetic - String manipulation functions and library functions of string.

## **UNIT III FUNCTIONS**

**(9)**

Functions - Types of Functions - Function prototypes - Function definition - Function call including passing arguments by value and passing arguments by reference - Passing arrays to functions - Math library functions - Recursive functions - Scope rules (local and global scope) - Storage classes in C.

## **UNIT IV POINTERS**

**(9)**

Pointers - Pointer declaration and initialization - Types of pointers - Pointer expressions and arithmetic - Operations on pointers - Passing pointer to a function - Pointer and one-dimensional array - Pointers and strings – Command line arguments - Dynamic memory management functions.

## **UNIT V USER DEFINED TYPES AND FILE HANDLING**

**(9)**

User defined types - Enumerator – Typedef - Structures - Declaration of a structure - Accessing structures - Array of Structures - Structures and pointers - Nested structures – Bit fields – Unions - Declaration of a union – Accessing unions – Union vs Structure - File Input/Output – Preprocessor directives.

**TOTAL : 45**

### **TEXT BOOKS:**

1. Programming in C by Ashok N. Kamthane, 3<sup>rd</sup> edition, Pearson, 2015.
2. Programming in C, Reema Thareja, Oxford University Press, Second Edition, 2016.

### **REFERENCE BOOKS:**

1. “C How to Program” By Paul Deitel and Harvey Deitel, 8<sup>th</sup> edition, Prentice Hall, 2015.
2. “Programming in Ansi C” By E. Balagurusamy, 8<sup>th</sup> edition, Mcgraw Hill Education, 2019.
3. “Let Us C”, by Yashwant Kanetkar, 17th Edition, Bpb Publications, 2020.
4. “C: The complete reference”, Herbert Schildt, 4<sup>th</sup> edition, Mcgraw Hill Education, 2017.

## WEBLINKS:

1. [www.hackerrank.com](http://www.hackerrank.com)
2. [www.codechef.com](http://www.codechef.com)
3. [www.learn-c.org](http://www.learn-c.org)
4. [www.udemy.com](http://www.udemy.com)
5. [www.hackearth.com](http://www.hackearth.com)

## ii) LABORATORY

### LIST OF EXPERIMENTS:

1. Develop a C Program to find the roots of quadratic equation for non-zero coefficient using if-else ladder construct.
2. Develop Programs using simple control statements such as if else, while, do while. Example Extracting the digits of an integer, reversing digits, finding sum of digits
3. Develop a C Program to implement a simple calculator to perform addition, subtraction, multiplication and division operations using switch construct. Display appropriate messages for invalid operator and divide by zero error.
4. Develop C Program to generate Fibonacci sequence, calculation of factorials, printing various patterns and generate the Prime numbers between the ranges m & n using for loop.
5. Develop a C program to read n elements into an integer array, Insert and Delete element from the array. Print the input array and the resultant array with suitable messages.
6. Develop a C program to read two matrices A (m x n) and B (p x q) and compute the product of the two matrices. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only. Program must check the compatibility of orders of the matrices for multiplication. Report appropriate message in case of incompatibility.
7. Develop a C function Program to sort the given names in Ascending Order.
8. Develop a C program to count the vowels & consonants in a given string.
9. Develop a C Program to find the GCD of two integers using Euclid's algorithm
10. Develop a recursive C function to find the factorial of a number, n!, defined by  $\text{fact}(n)=1$ , if  $n=0$ . Otherwise,  $\text{fact}(n)=n*\text{fact}(n-1)$ . Using this function, develop a C program to compute the Binomial coefficient  $nCr$ . Perform input validation as well.

11. Develop a C program to find the smallest and largest elements in an array using pointers and then swap these elements and display the resultant array.
12. Develop a C program to find the sum of all the elements of an integer array using pointers.
13. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using structures and pointers

**Total: 30**

## SEMESTER-I

23BEEE111

WORKSHOP PRACTICES

4H-2C

Instruction Hours/week: L:0 T:0 P:4

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

- To prepare the students to gain the knowledge about various manufacturing methods.
- To impart knowledge on the operations in CNC machining.
- To prepare the students to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- To provide practical knowledge on the use of Basic Mechanical Components.
- To provide practical knowledge on the use of Mechanical components.

## COURSE OUTCOMES:

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

- Inspect machined component in lathe operation
- Identify the mating gap in the field work piece and chiselled work piece
- Develop soldering processes for the given circuit
- Apply the principles of carpentry techniques to make functional structures.
- Build plumbing exercises to install and connect plumbing fixtures.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	2	1	-	1	1	-
CO2	2	1	-	-	-	-	-	-	2	1	-	1	1	-
CO3	3	2	1	-	-	-	-	-	2	1	-	1	1	-
CO4	3	2	1	-	-	-	-	-	2	1	-	1	1	-
CO5	3	2	1	-	-	-	-	-	2	1	-	1	1	-
Avg.	2.8	2	1	0.2	-	-	-	-	2	1	-	1	1	-

3-Strong; 2-Medium; 1-Low

**(i) LECTURES and VIDEOS:**

**Detailed contents**

1. Study on various manufacturing methods- Casting and Forming.
2. Study on Machining and Welding.
3. Study on Job fitting.
4. Study on CNC machine operation.
5. Study on Fitting operations and power tools.

**(ii) WORKSHOP PRACTICE:**

1. Fitting shop – Filing and Matting practices.
2. Welding shop – Arc welding practices.
3. Casting - Foundry practices.
4. Machine shop – Identifying components of Lathe machine and various Lathe operations.
5. Plumbing Exercises – Identifying Plumbing components.

**TEXT BOOKS:**

1. Gowri S, Jeyapoovan, T.Engineering Practices Lab Manual, 5<sup>th</sup> edition, Vikas Publishing House Pvt. Ltd, Chennai. 2017.
2. Bawa, H.S, Workshop Practice, 2<sup>nd</sup> edition, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2019.

**REFERENCE BOOKS:**

1. Choudhry S K, Elements of workshop technology, Vol 2, 13<sup>th</sup> edition, Indian book distributing company, Kolkatta, 2020.
2. D K Singh, Manufacturing Technology, 2<sup>nd</sup> edition, Pearson Education, 2018.

**WEBLINKS:**

1. <http://ecoursesonline.iasri.res.in/course/view.php?id=86>
2. [https://engg.kkwagh.edu.in/workshop\\_about\\_engg](https://engg.kkwagh.edu.in/workshop_about_engg)

**SEMESTER-I****23BEMC151****DESIGN THINKING****3H - 2C****Instruction Hours/week: L:1 T:0 P:2****Marks: Internal:100 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Illustrate design thinking concepts and principles
- Utilize design thinking methods in every stage of the problem
- Identify the different phases of design thinking
- Plan for various product and service communication in design thinking
- Interpret the use of tools for the design process

**COURSE OUTCOMES:**

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

- Explain the design thinking process, tools and theories.
- Identify the types of users and the requirements of customers.
- Explore the concepts of Prototyping and its testing.
- Analyze design thinking strategies in product and service design.
- Customize existing products by utilizing design thinking strategies.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	1	1	-	-	-	-	1	1	1	-	3	-	1
<b>CO2</b>	3	2	1	-	-	-	-	2	1	1	-	3	-	1
<b>CO3</b>	3	2	2	1	-	2	1	2	2	2	-	3	-	1
<b>CO4</b>	3	3	2	1	-	2	1	2	2	2	-	3	-	1
<b>CO5</b>	3	3	2	1	-	2	1	2	2	2	-	3	-	1
<b>Avg.</b>	<b>2.8</b>	<b>2.2</b>	<b>1.6</b>	<b>0.6</b>	<b>-</b>	<b>1.2</b>	<b>0.6</b>	<b>1.8</b>	<b>1.6</b>	<b>1.6</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>1</b>

**3-Strong; 2-Medium; 1-Low**

**UNIT 1 -INTRODUCTION****(6)**

Understanding Design thinking and tools - Human-Centric Design Process - Design Thinking Process- DT Activity with case studies.

**UNIT-2 EMPATHISE WITH USERS****(6)**

Five Whys - Needs of user - Types of user research -Customer Journey Mapping - Observational Research

**UNIT-3 PROTOTYPING****(6)**

Ideas to presentable concepts - Scenario-based Prototyping – Testing prototypes - Usability and ergonomic testing - Rapid prototyping.

**UNIT-4 PRODUCT AND SERVICE DESIGN****(6)**

Product Design - Interaction Design- Service Design - Communication Design - Transportation Design.

**UNIT-5 DESIGN AND INNOVATION****(6)**

DT for strategic innovations - Extreme Competition - Experience design - Standardization - Humanization - Creative Culture.

**TOTAL HOURS: 30****TEXT BOOKS:**

1. Bala Ramadurai, "Karmic Design Thinking", 2020.
2. Christian Mueller-Roterberg, "Handbook of Design thinking", Amazon Digital Services LLC - KDP Print US, 2018.

**REFERENCE BOOKS:**

1. Tim Brown, "Change by Design", Harper Business Publisher, 2019
2. Hasso Plattner, Christoph Meinel and Larry Leifer, "Design Thinking: Understand –Improve – Apply", Springer, 2011
3. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

**SEMESTER-I****23BEMC152****SPORTS AND YOGA****1H - 0C****Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:100 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To have knowledge of Physical fitness and exercise management to lead better quality life
- To enable to officiate, supervise various sports events and organize sports events
- To acquire the knowledge of Physical Education, Sports and Yoga and understand the purpose and its development
- To gain knowledge to plan, organize and execute sports events
- To guide the society for healthy mental and physical life

**COURSE OUTCOMES:**

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

- Practice physical activities and yoga for strength, flexibility and relaxation.
- Use techniques for increasing concentration and decreasing anxiety for stronger academic performance.
- Perform yoga exercises in various combination and forms.
- Improve personal fitness through participation in sports and yoga activities.
- Follow sound nutritional practices for maintaining good health and physical performance.

**UNIT I INTRODUCTION TO PHYSICAL FITNESS**

Explain importance of physical education - Describe importance of Physical Fitness & Wellness -

Explain the components of physical fitness - Demonstrate healthy life style - Prevent health threats by changing life style

**UNIT II FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN SPORTS & YOGA**

Explain importance of anatomy and physiology - Describe effects of exercise in various body systems

- Describe concept of correct posture - Explain corrective measures for posture deformities.

**UNIT III YOGA & PRANAYAMA**

Explain importance of yoga - Perform various pranayama for increasing concentration - Use meditation and other relaxation techniques for improving concentration.



**TEXT BOOKS:**

1. Ajmer Singh, Modern Trends and Physical Education class 11 & class12, Kalyani Publication, NewDelhi.
2. B.K.S. Iyengar, Lighton Yoga, Thomson's Publication, New Delhi.

**REFERENCE BOOKS:**

1. V.K. Sharma, Health and Physical Education, NCERT Books; Class11,12 Saraswati House Publication, New Delhi
2. Acharya Yatendra, Yoga and Stress Management, Finger print Publishing

## SEMESTER-I

23BEMC153

தமிழர் மரபும் பண்பாடும்

1H-0 C

கற்பித்தல் நேரம்/வாரம்: L:1 T:0 P:0

மதிப்பெண்: இடைத்தேர்வு: 100

மொத்தம்:100

**பாடத்திட்ட பயன் விளைவு:**

- வரலாற்றிற்கு முற்பட்ட தமிழகத்தை மாணவர்களுக்கு அறிமுகப்படுத்துதல்
- பழந்தமிழர் பண்பாடு சார்ந்த வாழ்க்கை முறையை மாணவர்கள் அறிய ஊக்குவித்தல்
- தமிழ் மொழியின் பழைமையும், திராவிட மொழிகளில் தமிழ்மொழியின் தனிச்சிறப்பையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
- தமிழர்களின் வாழ்வியல், தமிழர்கலைகள், ஆற்றங்கரைப்பண்பாடுகள் குறித்து மாணவர்கள் அறியச்செய்தல்.
- இந்தியக்குடியரிமைப்பணி முதலான போட்டித்தேர்வுகளில் விருப்பப்பாடமாக இடம்பெறுகின்ற தமிழ்நாகரிகமும் பண்பாடும் குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்

**பாடத்திட்டப் பொதுநோக்கம்:**

1. இந்தியக்குடியரிமைப்பணி முதலான போட்டித்தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற, 'தமிழ்இலக்கியவரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத்தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின்வளர்ச்சித்துறையாகிய, 'அறிவியல்தமிழ்'; 'இணையதமிழ்' குறித்த பன்னோக்கு அணுகுமுறையிலான ஆய்வுச்சிந்தனை மேம்பாடு.
4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல்.
5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப்பேணுவதற்குக்கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மைவளர்ச்சி. மொழிபெயர்ப்புத்துறை சார்ந்த வேலைவாய்ப்புத்திறன் பெற்றிருத்தல்.

### **அலகு:1 தமிழர் மரபு**

மரபு-விளக்கம்-சங்ககால தமிழர் மரபு – திணைப்பகுப்பும் தமிழர் மரபும்- உலகப்பொதுமை – அகத்திணை மரபு – புறத்திணை மரபு- இடைக்காலத்தமிழர் மரபு – பிற்கால மரபும் மாற்றமும் – தற்கால தமிழர்மரபு - வளர்ச்சி.

### **அலகு: 2 தமிழர் பண்பாடு**

பண்பாடு – விளக்கம் – பழந்தமிழர் பண்பாடு – இயற்கை சார்ந்த வாழ்வியல் – தமிழர் சமயம் – அரசியல் நிலை-சமூகப் பழக்கவழக்கங்கள் – நம்பிக்கைகள் – வாழ்வியல் அறங்கள் – வணிகம் போன்றவை.

### **அலகு:3 தமிழர் கலைகள்**

தமிழகத்தில் கலைகளின் வளர்ச்சி – சிற்பக்கலை வளர்ச்சி –கோயில் கலை – கற்கோவில்கள் - ஓவியக்கலை – அழகுக்கலைகள் - கூத்துக்கலை – மருத்துவக்கலை – நாடகக்கலை- இசைக்கலை போன்றவை.

### **அலகு: 4 தமிழர் சமயம்**

பழந்தமிழரின் சமயம் – சங்ககால சமயம் – தொல்காப்பியத்தில் சமயம் – சைவ சமயம் – வைணவம் – தமிழ்ப் பண்பாட்டில் பௌத்தம் – தமிழ்ப் பண்பாட்டில் சமணத்தின் தாக்கம்-தமிழ்ப் பண்பாட்டில் இசுலாம் மற்றும் கிறித்துவ சமயத்தின் தாக்கம்- தமிழர் பண்பாட்டில் விழாக்கள்- கோயில்களும் விழாக்களும்- சமூக ஒருங்கிணைப்பில் விழாக்களின் பங்கு- சங்க இலக்கியத்தில் விழாக்கள் பற்றிய குறிப்புகள்-இடைக்கால இலக்கியங்களில் விழாக்கள் பற்றிய செய்திகள் – விழாக்களின் சமூகப்பங்களிப்பு – தற்காலத்தில் தமிழர் விழாக்கள் - விளையாட்டும் விழாக்களும்.

### **அலகு: 5 இலக்கியங்களில் தமிழர் பண்பாட்டுப் பதிவுகள்**

சங்க இலக்கியமும் வாழ்வியலும்-திருக்குறளில் வாழ்வியல் நெறிகள் – இரட்டைக் காப்பியங்களும் வாழ்வியலும் – சிற்றிலக்கியங்களில் வாழ்வியல் பதிவுகள்-இக்கால இலக்கியமும் வாழ்வியலும்.

### **பார்வைநூல்கள்:**

1. தமிழ் இலக்கிய வரலாறு – தமிழண்ணல், மீனாட்சி புத்தக நிலையம்- மதுரை-இரண்டாம் பதிப்பு-ஜூலை – 2000.
2. தமிழர் நாகரிகமும் பண்பாடும், அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், சென்னை, திருத்திய பதிப்பு – 2022.
3. தமிழர் வரலாறும் பண்பாடும், நா. வானமாமலை, நியூசெஞ்சுரி புக் ஹவுஸ், சென்னை, ஆறாம்பதிப்பு - 2007 .
4. தமிழக வரலாறு மக்களும் பண்பாடும், கே.கே. பிள்ளை, உலகத் தமிழராய்ச்சி நிறுவனம், சென்னை.

## SEMESTER-II

23BECC201A

GRAPH THEORY

4H-4C

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

- To provide the basic concepts of graphs.
- To impart the knowledge of trees and its properties via various algorithms.
- To afford the adequate knowledge on matrix representation of graphs.
- To inculcate the concept of coloring and dominating sets.
- To understand the concepts and significance of lattices which are widely used in engineering fields.

## COURSE OUTCOMES:

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

- Infer the basic terminologies of directed and undirected graphs.
- Illustrate the properties of trees, connectivity, fundamentals of circuits, cutset through algorithms.
- Apply matrix representation of graphs to explore spectra and energy of graphs.
- Interpret the coloring and domination of a given graph.
- Explain Lattice theory and its operations on discrete structural areas of computing.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.2	1.2	0.2	-	-	-	-	-	-	-	-	1	-	-

3-Strong; 2-Medium; 1-Low

## **UNIT I-GRAPHS**

**(12)**

Graphs: Directed and undirected graphs – Konigsberg bridge problem – Handshaking Theorem– Walk, Trail, Path, Circuit, Cycle, sub graphs, induced and spanning subgraphs, connected graphs, complement of a graph – Euler, Hamiltonian graphs - Isomorphism of graphs.

## **UNIT II-TREES**

**(12)**

Trees: Properties of trees – Distance and centers in tree – Rooted and binary tree Spanning trees – Connectivity and separability – Fundamental Circuits and Cut sets – Algorithm on spanning trees: Kruskal’s and Prim’s Algorithm – Dijkstra’s shortest path algorithm.

## **UNIT III-MATRIX REPRESENTATION OF GRAPHS**

**(12)**

Matrix Representation of Graphs: Adjacency matrix, Incidence matrix, Circuit matrix, Fundamental circuit matrix, Laplacian matrix, rank of these matrices and its properties – Spectra and Energy of Graphs.

## **UNIT IV-COLORING, COVERING AND PARTITIONING:**

**(12)**

Coloring, Covering and Partitioning: Chromatic number – Chromatic Partitioning: Dominating set – Minimal Dominating set – Domination number- Chromatic Polynomial– Matching – Four color theorem (Statement only).

## **UNIT V-LATTICE THEORY**

**(12)**

Lattice theory: Partial ordering – Posets – Lattices as posets – Properties of lattices – Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices.

**TOTAL: 45+15**

### **TEXT BOOKS:**

1. Narsingh Deo., “Graph Theory with applications to Engineering and Computer Science”, Dover Publications Inc, First Edition, 2016.
2. Karin R Saoub., “Graph Theory – An Introduction to Proofs, Algorithms and Applications”, CRC Press, First Edition, 2021.

### **REFERENCE BOOKS:**

1. Kenneth H. Rosen., “Discrete Mathematics and Applications”, Mcgraw Hill, 7th Edition, 2012.
2. Clark J and Holton D.A., “A First Look at Graph Theory”, Allied Publishers, 1995.
3. Grimaldi R.P., “Discrete and Combinatorial Mathematics: An Applied Introduction”, Addison Wesley, 2016.
4. J. A. Bondy and U. S. R. Murty., “Graph Theory With Applications”, Elsevier Science Publishing, 1976.
5. R. L. Goodstein., “Boolean Algebra”, Dover Publications, 2007.

**WEBLINKS:**

1. <http://math.fau.edu/Locke/Courses/GraphTheory/Spring2019>
2. [https://onlinecourses.nptel.ac.in/noc22\\_ma10/preview](https://onlinecourses.nptel.ac.in/noc22_ma10/preview)
3. <https://nptel.ac.in/courses/106108054>
4. [https://onlinecourses.nptel.ac.in/noc21\\_cs48/preview](https://onlinecourses.nptel.ac.in/noc21_cs48/preview)
5. [http://www.cectl.ac.in/images/pdf\\_docs/studymaterial/cse/s3/dcs4.pdf](http://www.cectl.ac.in/images/pdf_docs/studymaterial/cse/s3/dcs4.pdf)

**SEMESTER-II****23BECC201B****COMPUTATIONAL METHODS FOR ENGINEERS****4H-4C****Instruction Hours/week: L:3 T:1 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To provide the knowledge of Vector differentiation and Integration.
- To inculcate the concepts of theories on Numbers.
- To introduce the concepts of Graphs.
- To introduce diversified methods of trees namely the algorithm on spanning trees.
- To afford the adequate knowledge of Linear Programming Problems.

**COURSE OUTCOMES:**

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

- Make use of vector calculus for finding the area and volume.
- Interpret the concepts of divisibility, prime number, congruence and number theorems.
- Explain the terminology of basic graphs and its Matrix representation.
- Illustrate the properties of trees, connectivity, fundamentals of circuits, cut set through algorithms.
- Solve linear programming models by Graphical method, Simplex method and Dual simplex method.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.4	1.4	0.4	-	-	-	-	-	-	-	-	1	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I VECTOR CALCULUS (12)**

Vector differential operator – Gradient, divergence and curl – Identities (Statement only) – Directional derivatives – Irrotational and solenoidal vector fields – Conservative vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proofs) – Simple applications involving square, rectangle, cubes and rectangular parallelepipeds.

## **UNIT II NUMBER THEORY (12)**

Divisibility – Fundamental Properties – Euclidean algorithm – Euclid’s lemma – Fundamental theorem of arithmetic – Congruence – Fermat’s Little theorem – The Fermat-Euler theorem.

## **UNIT III GRAPH THEORY (12)**

Incidence and degree – Finite and Infinite graphs – Sub graphs – Isomorphism of graphs – Walks, Paths and Circuits – Eulerian and Hamiltonian graphs – Planar graph – Matrix representation of graphs – Incidence and Adjacency matrices

## **UNIT IV TREES (12)**

Trees: Properties of trees – Distance and centers in tree – Rooted and binary tree – Spanning trees – Properties of trees – Algorithm on spanning trees – Kruskal’s algorithm.

## **UNIT V LINEAR PROGRAMMING PROBLEM (12)**

Formulation of Linear Programming Problem – Advantages and disadvantages of LPP – Algebraic solution of a LPP - Graphical method - The Simplex method - Principle of duality - Dual and primal problems - Dual Simplex method.

**Total 45+15**

### **TEXT BOOKS:**

1. Grimaldi R.P, “Discrete and Combinatorial Mathematics: An Applied Introduction”, Addison Wesley, 2016.

### **REFERENCE BOOKS:**

1. Karin R Saoub, “Graph Theory – An Introduction to Proofs, Algorithms and Applications”, CRC Press, 2021.
2. Ramana B V, “Higher Engineering Mathematics”, McGraw Hill Education, Twenty Ninth Reprint, 2017.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, Tenth Edition, 2017.



**WEB URLs:**

1. <https://nptel.ac.in/courses/111105122>
2. <https://nptel.ac.in/courses/111/101/111101137/>
3. <https://nptel.ac.in/courses/111/106/111106050/>
4. <https://nptel.ac.in/courses/111/106/111106050/>
5. <https://nptel.ac.in/courses/112106134>

## SEMESTER-II

23BECC201C

TRANSFORMS AND ITS APPLICATIONS

4H-4C

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

## COURSE OBJECTIVES:

- To make the students to understand the concept of periodic function and represent them in Fourier series.
- To make the students to understand the applications of partial differential equations.
- To acquaint the students with the concepts of Fourier transform techniques.
- To impart knowledge in Laplace transform techniques and its applications.
- To provide knowledge about solving ordinary differential equations using the Inverse Laplace transform.

## COURSE OUTCOMES:

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

- Illustrate Fourier series representation of periodic functions.
- Apply Fourier series in one dimensional heat flow and wave equation.
- Make use of Fourier transform for converting elementary functions into frequency domain.
- Utilize Laplace Transform to convert time-domain systems into frequency-domain systems.
- Apply Inverse Laplace Transform in linear differential equations.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.8	1.8	0.8	-	-	-	-	-	-	-	-	1	-	-

3-Strong; 2-Medium; 1-Low

**UNIT I FOURIER SERIES (12)**

Dirichlet's conditions – General Fourier series in the interval  $(0, 2l)$  &  $(-l, l)$  – Half range sine series – Half range cosine series – Harmonic analysis.

**UNIT II: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12)**

Fourier series solution for one dimensional wave equation – Fourier series solution for one dimensional heat equation with zero end conditions.

**UNIT III FOURIER TRANSFORMS (12)**

Fourier transform pair – Complex form of Fourier transform- Fourier sine and cosine transforms – Convolution theorem – Parseval's identity of Fourier transform.

**UNIT IV LAPLACE TRANSFORM (12)**

Transforms of standard functions – Properties of Laplace transform – Transforms of derivatives and integrals – Initial and final value theorem – Transforms of periodic functions.

**UNIT V INVERSE LAPLACE TRANSFORM (12)**

Inverse Laplace transforms of standard functions – Inverse Laplace transform using second shifting theorem – Method of partial fractions– Solution of ordinary differential equations with constant coefficients using Laplace transforms

**Total Hours: 45+15**

**TEXT BOOKS:**

1. John W. Miles, "Integral Transforms in Applied Mathematics", Cambridge University Press, 2008.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition 2017.

**REFERENCE BOOKS:**

1. Eric W Hansen, "Fourier Transforms: Principles And Applications", John Wiley, 2014.
2. N.W. McLachlan, "Laplace Transforms and Their Applications to Differential Equations", Dover Publications Inc., 2014.
3. Richard Haberman, "Applied Partial Differential Equations with Fourier Series and Boundary Value Problems", Pearson, Fifth edition, 2021.

**WEBLINKS:**

1. <https://nptel.ac.in/courses/111106111>
2. <https://nptel.ac.in/courses/111107111>
3. <https://nptel.ac.in/courses/111102129>
4. <https://nptel.ac.in/courses/111106139>
5. <https://archive.nptel.ac.in/courses/111/105/111105123/>

## SEMESTER-II

23BEEE202

ELECTRO CHEMISTRY

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 make the students conversant with the information on electrolyte properties.
- To make the student acquire sound knowledge of electrochemical cells.
- To impart knowledge on basic principles of battery and conversion devices
- To build the concept of corrosion and its prevention.
- To learn the concepts and applications of different electroanalytical technique and understand the chemical principles in the projects undertaken in field of engineering

**COURSE OUTCOMES:**

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

- Explain the basic concepts of electrochemistry and its applications.
- Compare the performance of electrochemical cells using conductometric and potentiometric titrations.
- Apply the concepts of electrochemistry in storage devices.
- Illustrate the electrochemical corrosion and its prevention.
- Explain the principles and working of electroanalytical techniques.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	1	1	-	1	-	1	-	-
CO2	2	1	-	-	-	2	1	1	-	1	-	1	-	-
CO3	3	2	-	-	-	2	1	1	-	1	-	1	-	-
CO4	2	1	-	-	-	2	1	1	-	1	-	1	-	-
CO5	2	1	-	-	-	2	1	1	-	1	-	1	-	-
Avg.	2.2	1.2	-	-	-	2	1	1	-	1	-	1	-	-

3-Strong; 2-Medium; 1-Low

## **UNIT I PROPERTIES OF ELECTROLYTES**

**(9)**

Introduction to Electrochemistry, Ohm's law- Conductance in metals and electrolytic solution- Specific conductance and electrolytic conductance. Faraday's laws of Electrolysis, Arrhenius theory of electrolytic dissociation, concept of units in electrochemistry- Dissociation constants-pH Scale- Relation between pH and pOH, common ion effect-buffer solutions- Types-buffer action- Henderson's Equation-Hydrolysis of Salts-Degree of hydrolysis.

## **UNIT II EQUILIBRIUM ELECTROCHEMISTRY**

**(9)**

Electrochemical cells – Reversible and irreversible cells – EMF – Measurement of emf – Single electrode potential – Nernst equation – Reference electrodes –Standard Hydrogen electrode – Calomel electrode – Ion selective electrode – Glass electrode and measurement of pH – Electrochemical series – Significance – Conductometric Titrations-Potentiometric titrations (Redox -  $\text{Fe}^{2+}$  vs dichromate).

## **UNIT III ENERGY STORAGE DEVICES**

**(9)**

Batteries- Primary and secondary cells: Leclanche cell, Lead Acid Battery, Nickel Cadmium Battery, Lithium Battery, Charging and discharging reactions. An introduction to Fuel Cell,  $\text{H}_2\text{-O}_2$  Fuel Cell. Solar Energy: Introduction, importance of solar PV cell, Construction and working of solar PV cell, advantages and disadvantages.

## **UNIT IV ELECTROCHEMISTRY OF CORROSION**

**(9)**

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

## **UNIT V ELECTROANALYTIC TECHNIQUES**

**(9)**

Electroanalytical techniques (Principles, Instrumentation and applications only) cyclic voltammetry, amperometry, polarography, electrochemical impedance spectroscopy, Electrochemical sensors, modified electrodes and their applications.

**Total Hours: 45**

### **TEXT BOOKS:**

1. P C Jain & Monica Jain, Engineering Chemistry, 17<sup>th</sup> Edition, Dhanpat Rai Publishing Company, 2015.
2. B.K. Sharma, "Instrumental methods of Analysis" Geol Publications, 2000.
3. A.K. Srivastava and P.C. Jain, "Instrumental approach to chemical Analysis" S. Chand Publications, 2009.

## REFERENCE BOOKS:

1. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", Vishal Publications, Jalandhar, 2002.
2. R.L. Madam, G.D. Tuli, "Simplified course in Physical Chemistry" 5<sup>th</sup> revised and enlarged edition, S. Chand & Co., New Delhi, 2009.
3. Samuel Glasstone, "An introduction to Electrochemistry", 2<sup>nd</sup> Edition, East-West edition, New Delhi, 2016.
4. N. Kundu and S.K. Jain, "Physical Chemistry", S. Chand & Co, New Delhi, 2000.
5. Cynthia G. Zoski (2007) Hand Book of Electrochemistry, Academic Press, Elsevier., UK
6. D.Pletcher and F.C. Walsh, (2012) Industrial Electrochemistry, Chapman and Hall, London
7. Vladimir S. Bagotsky, Alexander M. Skundin, Yuriy M. Volfkovich, (2015) Electrochemical Power Sources: Batteries, Fuel Cells, and Supercapacitors, Wiley India Pvt. Ltd
8. Bruno Scrosati (2012) Applications of Electroactive Polymers Chapman & Hall, London.

## SEMESTER-II

23BEEE203

FUNDAMENTALS OF WEB 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 understand the principles of web design.
- To gain knowledge of HTML and its elements.
- To infer the concepts of CSS and various layouts for styling a web page.
- To develop designing interactive web pages using JavaScript.
- To learn about responsive web design using Bootstrap.

## COURSE OUTCOMES:

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

- Develop interactive front-end web user interfaces using responsive web design principles.
- Experiment with HTML tags and its elements for designing static pages.
- Apply the concepts of CSS and layouts for styling web pages.
- Build dynamic web pages using JavaScript.
- Create responsive web pages by using Bootstrap.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	2	2	-	2	-	2
CO2	3	2	1	-	1	-	-	-	2	2	-	2	-	2
CO3	3	2	1	-	1	-	-	-	2	2	-	2	-	2
CO4	3	3	2	1	1	-	-	-	2	2	-	2	-	2
CO5	3	3	2	1	1	-	-	-	2	2	-	2	-	2
Avg.	3	2.2	1.4	0.4	1	-	-	-	2	2	-	2	-	2

3-Strong; 2-Medium; 1-Low



## **UNIT I THE ESSENTIALS OF WEB DESIGN**

**(9)**

Introduction to web design – the internet versus the web – web browsers – the design process - defining good design - web page anatomy - grid theory – balance – unity – emphasis – layouts – web trends - responsive design - screen resolutions - responsive web design principles - responsive frameworks – accessibility – site performance - modern web development tools.

## **UNIT II INTRODUCTION TO HTML**

**(9)**

Introduction to HTML - document structure – paragraphs – headings – lists – div – span – improving accessibility with aria – hyperlinks – adding images – table markup – forms – embedded media.

## **UNIT III CASCADING STYLE SHEETS**

**(9)**

Introduction to CSS – units of measurement – formatting text with css3 – colours and backgrounds - padding – borders – margins – floating and positioning – CSS layout with Flexbox and Grid.

## **UNIT IV DYNAMIC WEB PAGES USING JAVASCRIPT**

**(9)**

Introduction to JavaScript – adding JavaScript to a page – anatomy of a script – the browser object – events – DOM – polyfills – JavaScript libraries.

## **UNIT V RESPONSIVE WEB DESIGN USING BOOTSTRAP**

**(9)**

Introduction to Bootstrap – setting up bootstrap – structuring web page using bootstrap – grid system – typography – tables – forms – images – effects – icons - components.

**TOTAL: 45**

### **TEXT BOOKS:**

1. “Learning Web Design”, Jennifer Niederst Robbins, O’Reilly Media, Inc, Fifth Edition, 2018.
2. “Introducing Bootstrap 4”, Jorg Krause, Apress Media LLC, Second Edition, 2020.

### **REFERENCE BOOKS:**

1. “The Principles of Beautiful Web Design”, Jason Beaird, James George and Alex Walker, SitePoint Pty. Ltd., Fourth Edition, 2020.
2. “Responsive Web Design with HTML5 and CSS”, Ben Frain, Packt Publishing, Third Edition, 2020.
3. “Mastering Bootstrap 4”, Benjamin Jakobus and Jason Marah, Packt Publishing, Second Edition, 2016.

**WEBLINKS:**

1. <https://www.w3schools.com/html/>
2. <https://www.w3schools.com/css/>
3. <https://www.udacity.com/course/responsive-web-design-fundamentals--ud893>
4. <https://javascript.info/>
5. <https://getbootstrap.com/docs/4.6/getting-started/introduction/>

## SEMESTER-II

23BEEE241

ELECTRICAL CIRCUIT ANALYSIS

6H-5C

(Theory &amp; Lab.)

Instruction Hours/week:L:3 T:1 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## i)THEORY

## COURSE OBJECTIVES:

- 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 & coupled circuits

## COURSE OUTCOMES:

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

- Build the electric circuits DC and AC excitation by applying various circuit laws.
- Apply the network theorems to determine behavior of the given DC and AC circuit.
- Compare the frequency response of series and parallel RLC circuits
- Illustrate the transient response of DC and AC circuit.
- Infer power, line/ phase voltage and currents of the given three phase circuit and dynamic behavior of two port networks.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	1	1	-	1	3	-
CO2	3	3	2	2	-	-	-	1	1	1	-	1	3	-
CO3	2	2	1	1	-	-	-	1	1	1	-	1	2	-
CO4	2	2	1	1	-	-	-	1	1	1	-	1	2	-
CO5	2	2	1	1	-	-	-	1	1	1	-	1	2	-
Avg.	2.4	2.4	1.4	1.4	-	-	-	1	1	1	-	1	2.4	-

3-Strong; 2-Medium; 1-Low

## **UNIT I BASIC CIRCUITS ANALYSIS (12)**

Ohm's Law – Kirchhoff'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

**TOTAL:45+15**

### **TEXT BOOKS:**

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998

### **REFERENCE BOOKS:**

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

## **(ii) LABORATORY**

### **LIST OF EXPERIMENTS**

1. Experimental verification of electrical circuit problems using ohm's laws.
2. Node and Mesh Analysis for AC and DC circuits.
3. Experimental verification of electrical circuit problems using Kirchhoff's voltage laws and Kirchhoff's current laws.
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 Superposition theorem.

## SEMESTER-II

23BEEE242A

DATA STRUCTURES AND ALGORITHMS

6H-5C

(Theory &amp; Lab.)

Instruction Hours/week: L:4 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## i) THEORY

## COURSE OBJECTIVES:

- To understand the concepts of ADTs.
- To learn linear data structures – lists, stacks, and queues.
- To interpret non-linear data structures – trees and graphs.
- To implement sorting, searching and hashing algorithms.
- To apply Tree and Graph structures to real world scenario.

## COURSE OUTCOMES:

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

- Build abstract data types for linked list data structure.
- Apply the concepts of stack, queue and its applications.
- Experiment with operations on binary trees.
- Identify the traversal techniques of graphs and its applications.
- Inspect sorting, searching and hashing techniques.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	1
Avg.	3	3	2.4	0.2	-	-	-	-	2	2	-	2	-	1

3-Strong; 2-Medium; 1-Low

## **UNIT I LISTS**

**(9)**

Abstract Data Types (ADTs) – Elementary Data types–List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Doubly-linked lists – Circularly linked lists – Applications of lists – Polynomial ADT –Multilists–Sparse Matrices.

## **UNIT II STACKS AND QUEUES**

**(9)**

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – Deque – Applications of Queues.

## **UNIT III TREES**

**(9)**

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees –Red-Black Trees – Priority Queue (Heaps) – Binary Heap.

## **UNIT IV MULTIWAY SEARCH TREES AND GRAPHS**

**(9)**

B-Tree – B+ Tree – Tries – Graph Definition – Representation of Graphs – Types of Graphs - Breadth-first traversal – Depth-first traversal — Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

## **UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES**

**(9)**

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort — Quick Sort – Merge Sort – Heap Sort – Radix Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Mark Allen Weiss,” Data Structures and Algorithm Analysis in C”, Pearson Education, Second Edition, 2005
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein,” Introduction to Algorithms”, Mcgraw Hill/ MIT Press, Fourth Edition, 2022

### **REFERENCE BOOKS:**

1. Narasimha Karumanchi,” Data Structures and Algorithms Made Easy”, Career Monk Publications, First Edition,2016
2. Langsam, Augenstein and Tanenbaum, “Data Structures Using C”, Pearson Education, Second Edition,2015
3. Kamthane,” Introduction to Data Structures in C”, Pearson Education, First Edition,2007
4. Kruse,” Data Structures and Program Design in C”, Pearson Education, Second Edition,2003

**WEBLINKS:**

1. [www.nptel.ac.in/courses/106106145](http://www.nptel.ac.in/courses/106106145)
2. [www.nptel.ac.in/courses/106102064](http://www.nptel.ac.in/courses/106102064)
3. [www.coursera.org/learn/data-structures](http://www.coursera.org/learn/data-structures)
4. [www.edx.org/learn/data-structures](http://www.edx.org/learn/data-structures)
5. [www.cs.usfca.edu/~galles/visualization/Algorithms.html](http://www.cs.usfca.edu/~galles/visualization/Algorithms.html)

**ii) LABORATORY****LIST OF EXPERIMENTS:**

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
5. Implementation of Binary Search Trees and AVL Trees
6. Implementation of Heaps using Priority Queues
7. Implementation of Dijkstra's Algorithm
8. Implementation of Prim's Algorithm
9. Implementation of Linear Search and Binary Search
10. Implementation of Insertion Sort and Selection Sort
11. Implementation of Merge Sort and Quick Sort
12. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

**TOTAL: 30**



**SEMESTER-II****23BEEE242B****OBJECT ORIENTED PROGRAMMING WITH PYTHON****6H-5C****(Theory & Lab.)****Instruction Hours/week: L:4 T:0 P:2****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****i) THEORY****COURSE OBJECTIVES:**

- To learn basic python language syntax, semantics and control structures.
- To apply list, tuple, set and dictionary to handle data.
- To solve the problems using functions and modules.
- To infer the object-oriented programming concepts in python.
- To interpret inheritance and exception handling in python.

**COURSE OUTCOMES:**

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

- Apply python control flow statements to solve problems.
- Model data structures for string, tuple, list, set, and dictionary.
- Identify Python built-in functions to write user defined functions.
- Apply object-oriented programming concepts in python.
- Analyze the concepts of exception handling to a real world scenario.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	1
Avg.	3	2.2	1.2	0.2	-	-	-	-	2	2	-	2	-	1

**3-Strong; 2-Medium; 1-Low**

## **UNIT I - PYTHON FUNDAMENTALS**

**(9)**

Introduction to Python – language classification - python language syntax - keywords - identifiers - indentation - comments - input - output - escape characters – variables – operators - Control Statements.

## **UNIT II - DATA STRUCTURES IN PYTHON**

**(9)**

String - Mutable vs immutable types – indexing and slicing – String functions - Tuple - Tuple operations– List - List operations – List as array – List comprehension - Set - Set operations – Dictionary – Dictionary operations.

## **UNIT III - FUNCTIONS AND MODULES**

**(9)**

Python built in functions - User defined functions - Creating function – Invoking functions – Types of function arguments – Recursion and lambda or anonymous functions - Defining, Creating and Accessing a Package, importing packages and user defined modules.

## **UNIT IV - CLASSES AND OBJECTS**

**(9)**

Object Oriented terminologies (class, object, method, inheritance, abstraction, encapsulation, polymorphism) – UML Class diagram - access specifiers – Creating classes – Creating object – Accessing members - `__init__()` method - instance, static and class methods - Importance of self – Implementing encapsulation.

## **UNIT V - INHERITANCE, POLYMORPHISM AND EXCEPTION HANDLING**

**(9)**

Implementing inheritance – Types of inheritance – Implementing Polymorphism - Method overloading – Method overriding – Operator overloading - Abstract Classes - Association and Aggregation - Errors vs exceptions – Handling exceptions – Raising exception – Creating user defined exception.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Think Python: How to Think Like a Computer Scientist Anany Levitin, Allen B. Downey  
Second Edition, O'Reilly, 2016.
2. Python 3 Object-oriented Programming, Dusty Phillips, Third Edition, Packet Publishing, 2018.

### **REFERENCE BOOKS:**

1. The Absolute Beginner's Guide to Python Programming, Kevin Wilson, A press Media LLC,  
First Edition, 2022.
2. Python 3 The Comprehensive Guide, Johannes Ernesti, Peter Kaiser, Rheinwerk Publishing Inc.,  
First Edition, 2022
3. Fundamentals of Python Programming, Richard L. Halterman, Southern Adventist University,  
First Edition, 2019

**WEBLINKS:**

1. <https://docs.python.org/3/>
2. <https://www.programiz.com/python-programming>
3. <https://www.scaler.com/topics/python/>
4. <https://www.geeksforgeeks.org/python-oops-concepts/>
5. <https://www.edureka.co/blog/object-oriented-programming-python/>

**ii) LABORATORY****LIST OF EXPERIMENTS:**

1. Programs using operators and control structures.
2. Programs using string functions.
3. Programs using tuple.
4. Programs using list.
5. Programs using set.
6. Programs using dictionary.
7. Programs using built-in functions.
8. Implementing user defined functions with various parameter options
9. Implementation of class & objects.
10. Implementation of inheritance and association.
11. Implementation of overloading and overriding.
12. Implementation of exception handling.

**TOTAL: 30**

## SEMESTER-II

23BEEE211

ENGINEERING GRAPHICS

4H-3C

Instruction Hours/week:L:2 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- Expose them to existing national standards related to technical drawings and develop their ability to produce engineering drawings using drawing instruments.
- Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.
- Introduce CAD software for the creation of 2D engineering drawings.
- Develop a clear understanding of projection and the projection of points.
- Produce computer generated drawings using CAD software and develop a clear understanding of plane geometry.

**COURSE OUTCOMES:**

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

- Apply BIS and ISO standards in engineering drafting.
- Construct mathematical curves in engineering applications
- Illustrate geometrical solids in 3D space using orthographic projections.
- Develop the projection of simple solids.
- Interpret the information of the 2D and 3D drawing.

**CO- PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	1	-	2	-	2	1	-
CO2	3	2	-	-	-	-	-	1	-	2	-	2	1	-
CO3	3	2	-	-	-	-	-	1	-	2	-	2	1	-
CO4	3	2	-	-	-	-	-	1	-	2	-	2	1	-
CO5	3	3	2	1	-	-	-	1	-	2	-	2	1	-
Avg.	3	2.2	0.4	0.2	-	-	-	1	-	2	-	2	1	-

3-Strong; 2-Medium; 1-Low

## **UNIT I INTRODUCTION**

**(9)**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Bureau of Indian Standards (BIS), Layout of drawing sheets, sizes of drawing sheets, different types of lines used in drawing practice geometric constructions, principles of dimensioning– linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension. Reducing Scale, Enlarging Scale, Plain Scale, Diagonal Scale and Vernier Scale. Conic sections including the Ellipse, Parabola and Hyperbola (eccentricity method only); Cycloid, Epicycloid, Hypocycloid and Involute.

## **UNIT II FREE HAND SKETCHING**

**(9)**

Representation of Three-Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

## **UNIT III INTRODUCTION TO COMPUTER GRAPHICS – 2D**

**(9)**

Overview of Computer Graphics, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software, Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Annotations, layering and other functions. Sketching of 2D simple geometries, editing and dimensioning of 2D geometries.

## **UNIT IV PROJECTION OF POINTS AND LINES**

**(9)**

Projection of points and straight lines located in the first quadrant inclined to both planes– Determination of true lengths and true inclinations (By using CAD software).

## **UNIT V PROJECTION OF PLANE SURFACES**

**(9)**

Projection of polygonal surface and circular lamina inclined to both reference planes (By using CAD software)

**TOTAL: 45**

### **TEXT BOOKS:**

1. Venugopal K and Prabhu Raja V, (2021), Engineering Graphics, New Age International Publishers.
2. James D. Bethune, (2020), Engineering Graphics with AutoCAD, Macromedia Press.
3. C M Agrawal and Basant Agrawal, (2019), Engineering Graphics, Tata McGraw Hill, New Delhi.

### **REFERENCE BOOKS:**

1. Annaiah M.H., Prem Kumar, Chandrappa C N, (2022), Computer Aided Engineering Drawing, New Age International Private Limited.
2. Narayana, K.L. and P Kannaiah, (2021), Text book on Engineering Drawing, Scitech Publications (India) Pvt. Ltd.
3. Shah, M.B. and Rana B.C., (2010), Engineering Drawing and Computer Graphics, Pearson Education.
4. Bhatt N.D., Panchal V.M. and Ingle P.R, (2019), Engineering Drawing, Charotar Publishing House.

**WEBLINKS:**

1. [https://onlinecourses.nptel.ac.in/noc21\\_me128](https://onlinecourses.nptel.ac.in/noc21_me128)
2. <https://www.mygreatlearning.com/academy/learn-for-free/courses/engineering-graphics-drawin>
3. <https://www.autodesk.in/solutions/technical-drawing>

<b>23BEMC251</b>	<b>SEMESTER-II SOFT SKILLS</b>	<b>1H -0C</b>
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**Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:100 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Encourage all round development of the students by focusing on soft skills.
- Make the students aware of critical thinking and problem-solving skills.
- Develop leadership skills and organizational skills through group activities.
- Function effectively with heterogeneous teams.
- Develop social and work-life skills as well as personal and emotional well-being.

**COURSE OUTCOMES:**

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

- Memorize various elements of effective communicative skills.
- Interpret people at the emotional level through emotional intelligence.
- Apply critical thinking skills in problem solving.
- Analyze the needs of an organization for team building.
- Judge the situation and take necessary decisions as a leader.

**UNIT-1 COMMUNICATION SKILLS**

Introduction, meaning, significance of soft skills –definition, significance, types of communication skills  
-Intrapersonal & Inter-personal skills

**UNIT-2 CRITICAL THINKING**

Active Listening –Observation –Curiosity –Introspection –Analytical Thinking –Open-mindedness –  
Creative Thinking-Public Speaking

**UNIT -3 PROBLEM SOLVING & DECISION MAKING**

Meaning & features of Problem Solving –Managing Conflict –Conflict resolution –Methods of decision making –Effective decision making in teams –Methods & Styles -Time Management

**TEXT BOOKS:**

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher: I K International Publishing House; 0 edition (February 28, 2018)
3. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018

**SEMESTER-II****23BEMC252****WOMEN SAFETY AND SECURITY****1H - 0C****Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:100 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Highlight the social construction of gender in Indian society and the role of social institutions in the socialization process.
- Make aware about the practical issues concerning gender and politics.
- Classify the students in engendering national policies and programmes.
- Observe the liability of women and women's work in the context of globalization.
- Acquaint knowledge about the political participation of women and the gendered structures of governance and polity.

**COURSE OUTCOMES:**

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

- Infer into the basic concepts related to sex, gender, femininity etc.
- Demonstrate the rationale for women's studies
- Compare Gender Equality Issues and Movements in Women's Studies
- Summarize the Social construction of Gender, Gender Roles and Gender stereotyping.
- Illustrate Social Structures, Changing Status of Women in India.

**UNIT I FUNDAMENTAL CONCEPTS OF WOMEN'S STUDIES**

Definition- Objectives of Women's Studies; Importance of Women's Studies; Women's Studies as an Academic Discipline; Role of UGC Centre for Women's Studies

**UNIT II SOCIAL EMPOWERMENT**

Women in Higher Education; Gender issues in Health, Environment, Family welfare Measures, Indecent representation of Women in media; Women in Difficult circumstances; Constitutional.

**UNIT III POLITICAL EMPOWERMENT**

Women leaders in politics-Women in Local Governance- Barriers- Reservation policies- Women's Political Rights, Property Rights - Violence against Women -Women's work

**TEXT BOOKS:**

1. Amy S. Wharton. (2005). "The Sociology of Gender: An Introduction to Theory and Research". (Key Themes in Sociology) Blackwell Publishing, UK, Indian Reprint, Kilaso Books, New Delhi.
2. Devaki Jain and Pam Rajput (Ed). (2003). "Narratives from the Women's Studies Family: Recreating Knowledge, Sage, and New Delhi.
3. Jasbir Jain (Ed). (2005). "Women in Patriarchy: Cross Cultural". Rawat Publication Jaipur.



## SEMESTER-III

23BEEE301A

DISCRETE MATHEMATICS

4H-4C

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To inculcate the concepts of theories on Numbers.
- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To synthesize methods of solving problems in summation of series and recurrence relations.
- To introduce the concept of Theoretical Distributions.
- To make the students to interpret the importance of correlation function and spectral studies.
- Provide a firm basis for further reading and study in the subject.

**COURSE OUTCOMES:**

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

- Interpret the concepts of divisibility, prime number, congruence and number theorem.
- Solve a given problem using propositional logic.
- Explain the concept of Mathematical induction and the fundamentals of Probability
- Infer standard distributions of random variables.
- Explain the perceptions of correlation and spectral densities.

**CO- PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.2	1.2	0.2	-	-	-	-	-	-	-	-	1	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I NUMBER THEORY**

**(12)**

Divisibility – Fundamental Properties – Euclidean algorithm – Euclid’s lemma – Fundamental theorem of arithmetic – Congruence – Fermat’s Little theorem (statement only) and the Chinese remainder theorem (statement only).

## **UNIT II PROPOSITIONAL CALCULUS**

**(12)**

Propositional Calculus: Propositions – Logical connectives - compound propositions – conditional and biconditional propositions - Truth tables - Tautologies and contradictions – contrapositive – Logical equivalences and implications – Demorgan’s Laws – Normal forms – Principal conjunctive and disjunctive normal forms.

## **UNIT III COMBINATORICS**

**(12)**

Mathematical Induction – Permutations and combinations - Recurrence Relation – Formation of Recurrence relation – Solution of recurrence relation by Generating Functions – Concept of Probability – Conditional– Theorem of Total Probability – Baye’s theorem.

## **UNIT IV THEORETICAL DISTRIBUTIONS**

**(12)**

One-dimensional Random Variables – Discrete and Continuous Random variables – Probability distribution function – Probability density function - Mathematical Expectations – Moments – Mean and Variance – Moment generating function of Binomial, Poisson and Normal distributions-

## **UNIT V STOCHASTIC PROCESS**

**(12)**

Classification of Random Process – Discrete and Continuous cases — Auto Correlation Functions – Properties – Stationary Random processes – WSS and SSS processes – Power spectral density – properties of power spectral density – Cross-power spectral density and properties – Auto-correlation function and power spectral density of a WSS random sequence.

**TOTAL: 45+15**

## **TEXT BOOKS:**

1. Ralph P Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, 5th Edition, Pearson New International Edition, 2016.
2. Kenneth H. Rosen, “Discrete Mathematics and Applications”, 7th Edition, McGraw Hill Education, 2012.
3. Peebles P Z, “Problems and solutions in probability, random variables and random signal principles (SIE)”, 1st Edition, McGraw Hill Education, 2017.
4. Roy D Yates and David J Goodman, “Probability and Stochastic processes 2nd Edition”, Wiley India Pvt Ltd, 2005.
5. Douglas C. Montgomery & George C. Runger, “Applied Statistics and Probability for Engineers”, John Wiley, Sixth Edition, 2016.

## REFERENCE BOOKS:

1. Kenneth H Rosen, “Discrete Mathematics and its Applications with Combinatorics and Graph Theory”, 7<sup>th</sup> Revised Edition, Tata McGraw – Hill Pub Co Ltd, 2017.
2. Kishor S Trivedi, “Probability and Statistics with reliability, Queueing and Computer Science Applications”, 2nd Edition, Revised Paper book, Prentice Hall of India, 2016.
3. Bernard Kolman, Robert C Busby and Sharon Ross, “Discrete Mathematical Structures”, 6th Edition, Pearson publishers, 2008.
4. Henry Stark and John W Woods, “Probability and Random Processes with application to signal processing”, 3rd Edition, Pearson Education, 2002.

## WEBLINKS:

1. <https://www.geeksforgeeks.org/proposition-logic/>
2. [www.tutorialspoint.com/discrete\\_mathematics/](http://www.tutorialspoint.com/discrete_mathematics/)
3. <https://nptel.ac.in/courses/108103185>
4. <https://nptel.ac.in/courses/108106083>
5. [www.mathworld.wolfram.com](http://www.mathworld.wolfram.com)

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<b>23BEEE301B</b>	<b>SEMESTER-III</b> <b>NUMERICAL METHODS</b>	<b>4H-4C</b>
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**Instruction Hours/week: L:3 T:1 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To inculcate the basic concepts of solving algebraic and transcendental equations.
- To understand the numerical techniques of interpolation in various intervals
- To provide the knowledge of numerical differentiation and integration
- To provide the knowledge of solving ordinary differential equations numerically
- To inculcate various techniques of solving partial differential equations numerically.

**COURSE OUTCOMES:**

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

- Solve the systems of linear and nonlinear equations by iterative methods.
- Make use of interpolation methods for finding the missing terms.
- Apply numerical methods for finding differentiation and integration of a given function.
- Solve ordinary differential equations using Euler's, Taylor's, Runge Kutta and Milne Thomson's method.
- Utilize implicit and explicit methods in heat and wave equations.

**CO- PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low**

## **UNIT I SOLUTION OF EQUATIONS**

**(12)**

Regular Falsi Method - Newton Raphson method for solving algebraic and transcendental equations - Solution of system of linear equations - Gauss elimination method - Gauss Jordan method -Gauss Seidel method

## **UNIT II INTERPOLATION**

**(12)**

Interpolations with unequal intervals-Lagrange's interpolation -Newton's divided interpolation - Interpolation with equal intervals-Newton's forward and backward interpolation

## **UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION**

**(12)**

Approximation of derivatives using Newton's forward and backward interpolation - Numerical integration using Trapezoidal, Simpson's 1/3 and 3/8 rule

## **UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**

**(12)**

**Single step method-** Euler's method-Taylor's series method-Fourth order Runge – Kutta method –Multi step method-Milne's predictor corrector method

## **UNIT V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS**

**(12)**

Solutions of one dimensional heat equation by Bender-Schmidt and Crank Nicholson methods – Numerical solutions of one dimensional wave equation by explicit method

**TOTAL: 60**

### **TEXT BOOKS:**

1. Kenneth H Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory", 7<sup>th</sup> Revised Edition, Tata McGraw – Hill Pub. Co. Ltd, 2017.
2. Steven C.Chapra and Raymond P.Canale, "Numerical Methods for Engineers", McGraw Hill Education, 7th Edition, 2015.
3. Curtis F. Gerald and Patrick O. Wheatley Applied Numerical Analysis Addison Wesley, Thirteenth Edition, 2004.

### **REFERENCE BOOKS:**

1. Richard L. Burden and J. Douglas Faires, "Numerical Methods", Brooks/Cole, 4th edition, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition, 2011

### **WEBLINKS:**

1. <https://archive.nptel.ac.in/courses/111/107/111107105/>
2. <https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/resources/lecture-2-eulers-numerical-method-for-y-f-x-y/>
3. <http://www.infocobuild.com/education/audio-video-courses/mathematics/numerical-analysis-iit-madras.html>
4. <http://www.infocobuild.com/education/audio-video-courses/mathematics/NumericalMethods-FiniteDifference-IIT-Roorkee/lecture-06.html>

## SEMESTER-III

23BEEE302

ELECTRICAL MACHINES-I

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To study the basic concepts of magnetic field.
- To understand the construction, working principle of DC machines and analyzes their performance.
- To Study the construction details of DC machines with back EMF equation and torque equation.
- To familiarize with the construction details of different types of transformers, working.
- To acquire the knowledge of constructional details, the principle of operation, prediction of performance, the methods of testing the three phase transformers and autotransformer.

**COURSE OUTCOMES:**

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

- Interpret the basic concepts of magnetic circuits and infer the different magnetic excited system.
- Analyze the operation of various DC machine and its performance.
- Explain the operation of DC generators & DC motor, its testing methods and speed control
- Interpret the constructional details single phase transformer, working principle and their performance.
- Interpret the constructional details three phase transformer, working principle and their performance.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2	1	1	-	-	-	1	-	-	-	1	3	1
<b>CO2</b>	3	3	2	2	-	-	-	1	-	-	-	1	3	1
<b>CO3</b>	2	2	1	1	-	-	-	1	-	-	-	1	3	1
<b>CO4</b>	2	2	1	1	-	-	-	1	-	-	-	1	3	1
<b>CO5</b>	2	2	1	1	-	-	-	1	-	-	-	1	3	1
<b>Avg.</b>	<b>2.2</b>	<b>2.2</b>	<b>1.2</b>	<b>1.2</b>	-	-	-	<b>1</b>	-	-	-	<b>1</b>	<b>3</b>	<b>1</b>

3-Strong; 2-Medium; 1-Low

## **UNIT I MAGNETIC FIELDS AND MAGNETIC CIRCUITS**

**(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 rotating element.

## **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 armature reaction.

## **UNIT-III DC MACHINE – MOTORING AND GENERATION**

**(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 DC machines

## **UNIT- IV SINGLE PHASE 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 single-phase transformers.

## **UNIT V THREE PHASE TRANSFORMERS**

**(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.

**TOTAL: 45**

**TEXT BOOKS:**

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, Mc Graw Hill Education, 2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

**REFERENCE BOOKS:**

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. 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

23BEEE303

ELECTROMAGNETIC FIELD

4H-4C

Instruction Hours/week:L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- 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

## COURSE OUTCOMES:

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

- Make use of vector calculus, coordinate system in electrostatic fields.
- Elaborate the concept of Conductors, Dielectrics and Capacitance
- Explain the concept of static magnetic fields.
- Illustrate the computation of force, inductance in magnetostatic fields and its boundary conditions.
- Explain the concept of Time varying fields and summarize the Maxwell's equation in different forms and different media.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	-	-	1	2	-
CO2	3	3	2	2	-	-	-	1	-	-	-	1	2	-
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	-
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	-
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	-
Avg.	2.4	2.4	1.4	1.4	-	-	-	1	-	-	-	1	2	-

3-Strong; 2-Medium; 1-Low

## **UNIT I REVIEW OF VECTOR CALCULUS AND STATIC ELECTRIC FIELD (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 operator del, 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, DIELECTRICS AND CAPACITANCE (9)**

Current and current density, Ohm's Law in Point form, Continuity of current Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance of wireline, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

## **UNIT-III STATIC MAGNETIC FIELDS (9)**

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

## **UNIT-IV MAGNETIC FORCES, MATERIALS AND INDUCTANCE (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 mutual inductances.

## **UNIT V TIME VARYING FIELDS AND MAXWELL'S EQUATIONS (9)**

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions. Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogeneous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

**TOTAL: 45**

### **TEXT BOOKS:**

1. M.N.O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 8th Revised edition, 2014.

**REFERENCE BOOKS:**

1. KA Gangadhar, Electromagnetic Field Theory“, Khanna Publishers; Eighth Reprint: 2015.
2. A. Pramanik, “Electromagnetism –Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, “Electromagnetism-Problems with solution”, Prentice Hall India,2012.
4. G.W. Carter, “The electromagnetic field in its engineering aspects”, Longmans,1954.
5. W.J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication,1980.

**WEBLINKS:**

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

## SEMESTER-III

23BEEE341A

JAVA PROGRAMMING

5H-4C

Instruction Hours/week:L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To learn the fundamental concepts of Java programming.
- To gain knowledge of inheritance in Java.
- To understand the concepts of abstraction, exception and packages in Java.
- To infer Java Collection API and Multithreading plugins.
- To implement JDBC and Lambda expression in Java.

**COURSE OUTCOMES:**

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

- Solve problems using basic object-oriented programming concepts.
- Develop Java programs using inheritance.
- Build Java programs using interface and package to solve a complex problem.
- Discover the collection API for given problem statement and Multithreading.
- Construct an application using JDBC Connections for Java Programming.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO4	3	3	2	1	-	-	-	2	2	2	-	2	-	1
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	1
Avg.	3	2.4	1.4	1	-	-	-	2	2	2	-	2	-	1

3-Strong; 2-Medium; 1-Low

## **UNIT I INTRODUCTION TO JAVA**

**(9)**

History of Java - Features of Java - Java Architecture - Comments - Data Types - Variables – Operators  
Type Conversion and Casting - Flow Control Statements - Reading Input from keyboard, Command  
Line Arguments, Using Scanner Class, Arrays - Classes and Objects - UML Class diagram - Methods -  
Constructors - static variables and Methods - this Keyword - Encapsulation -Concept of Access Control.

## **UNIT II INHERITANCE**

**(9)**

Inheritance, Types of Inheritance - Super and Sub Classes - super keyword - final class and methods -  
Object class - Understanding Polymorphism, Types of polymorphism, Method Overloading, Constructor  
Overloading, Method Overriding, Dynamic Method Dispatching - garbage collection - String class –  
String Buffer class – String Builder class

## **UNIT III DATA ABSTRACTION**

**(9)**

Packages, Introduction to Packages, User-Defined Packages, Accessing Packages - Abstract classes and  
Methods - Interfaces - Defining an interface - implementing interfaces - extending interfaces - Multiple  
Inheritance Using Interfaces - Exception Handling -Errors vs Exceptions - Exception hierarchy - usage  
of try, catch, throw, throws and finally - built in exceptions - user defined exceptions.

## **UNIT IV COLLECTION API AND MULTITHREADING**

**(9)**

Introduction to wrapper classes, Predefined wrapper classes, Conversion of types , Concept of Auto  
boxing and unboxing - Java Collections API - Introduction to Collection - Generics - List  
implementations - Set implementations - Map implementations – Multi threading: Introduction to  
Multi-threading - Process Vs Thread, Thread life cycle -Thread class, Runnable Interface - Thread  
creation, Thread control and priorities - Thread synchronization

## **UNIT V JDBC AND LAMBDA**

**(9)**

JDBC - Introduction to JDBC - Establishing connection - Executing query -Processing results - Prepared  
Statement - Callable Statement - Transactions - Meta-Data objects. Functional Interfaces -Predicates -  
Functions - Suppliers - Consumers - Lambda Expressions - Accessing local variables- Accessing class  
variables - Function argument in lambda expression - Sorting - Predicates and Lambda Expressions

**TOTAL :45**

### **TEXT BOOKS:**

1. Herbert Schildt, “Java2: The Complete Reference”, Tata McGraw- Hill, Twelfth Edition, 2022.
2. Cay S Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, Prentice Hall, Eleventh Edition, 2020.
3. Raoul – Gabriel Urma, Mario Fusco and Alan Mycroft,” Java 8 in Action: Lambdas, Streams and Functional – style Programming”, Manning Publications, First Edition, 2015.

## REFERENCE BOOKS:

1. David Flanagan and Benjamin Evans,” Java in Nutshell”, O’Reilly Media, Seventh Edition, 2018.
2. Deitel and Deitel,” Java How to Program, Early Objects”, Prentice Hall, Eleventh Edition, 2018.

## WEBLINKS:

1. <http://docs.oracle.com/javase/tutorial/java/nutsandbolts>
2. <http://www.javabeginner.com/learn-java>
3. <http://www.javapoint.com/creating-thread>
4. [http://www.ntu.edu.sg/home/ehchua/programming/java/JDBC\\_Basic.html](http://www.ntu.edu.sg/home/ehchua/programming/java/JDBC_Basic.html)
5. <http://www.javapoint.com/java-8-method-reference>

## ii) LABORATORY

### LIST OF EXPERIMENTS:

1. Programs using flow control statements and arrays.
2. Programs using classes and objects.
3. Programs using inheritance and polymorphism.
4. Programs using String, StringBuffer and StringBuilder class.
5. Programs using package, abstract class and interface.
6. Programs using exception handling mechanism.
7. Programs using user defined exception.
8. Programs using Collection API.
9. Programs using Multithreading.
10. Programs using Thread synchronization.
11. Programs using JDBC.
12. Programs using Lambda Expression.

**TOTAL : 30**

## SEMESTER-III

23BEEE341B

OBJECT ORIENTED PROGRAMMING  
(Theory & Lab.)

5H-4C

Instruction Hours/week:L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

## i) THEORY

## COURSE OBJECTIVES:

- To familiar with programming paradigms.
- To understand classes and objects.
- To understand realization of constructor and destructor.
- To know about inheritance and polymorphism concepts.
- To provide knowledge about pointers and exception handling.

## COURSE OUTCOMES:

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

- Illustrate the object oriented concepts and control structures.
- Build Java program using classes and objects.
- Develop program using inheritance and interfaces.
- Analyze multithreading and exception handling for real time applications.
- Interpret java program to handle input and output streams.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	1
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	1
CO4	3	3	2	1	-	-	-	2	2	2	-	2	-	1
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	1
Avg.	2.8	2.2	1.2	1	-	-	-	2	2	2	-	2	-	1

3-Strong; 2-Medium; 1-Low

## **UNIT I INTRODUCTION**

**(9)**

Introduction: Programming paradigms – Procedural programming – Modular programming – Object oriented programming – Basic concepts of OOPS – Procedure versus object oriented programming – Applications of C++

## **UNIT II BASIC I/O OPERATIONS**

**(9)**

Tokens – Keywords – Identifiers – Variables – Constants – Data types – Operators – Control structures – Basic I/O operations. Classes and Objects: Classes – Access specifiers – Objects – Scope resolution operator – Data and member functions – Objects and instances – Static class members – Default arguments – Constant objects – Array of objects – Constant member functions

## **UNIT III CONSTRUCTORS AND DESTRUCTORS**

**(9)**

Constructors and Destructors: Constructors – Types of constructors – Overloaded Constructors – Destructors – Overloading: Functions – Call by value – Call by reference – Call by address – Inline functions – Friend functions – Friend classes – Overloading – Function overloading – Operator overloading – Operator overriding.

## **UNIT IV INHERITANCE**

**(9)**

Inheritance: Introduction – Base and Derived classes – Accessibility modes and inheritances – Types of inheritance – Single – Multiple – Multilevel – Hybrid – Hierarchical inheritances – Threading – Constructors in Base and Derived classes – Abstract class – Wrapper classes. Pointers and Exception handling: Pointers –

## **UNIT V DYNAMIC MEMORY ALLOCATION**

**(9)**

Dynamic memory allocation – Array of pointer to base class objects – Polymorphism – Compile time and runtime – Static and dynamic binding – Virtual functions – Need for Virtual functions – Exception handling – Try-catch – Throw – Multiple catch statements – Uncaught exceptions – Templates – File concepts – Threading.

**TOTAL:45**

### **TEXT BOOKS:**

1. Balagurusamy E, "Object Oriented Programming with C++", Tata McGraw Hill, Sixth Edition, 2013.
2. Yashavant SKanetkar, "Let us C++", BPB publications, Second Edition, 2017.

### **REFERENCE BOOKS:**

1. Herbert Schildt, "C++ - The Complete Reference", Tata McGraw Hill Fourth Edition, 2017.
2. Ashok N Kamthane, "Programming in C++", Pearson Education Second Edition, 2013.
3. John R Hubbard, "Programming with C++", Tata McGraw Hill, Third Edition, 2009.



**WEBLINKS:**

1. [www.cplusplus.com](http://www.cplusplus.com).
2. [www.desy.de/gna/html/cc/Tutorial/node3.htm](http://www.desy.de/gna/html/cc/Tutorial/node3.htm)
3. [www.askville.amazon.com/Compare-Contrast-Structured-programming-Object-](http://www.askville.amazon.com/Compare-Contrast-Structured-programming-Object-)
4. [www.stanford.edu](http://www.stanford.edu)
5. [www.cs.uwlax.edu/~jjhursey/teaching/2012](http://www.cs.uwlax.edu/~jjhursey/teaching/2012)

**ii) LABORATORY****LIST OF EXPERIMENTS:**

1. Programs on control structures.
2. Programs on arrays.
3. Programs on functions.
4. Programs on inline functions.
5. Programs on classes and objects.
6. Programs on function overloading.
7. Programs on operator overloading.
8. Programs on constructors and destructors.
9. Program on friend class.
10. Programs on friend functions.
11. Programs on inheritances.
12. Programs on virtual base classes.
13. Program on virtual functions.
14. Programs on exception handling.

**TOTAL : 30**

## SEMESTER-III

23BEEE342

ELECTRON DEVICES AND CIRCUITS  
(Theory & Lab.)

5H-4C

Instruction Hours/week: L:3 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3 Hours

## (i) THEORY:

## COURSE OBJECTIVES:

- Understand the structure of basic electronic devices.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the operation of multistage and differential amplifiers.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

## COURSE OUTCOMES:

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

- Examine the construction, working of all types of diodes and its applications.
- Simplify the operation of BJT, MOSFET, FET, UJT, Thyristors and Transistors.
- Outline the small signal model of BJT amplifiers and its frequency response.
- Explain the concept of the multistage and difference amplifiers.
- Make use of feedback concept in different types of oscillators.

## CO-PO MAPPING:

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

3-Strong; 2-Medium; 1-Low

## **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 as regulator.

## **UNIT II TRANSISTORS AND THYRISTORS**

**(9)**

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

## **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 MULTI STAGE 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.

**TOTAL: 45**

### **TEXT BOOKS:**

1. David A. Bell, “Electronic devices and circuits”, Oxford University Higher Education, 5<sup>th</sup> edition 2018.
2. Sedra and smith, “Microelectronic circuits”, 7<sup>th</sup> Edition., Oxford University Press

### **REFERENCE BOOKS:**

3. Balbir Kumar, Shail. B. Jain, “Electronic devices and circuits”, PHI learning private limited, 2<sup>nd</sup> edition, 2019.
4. Thomas L. Floyd, “Electronic devices “Conventional current version”, Pearson prentice hall, 10<sup>th</sup> Edition, 2017.
5. Donald A Neamen, “Electronic Circuit Analysis and Design”, TataMc Graw Hill, 3<sup>rd</sup> Edition, 2003.

## **(ii) LABORATORY**

### **LIST OF EXPERIMENTS**

1. V-I Characteristics of P-N Junction Diode.
2. V-I Characteristics of Zener Diode & Zener Regulator Characteristics.
3. LED Characteristics.
4. Half Wave and Full Wave Rectifier with and without Filter.
5. Characteristics of BJT in CE Configuration.
6. Drain and Transfer Characteristics of Junction Field Effect Transistor (JFET).

**TOTAL: 30**

## SEMESTER-III

23BEEE311

ELECTRICAL MACHINES LABORATORY-I

2H-1C

Instruction Hours/week:L:0 T: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 experimentally verify the different speed control of DC motors.
- To experimentally verify the transformer by Sumpner's test.

## COURSE OUTCOMES:

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

- Analyze the characteristics of DC shunt generator, DC compound generator and calculate critical resistance and critical speed.
- Examine load characteristics of DC shunt, series and compound motor and identify its maximum efficiency operating point.
- Estimate the efficiency of DC machines in different methods
- Determine the load characteristics of single phase transformer, separate the different losses and find the efficiency.
- Experiment with single phase transformer to calculate its equivalent circuit parameters.

## CO-PO MAPPING:

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

3-Strong; 2-Medium; 1-Low

## LIST OF EXPERIMENTS

1. Open circuit characteristics and load test on separately excited DC generator.
2. Open circuit characteristics and load test on DC compound generator
3. Open circuit characteristics and load test on DC shunt generator.
4. Load test on DC shunt motor.
5. Load test on DC series motor
6. Load test on DC compound motor.
7. Swinburne's test and speed control on DC shunt motor.
8. OC and SC tests on single phase transformer.
9. Load test on single phase transformer.
10. Sumpner's test.

**TOTAL: 30**

## SEMESTER-III

23BEMC351

APTITUDE AND REASONING

1H-0C

Instruction Hours/week: L:1 T:0 P:0

Marks: Internal:100 External:0 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

- Categorize, apply, and use thought processes to distinguish between concepts of Quantitative methods.
- Prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- Critically evaluate numerous possibilities related to puzzles.
- Understand and solve puzzle-related questions from specific and other competitive tests.
- Solve questions related to Time and distance and time and work etc.

## COURSE OUTCOMES:

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

- Explain the basics of quantitative ability.
- Solve questions related to Logarithm, Permutation and Combinations, Probability, Basic Accountancy, Time, Speed, distance, work, Ratio and area etc.
- Utilize satisfactory competency in Verbal Reasoning Questions.
- Solve campus placements aptitude papers covering Quantitative Ability and verbal skills.
- Apply Quantitative and Verbal reasoning in puzzle-related questions.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	3	-	-
Avg.	2.8	1.8	1	-	-	-	-	-	-	-	-	3	-	-

3-Strong; 2-Medium; 1-Low

## **UNIT - I Quantitative Ability (Basic Mathematics)**

- 1.1. Number Systems
- 1.2. LCM and HCF
- 1.3. Decimal Fractions
- 1.4. Simplification
- 1.5. Square Roots and Cube Roots
- 1.6. Problems on Ages
- 1.7. Surds & Indices
- 1.8. Percentages

## **UNIT – II Quantitative Ability (Applied & Engineering Mathematics)**

- 2.1. Logarithm
- 2.2. Permutation and Combinations
- 2.3 Probability
- 2.4 Profit and Loss
- 2.5 Simple and Compound Interest
- 2.6. Time, Speed and Distance
- 2.7. Time & Work
- 2.8. Ratio and Proportion
- 2.9. Area
- 2.10 Mixtures and Allegation

## **UNIT – III Verbal - Aptitude**

- 3.1 Words
- 3.2 Idioms
- 3.3 Phrases in Context
- 3.4 Reading comprehension techniques
- 3.5 Narrative sequencing
- 3.6 Data interpretation

### **TEXT BOOKS:**

1. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Agarwal
2. Analytical and Logical Reasoning By Sijwali B S

### **REFERENCE BOOKS:**

1. Quantitative aptitude for Competitive Examination by R S Agarwal
2. Analytical and Logical Reasoning for CAT and other management entrance tests by Sijwali B S
3. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition

### **WEBLINKS:**

1. <https://prepinsta.com/>
2. <https://www.indiabix.com/>
3. <https://www.javatpoint.com/>



**SEMESTER-III****23BEMC352****FOREIGN LANGUAGE –GERMAN****1H-0C****Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:100 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Learn design thinking concepts and principles
- Use design thinking methods in every stage of the problem
- Learn the different phases of design thinking
- Apply various methods in design thinking to different problems
- Identify a solution to any problem of life and business

**COURSE OUTCOMES:**

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

- Demonstrate the critical theories of design, systems thinking, and design methodologies
- Define key concepts of design thinking
- Practice design thinking in all stages of problem solving
- Apply design thinking approach to real world problems
- Use the concept of design thinking in their business world.

**UNIT-I :** Herzlich willkommen! -Wie ist dein Name ? -Ich trinke gern Kaffee.-Wir konjugieren die Verben.

**UNIT-II :** A bit of history and ZAHLEN - Verben, W-Fragen, Ja-Nein Fragen, Imperativ-das Alphabet, die Woche, das Jahr -Was sind deine Hobbys ? Formular ausfüllen

**UNIT-III :** Mein Lehrbuch | Meine persönlichen Daten-Mein Arbeitsbuch -Wir beginnen Lektion - Wir lesen Lektion 3

**UNIT-IV :** formeller Brief- Wie lernst du Deutsch ? -Wir hören ein deutsches Lied- Wir lernen Hörverständnis | Wir beginnen Lektion

**UNIT V :** Eine E-Mail schreiben | Eine Wohnung beschreiben- Im Kaufhaus | Welche/Diese-Gesund und munter

**TEXT BOOKS :**

1. NETZWERK Deutsch als Fremdsprache A1(Goyal, New Delhi, 2015)
2. Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)

**WEB LINKS:**

- <https://www.tatsachen-ueber-deutschland.de/en>
- <https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html>

**SEMESTER-III****23BEMC352****FOREIGN LANGUAGE –FRENCH****1H-0C****Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:100 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Learn design thinking concepts and principles
- Use design thinking methods in every stage of the problem
- Learn the different phases of design thinking
- Apply various methods in design thinking to different problems
- Identify a solution to any problem of life and business

**COURSE OUTCOMES:**

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

- Demonstrate the critical theories of design, systems thinking, and design methodologies
- Define key concepts of design thinking
- Practice design thinking in all stages of problem solving
- Apply design thinking approach to real world problems
- Use the concept of design thinking in their business world.

**UNIT I**

Recognize the French letters, Identify the letter-combinations that are characteristic of the French language, Identify the remaining letter-combinations that are characteristic of the French language,

**UNIT II**

Use the imperative in the affirmative form, Say the time in French, Talk about the weather in French, .Talk about actions that just happened, Speak about actions that are yet to happen

**UNIT III**

Learn a few basic and commonly used 2nd group verbs, Understand the concept of French ‘modal verb, Learn a few basic and commonly used 3rd group verbs, Learn what reflexive verbs, Distinguish between moods and tenses

**UNIT IV**

Place an order in a restaurant, Learn a third past tense, Identify a direct object, Identify an indirect object, Use direct and indirect objects pronouns in a single sentence

**TEXT BOOKS:**

1. Alter Ego - Méthode de Français, A1 (2006): Berthet, Hugot et al., Hachette
2. Alter Ego – Cahier d’activités, A1 (2006): Berthet, Hugot et al., Hachette
3. Écho - Méthode de Français, A1 (2013): Girardet, Pecheur, CLE International

**WEB LINKS:**

- [www.leo.org](http://www.leo.org)
- [www. Nptel.com](http://www.Nptel.com)

## SEMESTER-IV

23BEEE401A

STATISTICS AND OPTIMIZATION TECHNIQUES

4H-4C

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To understand the concept of statistical tools and apply in engineering.
- To understand various statistical techniques from both applied and theoretical points of view.
- To provide the concept of linear programming problem and its various solution procedures.
- To impart the knowledge of transportation and assignment models.
- To afford the adequate knowledge on networking models and game theory.

**COURSE OUTCOMES:**

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

- Explain the concept of measures of central tendency and measures of dispersion.
- Apply small and large sample tests in testing of hypothesis.
- Make use of Graphical method, Simplex method and Dual simplex method in linear programming models.
- Interpret solutions for transportation and assignment problems
- Solve network models, 2xn and mx2 games with and without saddle point.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.6	1.6	0.6	-	-	-	-	-	-	-	-	1	-	-

3-Strong; 2-Medium; 1-Low

## **UNIT I DESCRIPTIVE STATISTICS**

**(12)**

Measures of central tendency – Mean, median, mode, geometric mean and harmonic mean – Dispersions – Range, mean deviation, variance, standard deviation, coefficient of variation – Relative measures – Coefficient of correlation – Pearson’s correlation coefficient – Lines of regression.

## **UNIT II SAMPLING THEORY**

**(12)**

Test of hypothesis – Large sample tests based on normal distribution – Test for single mean – Difference between means – Proportion – Difference between proportion – Small sample test – Student-t test – Test for single mean – Difference between means – Snedecor’s F test – Chi-square test for goodness of fit, independence of attributes.

## **UNIT III LINEAR PROGRAMMING PROBLEM**

**(12)**

Advantages and disadvantages of LP - Formulation of LP - Algebraic solution of a LP - Graphical method - The simplex method - Principle of duality - Dual and primal problems - Dual simplex method.

## **UNIT IV TRANSPORTATION AND ASSIGNMENT MODELS**

**(12)**

Initial basic feasible solution - North west corner rule, row-minima, column minima, matrix minima and Vogel’s approximation methods - MODI method for finding optimum solution - Unbalanced transportation problems – Assignment Model - Initial basic feasible solution - Hungarian algorithm - Unbalanced Assignment Problem - Maximization in assignment problems.

## **UNIT V NETWORK MODELS AND GAME THEORY**

**(12)**

CPM & PERT techniques - Critical path method - PERT approach - Expected length of a project - Probability of project completion by due date - Game theory – Pay-off matrix - Pure strategies: Games with saddle point - The rules of dominance - mixed strategies: Games without saddle point - Solution of  $2 \times n$  and  $m \times 2$  games.

**TOTAL: 45+15**

### **TEXT BOOKS:**

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, “Introduction to Mathematical Statistics”, Pearson, Eighth Edition, 2019.
2. Geoffrey Grimmett and David Stirzaker, “Probability and Random Processes”, Oxford University Press Fourth Edition, 2020.
3. Hamdy A.Taha, “Operations Research – An Introduction”, Pearson Prentice Hall of India, Pvt. Ltd., New Delhi, 10th Edition, 2017.
4. Kanti Swarup Gupta, P K Manmohan, “Operations Research”, Sultan Chand & Sons, Fifteenth edition, 2010

**REFERENCE BOOKS:**

1. Irwin Miller and Marylees Miller John E Freund's Mathematical Statistics with Applications Pearson, Eighth Edition, 2014.
2. Sheldon M Ross, "Introduction to Probability and statistics for Engineers and scientists Elsevier, Fourth Edition, 2014.
3. Frederick S.Hillier, Gerald J.Lieberman Bodhibrata, Nag Preetam Basu, "Introduction to Operations Research", Tata McGraw-Hill Education Private Limited, Tenth Edition, 2017.
4. Ronald LRardin, "Optimization in Operations Research", Pearson, Second edition, 2016.
5. Ravindran Phillips Solberg, "Operations Research – Principles and Practice", Wiley, Second edition, 2007

**WEBLINKS:**

1. <https://nptel.ac.in/courses/111104120>
2. <https://nptel.ac.in/courses/110106062>
3. <https://archive.nptel.ac.in/courses/111/103/111103159/#>
4. <https://nptel.ac.in/courses/110104063>

**SEMESTER-IV**  
**23BEEE401B PROBABILITY AND STATISTICS**

4H-4C

Instruction Hours/week:L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To provide the required fundamental concepts of probability theory and Random variables.
- To introduce the concept of Theoretical Distributions.
- To impart the knowledge of Measures of Central tendencies, Dispersions
- To impart the knowledge of correlation and Regression
- To inculcate the knowledge of testing of hypothesis using small and large sampling tests.

**COURSE OUTCOMES:**

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

- Infer the fundamentals of probability and random variables.
- Explain standard distributions of random variables.
- Make use of statistical data for finding the measures of central tendency and measures of dispersion.
- Interpret the data using correlation and regression.
- Apply small and large sample tests in testing of hypothesis.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	2	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	2	-	-
Avg.	2.4	1.4	0.4	-	-	-	-	-	-	-	-	2	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I PROBABILITY AND RANDOM VARIABLES (12)**

Concept of Probability – Addition and multiplication laws – Conditional probability – Total Probability – Baye’s theorem and its applications – One dimensional Random Variables (Discrete and Continuous) – Mathematical Expectation.

## **UNIT II THEORETICAL DISTRIBUTIONS (12)**

Discrete distributions – Binomial, Poisson, Geometric Distributions – Continuous distributions – Uniform, Exponential and Normal Distributions.

## **UNIT III DESCRIPTIVE STATISTICS (12)**

Measures of Central Tendency – Mean, Median, Mode – Measures of Dispersion – Mean deviation – Standard deviation – Coefficient of variation

## **UNIT IV CORRELATION AND REGRESSION (12)**

Correlation – Pearson’s Correlation coefficient – Spearman’s Rank correlation coefficient – Regression –Regression lines- Linear, Multiple Regression- Logistic Regression - Polynomial Regression.

## **UNIT V TESTING OF HYPOTHESIS (12)**

Large sample tests based on normal distribution – Test for single mean – Difference between means – Proportion – Difference between proportions – Small sample test – Student-t test – Test for single mean – Difference between means – Snedecor’s F test – Chi-square test for goodness of fit, independence of attributes.

**TOTAL: 45+15**

### **TEXT BOOKS:**

1. Geoffrey Grimmett and David Stirzaker, "Probability and Random Processes", Oxford University Press, Fourth Edition, 2020.
2. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, "Introduction to Mathematical Statistics", Pearson, Eighth Edition, 2019.
3. Douglas C. Montgomery & George C. Runger, "Applied Statistics and Probability for Engineers", John Wiley, Sixth Edition, 2016.

### **REFERENCE BOOKS:**

1. Irwin Miller and Marylees Miller John E Freund’s, “Mathematical Statistics with Applications”, Pearson, Eighth Edition, 2014.
2. Sheldon M Ross, “Introduction to Probability and statistics for Engineers and scientists”, Elsevier, Fourth Edition, 2014.

## WEBLINKS:

1. [https://onlinecourses.nptel.ac.in/noc23\\_ge25/preview](https://onlinecourses.nptel.ac.in/noc23_ge25/preview)
2. <https://nptel.ac.in/courses/111104032>
3. <https://nptel.ac.in/courses/111106112>
4. <https://nptel.ac.in/courses/111105042>
5. <https://nptel.ac.in/courses/103106120>



## SEMESTER-IV

23BEEE402

ELECTRICAL MACHINES-II

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:**

- Understand the concept of AC machine windings.
- To know the concepts of Rotating Magnetic Field in Alternators.
- To study about Synchronous Motors.
- To impart the knowledge of Induction machines.
- To analyze the performance of single phase induction motor.

**COURSE OUTCOMES:**

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

- Outline the basic concepts of machine winding and revolving magnetic field theory.
- Illustrate the Construction and Operation of Salient and Non-Salient Pole Alternators.
- Examine the Performance of Synchronous Machines by various Methods
- Analyze the Performance of Induction Machines by various Methods.
- Explain the construction, operation and performance of single phase induction motor.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	3	1
CO2	2	2	1	1	-	-	-	1	-	-	-	1	3	1
CO3	3	3	2	2	-	-	-	1	-	-	-	1	3	1
CO4	3	3	2	2	-	-	-	1	-	-	-	1	3	1
CO5	2	2	1	1	-	-	-	1	-	-	-	1	3	1
Avg.	2.4	2.4	1.4	1.4	-	-	-	1	-	-	-	1	3	1

3-Strong; 2-Medium; 1-Low

## **UNIT I FUNDAMENTALS OF AC MACHINE WINDINGS (9)**

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn 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 distribution factor, revolving magnetic field.

## **UNIT II ALTERNATORS (9)**

Introduction - MMF distribution - Rotating Magnetic Field. Alternators: Constructional details, Principle of operation and types of Rotor- EMF equation- Armature reaction - Voltage regulation - EMF, MMF and ZPF- Two Reaction Theory - Synchronization and Synchronizing Power - Parallel operation.

## **UNIT III SYNCHRONOUS MOTOR (9)**

Synchronous motors: Starting methods, Phasor diagram, V and Inverted - V Curves, Hunting and its suppression, Effect of change in Excitation, Synchronous Condenser.

## **UNIT IV INDUCTION MACHINES (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 stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

## **UNIT V 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.

### **TEXT BOOKS:**

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

### **REFERENCE BOOKS:**

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. 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](https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/108105131/lec84.pdf)

## SEMESTER-IV

23BEEE403

LINEAR INTEGRATED CIRCUITS

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To study the IC fundamentals and IC fabrication procedure.
- To study characteristics; realize circuits, design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp, A/D Converter and D/A Converter.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.
- To introduce the concepts of wave form generation and introduce some special function ICs

**COURSE OUTCOMES:**

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

- Explain the IC fabrication steps.
- Summarize the Characteristics of Op-Amp and its applications
- Interpret the linear and non-linear applications of OP-AMPS.
- Make use of the different types of Special ICs.
- Summarize the applications of different types of ICs.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	-
CO2	2	2	1	1	-	-	-	1	-	-	-	1	2	-
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	-
CO4	3	3	2	2	-	-	-	1	-	-	-	1	2	-
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	-
Avg.	2.2	2.2	1.2	1.2	-	-	-	1	-	-	-	1	2	-

**3-Strong; 2-Medium; 1-Low**

**UNIT I IC FABRICATION****(9)**

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

**UNIT II 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.

**UNIT III APPLICATIONS OF OP-AMP****(9)**

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

**UNIT IV SPECIAL ICs****(9)**

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

**UNIT V APPLICATION ICs****(9)**

IC voltage regulators –LM78XX, 79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator-SMPS-LM380 power amplifier- ICL8038 function generator IC.

**TOTAL:45****TEXT BOOKS:**

1. David A. Bell, Op-amp & Linear ICs, Oxford, 2010
2. D. Roy Choudhary, Sheil B. Jani, Linear Integrated Circuits, New Age, 2003

**REFERENCE BOOKS:**

1. Ramakant A. Gayakward, Op-amps and Linear Integrated Circuits, Pearson Education, 2003
2. Fireo, Opamps & Linear Integrated Circuits Concepts & Applications, Cengage, 2003

## SEMESTER-IV

23BEEE404

DIGITAL ELECTRONICS

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various types of A/D and D/A converters
- To introduce the concepts of semiconductor memories and Programmable Logic Devices

## COURSE OUTCOMES

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

- Recall the use of number systems and its conversion and compare the operation, characteristics of digital logic families
- Apply the minimal SOP and POS forms of logic expression using K map and implement it with the combinational logic
- Analyze and design a synchronous sequential circuit to obtain a state table, State diagram for the time sequence of all the variables
- Classify and explain the different types of A/D and D/A converters
- Explain the concepts of semiconductor memories and Programmable Logic Devices.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	1	-	-	-	1	2	-
CO2	3	3	2	2	-	-	-	1	-	-	-	1	2	-
CO3	3	3	2	2	-	-	-	1	-	-	-	1	2	-
CO4	3	3	2	2	-	-	-	1	-	-	-	1	2	-
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	-
Avg.	2.4	2.4	1.4	1.4	-	-	-	1	-	-	-	1	2	-

3-Strong; 2-Medium; 1-Low

## **UNIT I FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES (9)**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexa decimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, 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 using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, 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-T and D type's flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

## **UNIT IV A/D AND D/A CONVERTERS (9)**

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

## **UNIT V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES (9)**

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

**TOTAL :45**

### **TEXT BOOKS:**

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/contentstorage2/nptel\\_data](https://nptel.ac.in/contentstorage2/nptel_data)
3. [html/mhrd/ict/text/117101106/lec25.pdf](http://mhrd/ict/text/117101106/lec25.pdf)

## SEMESTER-IV

23BEEE441

MEASUREMENTS AND INSTRUMENTATION

5H-4C

(Theory &amp; Lab.)

Instruction Hours/week:L:3 T:0 P:2

Marks: Internal:40 External:60 Total: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 to measure electrical quantities using standard analog and digital measuring instruments.
- To make the students to have a clear knowledge of the storage, display devices and transducer
- To learn the measuring devices for virtual instrumentation.

## COURSE OUTCOMES:

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

- Explain the units, dimensions and standards in measurements.
- Experiment with the knowledge of measuring instruments.
- Apply their knowledge to measure electrical quantities using standard analog and digital measuring instruments.
- Illustrate storage, display devices and transducer.
- Identify the measuring devices for virtual instrumentation.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	-	1	-	1	-	1	-	1	2	-
CO2	3	3	2	1	-	1	-	1	-	1	-	1	2	-
CO3	3	3	2	1	-	1	-	1	-	1	-	1	2	-
CO4	2	2	2	1	-	1	-	1	-	1	-	1	2	-
CO5	3	3	2	1	-	1	-	1	-	1	-	1	2	-
Avg.	2.6	2.6	2	1	-	1	-	1	-	1	-	1	2	-

3-Strong; 2-Medium; 1-Low



## **UNIT I 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– working Principle and types 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.

## **UNIT III MEASUREMENT OF POWER AND ENERGY**

**(9)**

Dynamometer type wattmeter – Single and three phase wattmeter's – 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 Energy meters, Smart Energy meter.

## **UNIT IV STORAGE, DISPLAY DEVICES AND TRANSDUCER**

**(9)**

Magnetic measurements–Magnetic disk and tape–recorders–Strip chart recorder–XY recorder. 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.

## **UNIT V 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 dialog control.

**TOTAL:45**

### **TEXT BOOKS:**

1. Doebelin. E.O. Measurement Systems Application and Design Tata McGraw Hill Publishing Company, New Delhi. Tata McGraw Hill 2003.
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 Lab VIEW Tata McGraw Hill Publishing Company Ltd., 2nd Edition 2010.

### **WEBLINKS**

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

**(i) LABORATORY**

**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 energy meter.
6. Conversion of Galvanometer into Voltmeter and Ammeter.
7. Measurement of three phase power and power factor using two-watt meter method.
8. Measurements of resistance using Kelvin's bridge.
9. Calibration of Voltmeter, Ammeter and Wattmeter
10. Study of phantom loading.
11. Study of Smart Energy Meter.

**TOTAL:30**

## SEMESTER-IV

23BEEE411

ELECTRICAL MACHINES LABORATORY-II

2H-1C

Instruction Hours/week:L:0 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES

- To acquire the knowledge on performance characteristics of various AC machines.
- To understand the various losses in AC machines.
- To analyze the equivalent circuit parameters of AC machines.
- To find the efficiency of single phase induction motor.
- To study about speed control of Induction machines
- To analyse the performance characteristics of three phase Induction Motor

## COURSE OUTCOMES (COS)

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

- Experiment with the Synchronous Generator to analyze its performance by conducting various tests.
- Examine the characteristics of V and inverted V curves in Synchronous motor.
- Analyze the performance of Induction Machines.
- Measure the performance parameters of Induction Machines.
- Estimate the efficiency of an Induction Machine at loaded condition.

## CO-PO MAPPING:

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

3-Strong; 2-Medium; 1-Low

## 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 Induction Motor.
8. Load Test on three phase Induction Motor.
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.

**TOTAL:30**

**SEMESTER-IV****23BEEE412****ANALOG AND DIGITAL ELECTRONICS LABORATORY 2H-1C****Instruction Hours/week: L:0 T:0 P:2****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- 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 basics of linear integrated circuits and available ICs
- To understand the concept of SMPS.

**COURSE OUTCOMES:**

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

- Prove the truth table of Logic Gates and Boolean function.
- Apply Boolean functions to implement adder and subtractor circuits
- Analyze the code conversion techniques and multiplexer in digital circuits.
- Develop the Inverting, Non-Inverting, Integrator and Differentiator using Op-Amp.
- Explain the concept of design of SMPS

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low**

## **LIST OF EXPERIMENTS**

1. Verification of the truth tables of TTL gates.
2. Verification of Boolean function
3. Design and verification of the truth tables of Half and Full adder circuits
4. Design and verification of the truth tables of Half and Full subtractor circuits
5. Design of Binary to BCD Code converters
6. Verification of the truth table of the Multiplexer and De-multiplexer.
7. Inverting, Non-inverting and differential amplifiers.
8. Integrator and Differentiator.
9. Astable and Monostable multivibrators using NE555 Timer.
10. Study of SMPS

**TOTAL:30**

**SEMESTER-IV****23BEMC451****FOUNDATION OF ENTREPRENEURSHIP****1H-0C****Instruction Hours/week:L:1 T:0 P:0****Marks: Internal:100 External:0 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Equip and develop the learners' entrepreneurial skills and qualities essential to undertake business.
- Impart the learners' entrepreneurial competencies needed for managing business efficiently and effectively.
- Understand basic concepts in the area of entrepreneurship
- Develop personal creativity and entrepreneurial initiative
- Adopt the key steps in the elaboration of business idea

**COURSE OUTCOMES:**

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

- Gain entrepreneurial competence to run the business efficiently.
- Undertake businesses in the entrepreneurial environment
- Prepare business plans and undertake feasible projects.
- Be efficient in launching and develop their business ventures successfully
- Monitor the business effectively towards growth and development

**UNIT I ENTREPRENEURIAL COMPETENCE**

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful Entrepreneurs – Knowledge and Skills of an Entrepreneur.

**UNIT II ENTREPRENEURIAL ENVIRONMENT**

Business Environment - Role of Family and Society - Entrepreneurship Development

**UNIT III BUSINESS PLAN PREPARATION**

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership

**UNIT IV LAUNCHING OF SMALL BUSINESS**

Finance and Human Resource Mobilization - Operations Planning - Market and Channel Selection - Growth Strategies

**UNIT V MANAGEMENT OF SMALL BUSINESS**

Monitoring and Evaluation of Business - Effective Management of small Business - Case Studies.

**TEXT BOOKS:**

1. S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2016.
2. R.D. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.

**REFERENCE BOOKS:**

1. Rajeev Roy, Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
2. Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.



**SEMESTER-IV****23BEMC452****ESSENCE OF TRADITIONAL INDIAN  
KNOWLEDGE AND HERITAGE****1H-0C****Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:100 External: 0 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Impart a holistic understanding about Indian Culture and Thoughts from a Historical perspective.
- Encourage critical appreciation of the Indian thoughts and cultural manifestations.
- Introduce the students to important concepts from the diverse intellectual traditions of India.
- Make use of Indian cultural heritage and various epistemological inquiries.
- Gain knowledge of Indian heritage.

**COURSE OUTCOMES:**

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

- Understand the cultural diversity
- Infer the need of cultural unity
- Know the Dravidian culture
- Realize the power of the Indian educational system called gurukul
- Come to know the concepts of Vedic thought

**UNIT I INTRODUCTION TO INDIAN THOUGHT AND CULTURE**

Plurality of Indian Culture - Cultural Diversity and Cultural Unity -Different Manifestations of Indian Culture: Indus Valley culture -Vedic Culture and Dravidian culture.-The Medieval Bhakti Culture

**UNIT II TRADITIONAL KNOWLEDGE SYSTEMS OF INDIA**

Introduction to the Traditional Indian Education System of Gurukul - Parampara -Understanding Indian Philosophy: Vedic Thought and the nine schools of Philosophy - Indigenous Knowledge and Women in India

**UNIT III PROTECTION OF TRADITIONAL KNOWLEDGE**

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, the value of TK in the global economy, Role of Government to harness TK.

**TEXTBOOKS:**

1. Chatterjee, Satishchandra, and Dhirendramohan Datta. (2007) Introduction to Indian Philosophy. Rupa Publications, New Delhi.
2. Husain, S. Abid. (2003). The National Culture of India. National Book Trust, New Delhi.

## SEMESTER-V

23BEEE501

TRANSMISSION AND DISTRIBUTION

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 impart knowledge about the configuration of the electrical power system
- To study the line parameters and interference with neighbouring circuits
- To analyse and model different components of power system
- To learn different insulators and underground cables
- To learn mechanical design of lines and different types of grounding systems.

**COURSE OUTCOMES:**

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

- Interpret the structure of electric supply and distribution systems
- Categorize the transmission line parameters for different configurations.
- Identify the performance of short, medium and long transmission lines.
- Classify the various insulators and cables for transmission and distribution.
- Examine the mechanical design of lines and methods of grounding

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	1
CO2	3	3	2	2	-	-	-	1	-	-	-	1	3	1
CO3	3	3	2	2	-	-	-	1	-	-	-	2	3	1
CO4	2	2	1	1	-	-	-	1	-	-	-	2	2	1
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	1
Avg.	2.6	2.6	1.6	1.6	0.2	-	-	1	-	-	-	1.6	2.6	1

**3-Strong; 2-Medium; 1-Low**

## **UNIT I STRUCTURE OF POWER SYSTEM**

**(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 II TRANSMISSION LINE PARAMETERS**

**(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 OF TRANSMISSION LINES**

**(9)**

Classification of lines – short line, medium line and long line –Evaluation of A, B, C, D constants equivalent 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 INSULATORS AND CABLES**

**(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 LINES AND GROUNDING**

**(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

**TOTAL 45**

### **TEXT BOOKS:**

1. B.R.Gupta, “Power System Analysis and Design”, S.Chand, New Delhi, Fifth Edition 2005-08.
2. R.K.Rajput, “Power System Engineering”, Laxmi Publications (P) Ltd, New Delhi, 2006
3. D.P.Kothari,I.J.Nagarath, “Power System Engineering”, Tata McGraw-Hill Publishing Company limited, New Delhi,2007.

## REFERENCE BOOKS:

1. C.L.Wadhwa, “Electrical Power Systems”, New Academic Science Ltd,2009
2. Luces M. Fualkenberry, Walter Coffey, “Electrical Power Distribution and Transmission”, Pearson Education, 2007.
3. Hadi Saadat, “Power System Analysis”, PSA Publishing; Third Edition, 2010.
4. J.Brian,Hardy and Colin R.Bayliss, “Transmission and Distribution in Electrical Engineering”,Newnes; Fourth Edition,2012.
5. Gorti Ramamurthy, “Transmission and Distribution", Handbook of Electrical Power Distribution, 2009,Universities Press.

## WEBLINKS

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

## SEMESTER-V

23BEEE502

CONTROL SYSTEMS

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- 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 of systems.
- To introduce stability analysis and design of compensators.
- To introduce state variable representation of physical systems and non-linear control

**COURSE OUTCOMES:**

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

- Demonstrate an understanding of the fundamentals of (feedback) control systems.
- Examine the time -domain responses and frequency-domain responses of first and second-order systems to step and sinusoidal inputs.
- Solve the Performance of the given System using frequency response plots and root locus.
- Interpret a lag, lead, lag-lead compensators based on its specifications using root locus and bode plot approach and explain the concept of P, PI and PID Controller.
- Examine the system equations in state-variable form and non-linear control

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	-	-	-	1	-	-	-	2	3	1
CO2	3	3	3	3	1	-	-	1	-	-	-	2	3	1
CO3	3	3	2	3	1	-	-	1	-	-	-	2	3	1
CO4	3	3	3	3	1	-	-	1	-	-	-	2	3	1
CO5	3	3	3	3	1	-	-	1	-	-	-	2	3	1
Avg.	2.8	2.8	2.4	2.4	0.8	-	-	1	-	-	-	2	3	1

3-Strong; 2-Medium; 1-Low

## **UNIT I INTRODUCTION TO CONTROL SYSTEM (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 diagram reduction Techniques.

## **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 the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci

## **UNIT III FREQUENCY-RESPONSE ANALYSIS (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 TO CONTROLLER DESIGN (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 of controllers.

## **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.

**TOTAL: 45**

### **TEXT BOOKS:**

- 1.M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
- 2.B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

### **REFERENCE BOOKS:**

- 1.K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
2. 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.m](https://www.tutorialspoint.com/control_systems/control_systems_introduction.m)
2. <https://www.electronicshub.org/controlsystem/>
3. <https://nptel.ac.in/courses/107106081/>

## SEMESTER-V

23BEEE503

MICROPROCESSORS AND MICROCONTROLLERS

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

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

## COURSE OUTCOMES:

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

- Explain the Architecture-8085 and 8086
- Examine the addressing mode , interrupt , assembly language programs in 8086
- Make use of advanced Pentium processors and microcontroller
- Utilize the memory ,I/O device , controllers to interface
- Select suitable processor for various applications

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	2	3	1
CO2	3	3	2	2	-	-	-	1	-	-	-	2	3	1
CO3	3	3	2	2	-	-	-	1	-	-	-	2	3	1
CO4	3	3	2	2	-	-	-	1	-	-	-	2	3	1
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	1
Avg.	2.8	2.8	1.8	1.8	0.2	-	-	1	-	-	-	2	3	1

3-Strong, 2-Medium, 1-Low

## UNIT I MICROPROCESSOR-8085/8086

(9)

Introduction to 8085-Introduction to 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 Interfacing concepts.



## **UNIT II PROGRAMMING OF 8086 (9)**

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

## **UNIT III ADVANCED PROCESSOR AND MICROCONTROLLER (9)**

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

## **UNIT IV INTERFACING WITH 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 RISC AND ARM (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.

**TOTAL: 45**

### **TEXT BOOKS:**

- 1.R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 2002.
- 2.DA Patterson and J H Hennessy,"Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers 2018

### **REFERENCE BOOKS:**

1. Douglas Hall, Microprocessors Interfacing, Tata Mc Graw Hill, 2005.
2. Kenneth J. Ayala, The 8051 Microcontroller, Clifton Park, NY: Thomson Delmar Learning, 2005.
3. Jonathan W Valvano Introduction to Arm(r) Cortex-M Microcontrollers Create Space Independent Publisher2012

### **WEBLINKS**

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

**SEMESTER-V****23BEEE504****NETWORK ARCHITECTURE AND SECURITY****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 outline the fundamental concepts, technologies, and protocols used in computer networks
- To gain knowledge in network design, implementation, and management
- To identify the problems related to network performance and security
- To understand about the principles of data transmission, routing, and switching
- To implement network architecture, including local area networks (LANs), wide area networks (WANs), and internet protocols (IP)

**COURSE OUTCOMES:**

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

- Infer the layered architecture of computer networks functionalities.
- Apply error detection techniques in the Data Link Layer to ensure data integrity during data transmission.
- Test for the process of transition mechanisms from IPv4 to IPv6.
- Assess networking protocols in real-world problems.
- Recommend network secure architectures to protect against common network attacks.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO3	3	3	2	1	-	1	-	2	2	2	-	2	-	2
CO4	3	3	2	1	-	1	-	2	2	2	-	2	-	2
CO5	3	3	2	1	-	1	-	2	2	2	-	2	-	2
Avg.	3	2.6	1.6	0.6	-	0.6	-	1.2	2	2	-	2	-	2

**3-Strong; 2-Medium; 1-Low**

## **UNIT I – INTRODUCTION**

**(9)**

Introduction – history and development of computer networks – Networks topologies – Layering and protocols. Physical Layer: Different types of transmission media – errors in transmission – attenuation – noise. Repeaters – Encoding – NRZ, NRZI, Manchester, 4B/5B MAC Layer: Aloha, CSMA, CSMA/CD, CSMA/CA protocols. Examples: Ethernet, including Gigabit Ethernet and WiFi (802.11). Time permitting, a quick exposure to Token Ring and to Bluetooth, WiMax may also be included.

## **UNIT II - DATA LINK LAYER**

**(9)**

Data Link Layer: Error detection (Parity, CRC), Sliding Window, Stop and Wait protocols. LAN: Design, specifications of popular technologies, switching. A student should be able to design the LAN of a campus or a building.

## **UNIT III - NETWORK LAYER AND TRANSPORT LAYER**

**(9)**

Network layer: Internet Protocol, IPv6, ARP, DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing. Subnetting, Classless addressing, Network Address Translation. Transport layer: UDP, TCP. Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions. Design issues in protocols at different layers.

## **UNIT IV - NETWORK PROGRAMMING**

**(9)**

Network Programming: Socket Programming. Session, Presentation and Application Layers. Examples: DNS, SMTP, IMAP, HTTP, etc.

## **UNIT V – NETWORK SECURITY**

**(9)**

Network Security: Concepts of symmetric and asymmetric key cryptography. Sharing of symmetric keys - Diffie Hellman. Public Key Infrastructure. Public Key Authentication Protocols. Symmetric Key Authentication Protocols. Pretty Good Privacy (PGP), IPSec, Firewalls.

**TOTAL : 45**

### **TEXT BOOKS:**

1. “Computer Networks” ,5<sup>th</sup> Edition, AS Tanenbaum, DJ Wetherall, Prentice Hall, 2010.
2. “Computer Networks: A Systems Approach”, 5<sup>th</sup> Edition, LL Peterson, BS Davie, Morgan Kauffman, 2011.

### **REFERENCE BOOKS:**

1. “Computer Networking: A Top-Down Approach”, 5<sup>th</sup> Edition JF Kurose, KW Ross, Addison Wesley, 2009.
2. “Cryptography and Network Security, Principles and Practise”, 5<sup>th</sup> Edition, W.Satllings, Prentice Hall, 2010.

### **WEBLINKS:**

1. <https://in.coursera.org/learn/fundamentals-network-communications>
2. <https://www.udemy.com/course/the-ultimate-computer-networks-part-2/>

**SEMESTER-V****23BEEE511****CONTROL SYSTEMS LABORATORY****2H-1C****Instruction Hours/week: L:0 T:0 P:2****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To examine transfer function of DC Machine and its control.
- To understand physical system in both time domain and frequency domain
- To analyze the second order system for step response with and without controller
- To design lead and lag compensator for improving frequency response of system
- To design the controller for DC motor speed control

**COURSE OUTCOMES:**

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

- Determine the transfer function of DC Machine.
- Analyze the physical system in both time domain and frequency domain
- Evaluate the performance of second order system for step response with and without controller
- Improve the frequency response of the given system using lead or lag compensator.
- Design the controller for DC motor speed control

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low**

## **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 PID controllers.
6. Identification of type of damping from the given characteristic equation of second order system.
7. Simulation of step response of second order under damped system using "C" and Scilab.
8. Frequency response of Lead compensator network.
9. Frequency response of Lag compensator network.
10. DC Motor speed control.

**TOTAL: 30**

**SEMESTER-V****23BEEE512 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY 2H-1C****Instruction Hours/week: L:0 T:0 P:2****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To introduce students to basic Assembly Language Programming (ALP) in 8086 and 8085
- To infuse practical training on interfacing peripheral devices with 8086 microprocessor
- To inculcate A/D and D/A Interfacing with microcontroller
- To know about the performance of Stepper motor Interfacing with microcontroller
- To learn about the ARM controller for Flashing of LEDS and zig bee protocol.

**COURSE OUTCOMES:**

At the end of this course students will be able to

- Experiment with Assembly Language Programming (ALP) in 8086 and 8085
- Design advanced controller for speed control applications
- Demonstrate A/D and D/A Interfacing with microcontroller
- Evaluate the performance of Stepper motor Interfacing with microcontroller
- Make use of ARM controller for Flashing of LEDS and zig bee protocol.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	1	1	1	-	1	3	2
CO2	3	3	3	3	1	-	-	1	1	1	-	1	3	2
CO3	2	2	1	1	1	-	-	1	1	1	-	1	3	2
CO4	3	3	3	3	1	-	-	1	1	1	-	1	3	2
CO5	3	3	2	2	1	-	-	1	1	1	-	1	3	2
Avg.	2.8	2.8	2.2	2.2	1	-	-	1	1	1	-	1	3	2

**3-Strong; 2-Medium; 1-Low**

## LIST OF EXPERIMENTS:

### 8-bit Microprocessor 8085 Microprocessor

1. Simple arithmetic operations
  - Multi precision addition/subtraction/multiplication/division
2. Programming with control instructions
  - Increment/Decrement
  - Ascending/Descending order
  - Maximum/Minimum of numbers
  - Rotate instructions.
  - Hex/ASCII/BCD code conversions
3. Interface Experiments
  - A/D Interfacing
  - D/A Interfacing
4. Simple Interfacing experiments using 8279

### 8086 Microprocessor

5. Basic arithmetic and Logical operations
6. Floating point operations, string manipulations, sorting and searching

### 8051 Microcontroller

7. Demonstration of basic instructions with 8051 Microcontroller execution, including
  - Conditional jumps, looping
  - Calling subroutines
8. Parallel port programming with 8051 using port1 facility
  - Stepper motor
9. Flashing of LEDS using ARM
10. Implementing zig bee protocol with ARM.

**TOTAL: 30**

**SEMESTER-V****23BEMC551****CYBER SECURITY****1H-0C****Instruction Hours/week: L:1 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To understand the field of digital security and concepts of access control mechanism.
- To introduce keywords and jargons involved in securing browser
- To understand network basic and familiarize on security of network protocols
- To understand cyber-attacks and data privacy
- To learn the tools and methods used in cyber security

**COURSE OUTCOMES:**

At the end of this course students will be able to

- Infer the importance of a network basics and brief introduction on security of network protocols
- Apply a solid foundation in digital security and measures taken to protect device from threats.
- Discuss about cyber-attacks and data privacy issues and preventive measures.
- Make use of tools and methods used in cyber security.
- Explain Cyber security organizational implications.

**UNIT I NETWORKING BASICS****(9)**

Networking basics (home network and large-scale business networks), Networking protocols, Security of protocols, sample application hosted on-premises.

**UNIT II BASICS OF DIGITAL SECURITY****(9)**

Basics of digital security, protecting personal computers and devices, protecting devices from Virus and Malware, Identity, Authentication and Authorization, need for strong credentials, keeping credentials secure, protecting servers using physical and logical security, World Wide Web (www), the Internet and the HTTP protocol, security of browser to web server interaction.



### **UNIT III INTRODUCTION TO CYBER-ATTACKS**

**(9)**

Introduction to cyber-attacks, application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data security - Confidentiality, Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics.

### **UNIT IV TOOLS AND METHODS**

**(9)**

Tools and methods used in cyber security: Proxy servers and anonymizers – Phishing – Password cracking – Keyloggers and spywares – Virus and worms – Trojan horse – Steganography – DoS and DDoS attack – SQL Injection – Buffer overflow – Attacks on wireless networks – Phishing and Identity theft.

### **UNIT V CYBER SECURITY ORGANIZATIONAL IMPLICATIONS**

**(9)**

Cyber security organizational implications: Cost of cybercrimes and IPR – Web threats for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

#### **TEXT BOOKS:**

1. Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobile device safety made easy. Elsevier, 2016.
2. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011.

#### **REFERENCE BOOKS:**

1. Charles P. Pfleeger, Shari Lawrence, Pfleeger Jonathan Margulies; Security in Computing, Pearson Education Inc . 5th Edition, 2015
2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cyber security essentials. John Wiley & Sons, 2018.
3. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012.
4. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, First Edition, CRC Press, First Edition.

## SEMESTER-VI

23BEEE601

TQM AND PROFESSIONAL ETHICS

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:**

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Illustrate and apply QMS and EMS in any organization
- Apply the core values toward the ethical behavior of an engineer.
- Apply the ethical and moral principles in engineering experimentation.

**COURSE OUTCOMES:**

At the end of this course students will be able to

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply QMS and EMS in any organization.
- Apply the core values toward the ethical behavior of an engineer.
- Apply the ethical and moral principles in engineering experimentation

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	2	1	1	2	1	-	-
CO2	-	-	-	-	-	1	-	2	1	1	2	1	-	-
CO3	-	-	-	-	-	2	-	3	1	1	2	1	-	-
CO4	-	-	-	-	-	2	-	3	1	1	2	1	-	-
CO5	-	-	-	-	-	2	-	3	1	1	2	1	-	-
Avg.	-	-	-	-	-	1.6	-	2.6	1	1	2	1	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION**

**(9)**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

## **UNIT II TQM PRINCIPLES**

**(9)**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

## **UNIT III QUALITY MANAGEMENT SYSTEM**

**(9)**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

## **UNIT IV 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

## **UNIT V 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.

**TOTAL :45**

### **TEXT BOOKS:**

1. Dale H.Besterfield, Carol B.Michna,Glen H. Bester field, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, —Total Quality Management, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. Kiran.D.R, —Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.

### **REFERENCE BOOKS:**

1. Suganthi, L and Anand Samuel, —Total Quality Management, Prentice Hall (India) Pvt. Ltd., 2006
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, —Engineering Ethics Concepts and Cases, Thompson Learning, 2000.
3. Charles D Fleddermann, —Engineering Ethics, Prentice Hall, New Mexico, 1999

## SEMESTER-VI

23BEEE602

POWER SYSTEM ANALYSIS

4H-4C

Instruction Hours/week: L:3 T:1 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To understand the concepts of power systems and its components.
- To apply Gauss-Seidel and Newton Raphson methods for solving load flow problem
- To analyze the power system under symmetrical fault conditions.
- To examine the power system under unsymmetrical fault conditions.
- To study the stability of the power system with the help of equal area criteria.

**COURSE OUTCOMES:**

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

- Interpret the various power system components and calculate the per unit quantities
- Make use of Gauss-Seidel and Newton Raphson methods for solving load flow problem.
- Analyze the power system under symmetrical faults.
- Examine the power system under unsymmetrical faults.
- Inspect the stability of the power system with the help of equal area criteria, Modified Euler and Runge - Kutta methods.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	1	-	-	1	2	1
CO2	3	3	1	1	-	-	-	-	1	-	-	1	2	1
CO3	3	3	2	2	-	-	-	-	1	-	-	1	2	1
CO4	3	3	2	2	-	-	-	-	1	-	-	1	2	1
CO5	3	3	2	2	-	-	-	-	1	-	-	1	2	1
Avg.	2.8	2.8	1.6	1.6	-	-	-	-	1	-	-	1	2	1

**3-Strong; 2-Medium; 1-Low**

## **UNIT I POWER SYSTEM OVERVIEW**

**(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-Raphson method.

## **UNIT III SYMMETRICAL FAULT ANALYSIS**

**(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 UNSYMMETRICAL FAULT ANALYSIS**

**(9)**

Symmetrical components - Sequence impedances – Sequence circuits of synchronous machine, transformer and transmission line - Sequence networks - Analysis of unsymmetrical faults: single-line to-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 V STABILITY ANALYSIS**

**(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.

**TOTAL:45**

### **TEXT BOOKS:**

1. John J.Grainger, William D.Stevenson, "Power System Analysis", Mc Graw Hill Education (India) Private Limited, New Delhi, 2015.
2. Kothari D.P. and Nagrath I.J., "Power System Engineering", Tata Mc Graw-Hill Education, Second Edition, 2008.

### **REFERENCE BOOKS:**

1. Hadi Saadat, "Power System Analysis", Tata McGraw Hill Education Pvt.Ltd., New Delhi, 21st reprint, 2010.
2. Pai MA, "Computer Techniques in Power System Analysis", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Second Edition,2007.
3. J.Duncan Glover, Mulukutla S.Sarma,Thomas J.Overbye, "Power System Analysis & Design", Cengage Learning, Fifth Edition, 2012.

## SEMESTER-VI

23BEEE603

POWER ELECTRONICS

3H-3C

Instruction Hours/week: L:3T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To study the 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-DC switching
- Different modulation techniques of pulse width modulated inverters and to regulators.
- Operation of AC voltage controller and various configurations
- Understand harmonic reduction methods

**COURSE OUTCOMES:**

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

- Illustrate the operation, capabilities, characteristics of various power semiconductor devices and driver circuits.
- Analyze the performance of AC-DC converter for different loads
- Utilize the principle of DC-DC converters with various control techniques for renewable energy application
- Apply the Voltage and frequency control of inverters for harmonic reduction
- Explain the single and three phase voltage controllers

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	1	1	-	1	1	2	3	2
CO2	3	3	2	2	-	-	1	1	-	1	1	2	3	2
CO3	3	3	2	2	-	-	1	1	-	1	1	2	3	2
CO4	3	3	2	2	-	-	1	1	-	1	1	2	3	2
CO5	2	2	1	1	-	-	1	1	-	1	1	2	3	2
Avg.	2.6	2.6	1.6	1.6	-	-	1	1	-	1	1	2	3	2

3-Strong; 2-Medium; 1-Low

**UNIT - I POWER SEMI-CONDUCTOR DEVICES (9)**

Power diode, power BJT, SCR, Power MOSFET and IGBT – Structure and operation, Static and switching characteristics- Structure and V-I characteristics of GTO and TRIAC- Driver and snubber circuits.

**UNIT II AC TO DC CONVERTERS (9)**

Single phase and three phase half and fully controlled converters – Effect of source inductance – Analysis of converters with R and RL loads - Performance parameters - Dual converters.

**UNIT III DC TO DC CONVERTERS (9)**

Step-down chopper - Time ratio control and current limit control – Step-up chopper- Two quadrant and four quadrant choppers - Switching mode regulator - Buck, boost, buck-boost converters- Isolated converter: forward and flyback topology-DC-DC Converters for PV systems.

**UNIT IV DC TO AC CONVERTERS (9)**

Single phase and three phase bridge voltage source inverters –Voltage control and harmonic reduction (waveform improvement) - Current source inverter- Inverters application for Induction Heating and UPS.

**UNIT V AC TO AC CONVERTERS (9)**

Single phase and Three phase AC voltage controllers – Phase control – PWM control- single and three phase cyclo converters – On load Transformer Tap Changers-Simulation of Power Electronic Circuits (Quantitative)

**TOTAL:45**

**TEXT BOOKS:**

1. Ned Mohan Tore. M. Undeland, William. P. Robbins, “Power Electronics: Converters, Applications and Design”, 3rd Edition, Wiley, 2010, India.
2. Vidhyathil Joseph, “Power Electronics Principles and Applications”, McGraw Hill Education (India), 2010.

**REFERENCE BOOKS:**

1. Williams, B. W., “Power Electronics: Devices, Drivers, Applications, and Passive Components” 3rd Edition, McGraw Hill, 2006.
2. Andrzej M. Trzynadlowski, “Introduction to Modern Power Electronics”, 2nd Edition, Wiley India Pvt. Ltd., 2011.
3. P.S. Bimbira, “Power Electronics”, Khanna Publishers, 2012, New Delhi.
4. M.H. Rashid, “Power Electronics: Circuits, Devices and Applications”, 3rd Edition, Pearson Education, 2014, New Delhi.
5. M.D. Singh, K. B. Khanchandani, “Power Electronics”, 2nd Edition, Tata McGraw Hill, 2006, New Delhi. John B Peatman, “Designing with PIC Micro Controller”, McGraw-Hill, 2013.

**WEBLINKS**

1. <https://nptel.ac.in/courses/108105066/>
2. [https://nptel.ac.in/content/storage2/courses/108105066/PDF/L34\(DP\)\(PE\)%20\(\(EE\)NPTEL\).pdf](https://nptel.ac.in/content/storage2/courses/108105066/PDF/L34(DP)(PE)%20((EE)NPTEL).pdf)
3. <https://nptel.ac.in/content/storage2/courses/108103009/download/M4.pdf>

## SEMESTER-VI

23BEEE611

POWER SYSTEMS LABORATORY

2H-1C

Instruction Hours/week: L:0 T:0 P:2

Marks: Internal:40 External:60 Total:100  
End Semester Exam:3 Hours**COURSE OBJECTIVES:**

- To understand power system planning and computational parameters
- To acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
- To analyze the power flow using Gauss-Seidel , Newton-Raphson and Fast-Decoupled Methods.
- To find Symmetric and Unsymmetrical fault
- To understand the economic dispatch in power system with and without considering Transmission losses

**COURSE OUTCOMES:**

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

- Estimate the Voltage Regulation and Efficiency of a Medium Transmission Line Using Nominal T and Pi method
- Construct the bus admittance and impedance matrices
- Examine the Load flow problems and calculate the load flow results using Gauss-Seidel , Newton-Raphson and Fast-Decoupled Methods
- Classify the types of faults and analyze the power system on different faulted conditions.
- Illustrate the Economic Dispatch in Power Systems with and without considering transmission losses

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	1	1	2	-	1	2	2
CO2	3	3	2	2	2	-	-	1	1	2	-	1	2	2
CO3	3	3	2	2	2	-	-	1	1	2	-	1	2	2
CO4	3	3	2	2	2	-	-	1	1	2	-	1	2	2
CO5	1	1	-	-	2	-	-	1	1	2	-	1	2	2
Avg.	2.6	2.6	1.8	1.8	2	-	-	1	1	2	-	1	2	2

**3-Strong; 2-Medium; 1-Low**



## **LIST OF EXPERIMENTS**

1. Computation of Line Parameter
2. Find the Voltage Regulation and Efficiency of a Medium Transmission Line Using Nominal T Method through Scilab.
3. Find the Voltage Regulation and Efficiency of a Medium Transmission Line Using Nominal Pi Method through Scilab.
4. Formation of Bus Impedance Matrix.
5. Formation of Bus Admittance Matrix.
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 transmission losses.
10. Economic Dispatch in Power Systems with transmission losses.

**TOTAL:30**

## SEMESTER-VI

23BEEE612

POWER ELECTRONICS LABORATORY

2H-1C

Instruction Hours/week:L:0 T:0 P:2

Marks: Internal:40 External:60 Total:100

End Semester Exam: 3Hours

**COURSE OBJECTIVES:**

- To study the VI characteristics of SCR, TRIAC, MOSFET and IGBT.
- To analyze the performance of semi converter and full converter (controlled rectifier).
- To design and analyze the performance of SMPS.
- To study the behavior of voltage waveforms of single phase PWM inverter applying various modulation techniques.
- To study the behavior of voltage waveforms of three phase PWM inverter applying various modulation techniques.

**COURSE OUTCOMES:**

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

- Determine the characteristics of SCR, TRIAC, MOSFET and IGBT.
- Estimate the transfer characteristics of full converter (controlled rectifier) and semi converter.
- Experimentally verify the performance of basic DC/DC converter topologies used for SMPS.
- Analyze the performance of single phase DC to AC inverter.
- Analyze the performance of three phase DC to AC inverter.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	1	1	2	-	1	2	2
CO2	3	3	3	3	-	-	-	1	1	2	-	1	2	2
CO3	3	3	1	1	-	-	-	1	1	2	-	1	2	2
CO4	3	3	2	2	-	-	-	1	1	2	-	1	2	2
CO5	3	3	2	2	-	-	-	1	1	2	-	1	2	2
Avg.	3	3	2.2	2.2	-	-	-	1	1	2	-	1	2	2

**3-Strong; 2-Medium; 1-Low**

## 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 of TRIAC
5. Implementation of single-phase half-controlled converter using SCR.
6. Implementation of single phase fully controlled convertor using SCR
7. Implementation of DC-DC Boost convertor using MOSFET.
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.

**TOTAL:30**

**SEMESTER-VI****23BEMC651****UNIVERSAL HUMAN VALUES****1H-0C****Instruction Hours/week:L:1 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam: 3Hours****COURSE OBJECTIVES:**

- To help students to understand the need, basic guidelines, content and process of value education.
- To help students distinguish between values and skills
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- To help students understand the meaning of happiness within their selves.
- To help students understand the meaning of happiness and prosperity for a human being.

**COURSE OUTCOMES:**

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

- Understand the significance of value inputs in a classroom, distinguish between values and skills.
- Understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
- Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body.
- Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships.
- Explore their role in ensuring a harmonious society.

**UNIT I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION**

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

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

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

## **UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP**

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!

### **TEXT BOOKS:**

1. R R Gaur, R Sangal and G P Bagaria(2009).“A Foundation Course in Human Values and Professional Ethics”
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

### **REFERENCE BOOKS:**

1. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
2. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
3. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
4. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
5. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
6. A N Tripathy, 2003, Human Values, New Age International Publishers.

**SEMESTER-VII****23BEEE701****ELECTRICAL DRIVES AND CONTROL****3H-3C****Instruction Hours/week: L: 3 T: 0 P: 0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To study and understand the characteristics of Electrical drives .
- To understand power controlled rectifier circuits for DC drives
- To study and analyze the operation of chopper fed DC drive
- To understand the induction motor drive and its speed control using V/F control of inverters
- To learn the speed control methods of synchronous motor and BLDC motor using power converters

**COURSE OUTCOMES:**

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

- Compare various types of loads, quadrants of operation and characteristics of Electrical drives
- Construct power controlled rectifiers circuit for DC drives and its speed control
- Explain the speed control schemes for DC drives using DC-DC converter
- Utilize the DC- AC converter for the speed control of induction motor drives
- Apply the POWER converters for the speed control of synchronous motor and BLDC drives

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	2	3	1
CO2	3	3	2	2	-	-	-	1	-	-	-	2	3	1
CO3	2	2	1	1	-	-	-	1	-	-	-	2	3	1
CO4	3	3	2	2	-	-	-	1	-	-	-	2	3	1
CO5	3	3	2	2	-	-	-	1	-	-	-	2	3	1
Avg.	2.6	2.6	1.6	1.6	-	-	-	1	-	-	-	2	3	1

**3-Strong; 2-Medium; 1-Low**

**UNIT I DRIVE CHARACTERISTICS****(9)**

Elements of electric drive system- dynamic equations-speed torque characteristics of various types of loads – multi quadrant operation- Selection of power rating for drive motors: classes of duty, heating and cooling – constant torque and constant power operations - Electrical Braking

**UNIT II CONVERTER FED DC DRIVES****(9)**

Single phase half controlled and fully controlled converter fed DC motor drive - Three phase half controlled and fully controlled converter fed DC motor drive - Performance parameters -Dual converter fed separately excited DC motor drive..

**UNIT III CHOPPER FED DC DRIVES****(9)**

Single quadrant chopper fed DC motor drive - Analysis of performance parameters of step-down chopper fed separately excited DC motor drive – Two quadrant and four quadrant chopper fed DC drive.

**UNIT VI INDUCTION MOTOR DRIVES****(9)**

Stator voltage controller fed induction motor drive – VSI and CSI fed induction motor drive - static rotor resistance control - Slip power recovery scheme - Introduction to vector control of induction motor drive.

**UNIT V SYNCHRONOUS MOTOR DRIVE AND DRIVE APPLICATIONS****(9)**

Synchronous motor drive: V/F control- self-control – Permanent Magnet Synchronous motor drive applications: steel rolling mill– paper mill – traction – cranes and lifts- BLDC motor drive Electric Vehicle Drive - Simulation of simple DC and AC drive circuits using software tools.

**TOTAL: 45****TEXT BOOKS:**

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 Company 1991

**REFERENCE BOOKS:**

1. Vedam Subramaniam, “Electrical Drives and Applications”, Tata McGraw Hill, New Delhi, 2nd Ed. 2010.
2. Murphy J.M.D., “Thyristor Control of AC Motors”, Pergamon Press, New York, 1973.
3. Krishnan R., “Electric Motor and Drives: Modeling, Analysis and Control”, Pearson Education, New Delhi, 2001
4. Pillai S.K., “A First Course on Electrical Drives”, Wiley Eastern Ltd., Bombay, 2nd Ed. 2007.

## SEMESTER-VII

23BEEE702

POWER SYSTEM PROTECTION AND SWITCHGEAR

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 learn the fundamentals of protective equipment's used in power systems.
- Study of Relays, protection scheme and solid-state relays.
- Discussion on suitable protection schemes for different apparatus, feeders and bus bar faults.
- Study and causes of overvoltage and protection against overvoltage.
- To understand the different types of circuit breakers

## COURSE OUTCOMES

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

- Interpret the importance of protective devices in power systems.
- Explain the working of various protective relays.
- Apply suitable protection schemes for different apparatus, feeders and bus bar faults.
- Illustrate the causes of overvoltage and protection against overvoltage.
- Compare the operation of various circuit breakers with arcing concepts.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	1	1	1	-	-	1	1	3	1
CO2	2	2	1	1	-	1	1	1	-	-	1	1	3	1
CO3	3	3	2	2	-	1	1	1	-	-	1	1	3	1
CO4	2	2	1	1	-	1	1	1	-	-	1	1	3	1
CO5	3	3	2	2	-	1	1	1	-	-	1	1	3	1
Avg.	2.4	2.4	1.4	1.4	-	1	1	1	-	-	1	1	3	1

3-Strong; 2-Medium; 1-Low



## **UNIT I 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.

## **UNIT II OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS**

**(9)**

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

## **UNIT III APPARATUS PROTECTION**

**(9)**

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

## **UNIT IV THEORY OF CIRCUIT 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 circuit breaking.

## **UNIT V CIRCUIT BREAKERS**

**(9)**

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

**TOTAL: 45**

### **TEXT BOOKS:**

1. Sunil S.Rao, Switchgear and Protection, Khanna publishers, New Delhi, 2008.Switchgear Protection and Power Systems (Theory, Practice & Solved Problems)
2. Y.G.Paithankar and S.R.Bhide, Fundamentals of power system protection, Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi –2010

### **REFERENCE BOOKS:**

1. Badri Ram, B.H.Vishwakarma, Power System Protection and Switchgear, New Age International Pvt Ltd Publishers, Second Edition 2011.
2. B.Rabindranath and N.Chander, Power System Protection and Switchgear, New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co., 1998.
4. C.L.Wadhwa, Electrical Power Systems, 6th Edition, New Age International (P) Ltd., 2010.
5. Ravindra P.Singh, “Switchgear and Power System Protection “PHI Learning Private Ltd., New Delhi 2009.

## SEMESTER-VII

23BEEE703

SMART GRID

3H-3C

Instruction Hours/week: L: 3T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES

- To Study about Smart Grid technologies
- To Study about Communication technology for smart grids, Information security for the smart Grid
- To familiarize various sensing and measurement technologies involved with the smart grid.
- To familiarize the concepts of control and Distribution automation and management systems smart
- To understand about different Distributed Generation Systems.

## COURSE OUTCOMES

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

- Outline the fundamental elements of the smart grid.
- Infer the importance of information and communication technologies of the smart grid
- Interpret various sensing and measurement technologies involved with the smart grid.
- Illustrate the concepts of control and Distribution automation and management systems in smart grid
- Make use of power electronics in smart grid and to classify the different energy storage techniques

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	3	2
CO2	2	2	1	1	-	-	-	1	-	-	-	1	3	2
CO3	2	2	1	1	-	-	-	1	-	-	-	1	3	2
CO4	2	2	1	1	2	1	1	1	-	-	-	1	3	2
CO5	3	3	2	2	-	1	1	1	-	-	-	1	3	2
Avg.	2.2	2.2	1.2	1.2	0.4	0.4	0.4	1	-	-	-	1	3	2

3-Strong; 2-Medium; 1-Low

## **UNIT I SMART GRID ARCHITECTURAL DESIGNS**

**(9)**

Need for implementation of Smart grid - Smart Grid initiatives - Overview of the technologies required for the Smart Grid -Working Definition of the Smart Grid Based on Performance Measures - Representative Architecture - Functions of Smart Grid Components: Smart Devices Interface Component-Storage Component. Transmission Subsystem Component- Monitoring and Control Technology Component- Intelligent Grid Distribution Subsystem Component - Demand Side Management Component

## **UNIT II INFORMATION AND COMMUNICATION TECHNOLOGIES**

**(9)**

Data Communication, Dedicated and shared communication channels, Layered architecture and protocols, Communication technology for smart grids, Information security for the smart grid.

## **UNIT III SENSING AND MEASUREMENT TECHNOLOGIES**

**(9)**

Synchrophasor Technology – Phasor Measurement Unit, Smart metering and demand side integration - Communication infrastructure and protocol for smart metering – Data Concentrator, Meter Data Management System. Demand side Integration – Services, Implementation and Hardware Support of DSI.

## **UNIT IV CONTROL AND AUTOMATION TECHNIQUES**

**(9)**

Distribution automation equipment – Substation automation equipments: current transformer - potential transformer - Intelligent Electronic Devices - Bay controller - Remote Terminal Unit. Distribution management systems – SCADA: Modelling and analysis tools, applications.

## **UNIT V POWER ELECTRONICS AND ENERGY STORAGE SYSTEMS**

**(9)**

Power Electronics in smart grid application – Role of FACTS in smart grid by Shunt and series compensation techniques - Role of HVDC in smart grid for bulk power transfer and offshore wind connections. Energy Storage Technologies – Batteries - Flow Battery - Fuel Cell and Hydrogen Electrolyser – Flywheel - Super-Conducting magnetic energy storage system - Super Capacitor

**TOTAL: 45**

### **TEXT BOOKS:**

1. Stuart Borlase “Smart Grid: Infrastructure, Technology and Solutions”, CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley 2012.

### **REFERENCE BOOKS:**

1. Vehbi C. Gungör, 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, November 2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid –The New and Improved Power Grid: A Survey”, IEEE Transaction on Smart Grids, vol.14, 2012. 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****23BEEE791****PROJECT WORK PHASE-I****8H-4C****Instruction Hours/week:L:0 T:0 P:8****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

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

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

**COURSE OUTCOMES:**

- 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.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3

**3-Strong; 2-Medium; 1-Low**

## SEMESTER-VIII

23BEEE891

PROJECTWORKPHASE-II

16H-8C

Instruction Hours/week:L:0 T:0 P:16

Marks: Internal:80 External:120Total:200

End Semester Exam:3 Hours

**COURSE OBJECTIVES**

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

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

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3

**3-Strong; 2-Medium; 1-Low**

## PROFESSIONAL ELECTIVE COURSES

**B.E. Electrical and Electronics Engineering**

**2023-2024**

### **SEMESTER-IV**

**23BEEE4E01**

**POWER PLANT ENGINEERING**

**3H-3C**

**Instruction Hours/week: L:3 T:0 P:0**

**Marks: Internal:40 External:60 Total:100**

**End Semester Exam:3 Hours**

#### **COURSE OBJECTIVES:**

- To learn the economics connected with power generation.
- To understand the measurements of various parameter in thermal power plant and their control.
- To study about Gas power plant instrumentation
- To study about technologies of Hydro power plant
- To study layout and working of nuclear and Diesel – Electric powerplants.

#### **COURSE OUTCOMES:**

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

- Summarize the Economics of power Generation
- Explain the basic principles and various components of thermal power plant and its control
- Make use of Gas power plant for power generation
- Illustrate the concept of Hydro power plant
- Develop the knowledge about nuclear and Diesel – Electric powerplants.

#### **CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	1	1	1	-	-	-	-	2	-
CO2	2	2	1	1	-	1	1	1	-	-	-	-	2	-
CO3	3	3	2	2	-	1	1	1	-	-	-	-	2	-
CO4	2	2	1	1	-	1	1	1	-	-	-	-	2	-
CO5	3	3	2	2	-	1	1	1	-	-	-	-	2	-
Avg.	2.4	2.4	1.4	1.4	-	1	1	1	-	-	-	-	2	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I ECONOMICS OF POWER 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 THERMAL POWER PLANT (9)**

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

## **UNIT III GAS POWER PLANT (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 HYDRO POWER PLANT (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–ELECTRIC POWER 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.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Black and Veatch, Power Plant Engineering, CBS Publishers & Distributors, 2005.
2. Gupta B. R., Generation of Electrical Energy, S .Chand Publishing, New Delhi,14th Edition, 2012.
3. Deshpande M.V., Elements of Power Station Design, PHI Learning Pvt. Ltd.–reprint, 2010.

## SEMESTER-IV

23BEEE4E02

SENSOR AND TRANSDUCER

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 understand concept and working principle of different transducers.
- To summarize the characteristics of the transducers.
- To study the different types of resistive transducers.
- To understand concepts inductive and capacitive transducers and its working principle.
- To learn the various types of sensors.

**COURSE OUTCOMES:**

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

- Explain the concept and working principle of different transducers .
- Summarize the characteristics of the transducers
- Demonstrate the different types of resistive transducers.
- Outline the concept of inductive and capacitive transducers
- Interpret the various types of sensors.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO2	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO4	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO5	2	2	1	1	-	-	-	-	-	-	-	1	-	1
Avg.	2	2	1	1	-	-	-	-	-	-	-	1	-	1

3-Strong; 2-Medium; 1-Low



## **UNIT I INTRODUCTION OF TRANSDUCER**

**(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 – Thermistor’s 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.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Sawhney A.K, A Course in Electrical and Electronics Measurements and Instrumentation Dhanpat Rai & Company Private Limited,2015.
2. Renganathan. S, Transducer Engineering, Allied Publishers, Chennai,2003.

### **REFERENCE BOOKS:**

1. Doebelin. E.A, Measurement Systems – Applications and Design, Tata McGraw Hill, New York, 2000.
2. Patranabis. D Sensors and Transducers PHI Learning Pvt. Ltd.,2003.
3. John. P, Bentley Principles of Measurement Systems III Edition, Pearson Education,2000.

### **WEBLINKS**

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

**SEMESTER-VI**  
**23BEEE4E03 SIGNALS AND SYSTEMS 3H-3C**

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

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

**COURSE OUTCOMES:**

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

- Illustrate different types of signals and systems
- Analyze the linear shift invariant system.
- Identify discrete systems in different domain using Fourier Transform.
- Make use of Laplace Transform in the linear shift invariant system
- Utilize Z Transform and sampling for discrete time signals and systems.

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION TO SIGNALS AND 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.

## **UNIT II 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.

## **UNIT III FOURIER SERIES AND FOURIER TRANSFORM**

**(9)**

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

## **UNIT IV LAPLACE TRANSFORM ANALYSIS**

**(9)**

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 TRANSFORM AND SAMPLING**

**(9)**

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.

**TOTAL :45**

### **TEXT BOOKS:**

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.

### **REFERENCE BOOKS:**

1. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998
3. Simon Haykin, Barryvan Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.

4. M.J.Roberts, "Signals and Systems-Analysis using Transform methods and MATLAB",TMH,2003.
5. J.Nagrath, S.N.Sharan, R.Ranjan,S.Kumar, "Signals and Systems", TMH NewDelhi, 2001.

#### **WEBLINKS**

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

23BEEE4E04

DESIGN AND ANALYSIS OF ALGORITHMS

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 understand and apply the algorithm analysis techniques on searching and sorting algorithms.
- To illustrate different algorithm design techniques.
- To critically analyze the efficiency of graph algorithms.
- To solve programming problems using state space tree.
- To examine NP Completeness, Approximation algorithms and randomized algorithms.

## COURSE OUTCOMES:

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

- Solve the basic problems with asymptotic notations.
- Apply graph traversal algorithms for a given applications.
- Experiment with dynamic programming and greedy techniques.
- Examine backtracking strategy for solving real time problems.
- Evaluate the algorithmic techniques for tractable and intractable problems.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO4	3	3	2	1	-	-	-	-	2	2	-	2	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	2
Avg.	3	2.4	1.4	0.4	-	-	-	-	2	2	-	2	-	2

3-Strong; 2-Medium; 1-Low

## **UNIT I INTRODUCTION**

**(9)**

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties – Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – searching: linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting: Insertion sort – heap sort

## **UNIT II GRAPH ALGORITHMS**

**(9)**

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching

## **UNIT III ALGORITHM DESIGN TECHNIQUES**

**(9)**

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem – Optimal Merge pattern — Huffman Trees.

## **UNIT IV STATE SPACE SEARCH ALGORITHMS**

**(9)**

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem

## **UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM**

**(9)**

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation – NP algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3-CNF problem. Approximation Algorithms: TSP - Randomized Algorithms: concept and application - primality testing - randomized quick sort - Finding kth smallest number

**TOTAL :45**

### **TEXT BOOKS:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill/ MIT Press, Fourth Edition, 2022
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012

### **REFERENCE BOOKS:**

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", Career Monk Publications, First Edition, 2016
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Computer Algorithms/C++", Orient Blackswan, Second Edition, 2019
3. S. Sridhar, "Design and Analysis of Algorithms", Oxford university Press, First Edition, 2014
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint Edition, 2006

**WEBLINKS:**

1. [www.nptel.ac.in/courses/106105164](http://www.nptel.ac.in/courses/106105164)
2. [www.nptel.ac.in/courses/106106131](http://www.nptel.ac.in/courses/106106131)
3. [www.coursera.org/specializations/algorithms](http://www.coursera.org/specializations/algorithms)
4. <https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/>
5. [www.cs.usfca.edu/~galles/visualization/Algorithms.html](http://www.cs.usfca.edu/~galles/visualization/Algorithms.html)

**SEMESTER-V****23BEEE5E01****ELECTRICAL MACHINE 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 provide sound knowledge about the constructional details and design of various electrical machines.
- To study the design parameters of Transformer for given specifications.
- To learn about the design of Induction motor for given specifications .
- To construct the stator and rotor of Synchronous Machines.
- To use software tools to design electrical machines

**COURSE OUTCOMES:**

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

- Outline the various design factors, magnetic circuit fundamentals and select suitable materials required for construction of Electrical Machines and Transformers
- Examine the design parameters of Transformer for given specifications
- Design of Induction motor for given specifications.
- Construct the stator and rotor of Synchronous Machines
- Utilize software tools to design electrical machines.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	3	2	2	-	-	-	-	-	-	-	1	3	2
<b>CO2</b>	3	3	3	3	-	-	-	-	-	-	-	1	3	2
<b>CO3</b>	3	3	3	3	-	-	-	-	-	-	-	1	3	2
<b>CO4</b>	3	3	2	2	-	-	-	-	-	-	-	1	3	2
<b>CO5</b>	3	3	2	2	3	-	-	-	-	-	-	1	3	2
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>2.4</b>	<b>2.4</b>	<b>0.6</b>	-	-	-	-	-	-	<b>1</b>	<b>3</b>	<b>2</b>

**3-Strong; 2-Medium; 1-Low**



## **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 INDUCTION MOTORS**

**(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.

**TOTAL : 45**

### **TEXT BOOKS:**

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", ELBS London.

### **REFERENCE BOOKS:**

1. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.
2. K. L. Narang, "A Text Book of Electrical Engineering Drawings", SatyaPrakashan, 1969.
3. A. Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
4. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
5. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

## SEMESTER-V

23BEEE5E02

EMBEDDED SYSTEMS

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To provide a clear understanding on the basic concepts of embedded system, microcontroller, different components of microcontroller and their interactions.
- To learn the key concepts of embedded systems with Communication protocols.
- To learn the concept of I/O, timers, interrupts and interaction with peripheral devices
- To study the various scheduling concepts for process & basics of Real time operating system.
- To know about the applications of Embedded system in real time.

**COURSE OUTCOMES:**

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

- Illustrate the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
- Develop Embedded networking with communication protocols.
- Identify the key concepts of I/O, timers, interrupts and interaction with peripheral devices
- Summarize the basic concept of RTOS based embedded system design.
- Make use of Embedded system in real time applications

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	1	-	-	1	1	1
CO2	3	3	2	2	-	-	-	-	1	-	-	1	1	1
CO3	3	3	2	2	-	-	-	-	1	-	-	1	1	1
CO4	3	3	2	2	1	-	-	-	1	-	-	1	1	1
CO5	3	3	2	2	1	-	-	-	1	-	-	1	1	1
Avg.	2.8	2.8	1.8	1.8	0.4	-	-	-	1	-	-	1	1	1

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION TO EMBEDDED SYSTEMS (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, µC/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.

**TOTAL : 45**

### **TEXT BOOKS:**

1. Rajkamal, “Embedded System-Architecture, Programming, Design”, TMH, 2011.
2. Peckol, “Embedded system Design”, John Wiley & Sons, 2010
3. Shibu.K. V, “Introduction to Embedded Systems”, Tata McGraw Hill, 2009

### **REFERENCE BOOKS:**

1. LyaB. Das, “Embedded Systems”, Pearson Education, 2010.
2. Elica White, “Making Embedded Systems “, O’ Reilly Series, SPD, 2011
3. Dave, “Embedded Systems: Concepts Design and Programming, 1st edition, Pearson Education, 2015.
4. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006
5. Jonathan W. Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Cengage learning, 3rd edition, 2012
6. Han-Way Huang, “Embedded system Design using C8051”, Cengage Learning, 2006.

## SEMESTER-V

23BEEE5E03

HIGH VOLTAGE ENGINEERING

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

- To study about the nature of Breakdown mechanism in gaseous dielectrics.
- To study about generation of high voltages in laboratories.
- To know about measurement of high voltage and current.
- To learn about the concept of switching, lightning over voltages and insulation coordination.
- To study about testing of power apparatus in H.V. lab.

## COURSE OUTCOMES:

At the end of the course the student will be able

- Explain the nature of Breakdown mechanism in gaseous dielectrics.
- Identify the appropriate methods for high voltage and current generation.
- Choose the measurement principles to figure the values of high voltage and current.
- Experiment with the concept of switching and lightning over voltages.
- Classify the various high voltage apparatus and testing in HV lab

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	1	1	2	1
CO2	3	3	2	2	1	-	-	1	-	-	1	1	2	1
CO3	3	3	2	2	1	-	-	1	-	-	1	1	2	1
CO4	3	3	2	2	1	-	-	1	-	-	1	1	2	1
CO5	3	3	2	2	1	-	-	1	-	-	1	1	2	1
Avg.	2.8	2.8	1.8	1.8	0.8	-	-	1	-	-	1	1	2	1

3-Strong; 2-Medium; 1-Low

## **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.

**TOTAL : 45**

### **TEXT BOOKS:**

1. M.S.Naidu and V.Kamaraju, "High Voltage Engineering", 5th Edition, Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2013.
2. E.Kuffel and W.S. Zaengl, J.Kuffel, "High voltage Engineering Fundamentals", Newness, 2nd Edition, Elsevier, New Delhi, 2005.
3. Rakosh Das Begamudre, "High Voltage Engineering, Problems and Solutions", New Age International Publishers, New Delhi, 2010

## REFERENCE BOOKS:

1. Hugh M.Ryan, “High Voltage Engineering and Testing”, 2nd Edition, The Institution of Electrical Engineers, London, United Kingdom,2001.
2. Various IS standard for HV Laboratory Techniques and Testing.
3. L.L.Alston, “High Voltage Technology”, Oxford University Press,1st Indian Edition, 2011.
4. C.L.Wadhwa,“High Voltage Engineering”, New Age International Publishers, 3rd Edition, 2010.
5. Mazen Abdel Salam, Hussein Anis, Ahdab A-Morshedy and Roshday Radwan, “High Voltage Engineering–Theory & Practice”, 2nd Edition, Marcel Dekker, Inc.,2010.
6. Subir Ray, “An Introduction to High Voltage Engineering”, 2nd Edition, PHI Learning Private Limited, , 2011.
7. M.Khalifa,“High Voltage Engineering-Theory and Practice”, Marcel Dekker, Inc. NewYork and Basel, 1990.
8. Dieter Kind and Kurt Feser,“High Voltage Test Techniques”, Reed Educational and Professional Publishing Ltd. (Indian Edition), New Delhi, 2001.

**B.E. Electrical and Electronics Engineering****SEMESTER-V****23BEEE5E04****RENEWABLE ENERGY SYSTEMS****3H-3C****Instruction Hours/week: L:3 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of solar cells, photovoltaic conversion.
- To understand the basic principles of wind energy conversion.
- To gain the knowledge about hydro and ocean energy.
- To understand the basic principles of Biomass, fuel cell, Geo-thermal power plants and MHD.

**COURSE OUTCOMES:**

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

- Outline the environmental issues associated with fossil fuels and other energy resources.
- Make use of Solar PV systems for practical applications.
- Choose the Wind Turbine systems for application based on their working.
- Explain the operation of Hydroelectric Plant and Ocean Energy
- Compare the working of Biomass Power Generation ,Fuel Cell, Geo thermal plants and MHD

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	2	1	1	1	-	1	1	2	1
CO2	3	2	2	2	1	-	1	1	1	-	1	1	2	1
CO3	3	2	2	2	1	-	1	1	1	-	1	1	2	1
CO4	2	1	1	1	1	-	1	1	1	-	1	1	2	1
CO5	2	1	1	1	1	-	1	1	1	-	1	1	2	1
Avg.	2.4	1.4	1.4	1.4	1	0.4	1	1	1	-	1	1	2	1

**3-Strong; 2-Medium; 1-Low**

**UNIT I INTRODUCTION****(9)**

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization-Energy Conservation and Energy Efficiency-Needs and Advantages, Energy Conservation Act 2003.

**UNIT II SOLAR ENERGY****(9)**

Introduction to solar energy: solar radiation, availability, measurement and estimation–Solar thermal conversion devices and storage – solar cells and photovoltaic conversion –PV systems – MPPT. Applications of PV Systems– solar energy collectors and storage.

**UNIT III WIND ENERGY****(9)**

Introduction– Basic principles of wind energy conversion-components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Interconnected systems.

**UNIT IV HYDRO ENERGY****(9)**

Hydropower, classification, Turbines election, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean 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.

**TOTAL : 45****TEXT BOOKS:**

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

23BEEE5E05

ELECTRICAL ENERGY CONSERVATION  
AND MANAGEMENT

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

## COURSE OBJECTIVES:

- To gain the knowledge about energy scenarios.
- To the energy and its various form.
- To understand the basic principles of energy audit and concepts in economic analysis in energy management.
- To discuss the concept of Energy Efficiency in Electrical Systems.
- To discuss the concept of Energy Efficiency in Industrial Systems.

## COURSE OUTCOMES:

At the end of this course students will be able to

- Summarize the world and Indian energy scenarios
- Analyze the energy and its various forms
- Apply the principles of Energy Audit, Management and Conservation
- Identify the energy performance of Electrical Systems
- Make use of potential Energy Conservation aspects in Industrial Equipment

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	2	2	1	1	-	1	1	2	1
CO2	3	3	2	2	-	-	1	1	1	-	1	1	3	1
CO3	3	3	2	2	1	-	1	1	1	-	1	1	3	1
CO4	3	3	2	2	1	-	1	1	1	-	1	1	3	1
CO5	3	3	2	2	1	-	1	1	1	-	1	1	3	1
Avg.	2.8	2.6	1.8	1.8	0.6	0.4	1	1	1	-	1	1	2.8	1

3-Strong; 2-Medium; 1-Low

## **UNIT I ENERGY SCENARIO**

**(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 its features.

## **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 and conversion

## **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 IN ELECTRICAL SYSTEMS**

**(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 efficient motors.

## **UNIT V ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS**

**(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 cooling towers.

**TOTAL: 45**

**TEXT BOOKS:**

1. Energy Management: Conservation and Audits, 1st Edition, Kindle Edition, CRC Press, (28 July2020).
2. 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](http://www.bee-india.org)).

**REFERENCE BOOKS:**

1. Guide books for National Certification Examination for Energy Manager/Energy AuditorsBook-1, General Aspects (available online).
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online).

**WEB LINKS:**

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

## SEMESTER-V

23BEEE5E06

WEB APPLICATION AND DEVELOPMENT

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 understand the concepts of Servlet API.
- To gain knowledge of JSP and its tags.
- To illustrate the concepts of Hibernate for interacting with database.
- To understand Spring container, Modules, Dependency Injection and aspect-oriented programming.
- To understand how to design and develop application using Spring Boot

## COURSE OUTCOMES:

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

- Apply web based applications using Servlet.
- Build user interface for web applications using JSP and JDBC.
- Analyze object relation mapping with hibernate query language to interact with relational databases.
- Develop web based applications using Spring MVC.
- Construct web based applications using Spring Boot.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	-	-	1	2	2	-	2	-	2
CO2	3	2	2	1	1	-	-	1	2	2	-	2	-	2
CO3	3	3	2	1	1	-	-	1	2	2	-	2	-	2
CO4	3	3	2	1	1	-	-	1	2	2	-	2	-	2
CO5	3	3	2	1	1	-	-	1	2	2	-	2	-	2
Avg.	3	2.6	2	1	1	-	-	1	2	2	-	2	-	2

3-Strong; 2-Medium; 1-Low

**UNIT I SERVLET API****(9)**

Introduction to MVC - Features of MVC - Components of MVC. Servlet Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with Servlet Context and Servlet Config Object, Attributes in Servlet, Response and Redirection using Request Dispatcher, send Redirect Method, Session Tracking: using Cookies, HTTP Session Performing CRUD (Create, Read, Update, Delete) operation using Servlet with JDBC

**UNIT II JSP API****(9)**

Introduction to JSP, Comparison with Servlet, JSP Architecture, JSP: Life Cycle, Scripting Elements, Directives, Action Tags, Implicit Objects, Java Beans in JSP, Expression Language (EL), JSP Standard Tag Libraries (JSTL) Core Tags, Session Management, Exception Handling, CRUD Application.

**UNIT III HIBERNATE API****(9)**

Introduction to Hibernate, Exploring Architecture of Hibernate, Object Relation Mapping (ORM) with Hibernate, Hibernate Annotation, Querying in Hibernate - Hibernate Query Language (HQL) - Criteria Queries - Create queries with Native SQL, Basic O/R Mapping - Collection Mapping - Association Mappings - CRUD Operation using Hibernate API

**UNIT IV SPRING MVC****(9)**

Spring: Introduction, Architecture, Spring MVC Module, Life Cycle of Bean Factory, Constructor Injection, Dependency Injection, Inner Beans, Aliases in Bean, Bean Scopes, Spring Annotations, Spring AOP Module, Spring DAO, Database Transaction Management, CRUD Operation using DAO and Spring API. Build Tools – Maven and Gradle, pom.xml and build.gradle, building application using Maven and Gradle

**UNIT V SPRING BOOT****(9)**

Introduction to Spring Boot - Spring Vs. Spring Boot - Internals of Spring Boot - Spring Boot Application Creation - Spring Boot Auto Configuration - Spring Boot Annotations - Spring Data JPA Introduction - Crud Repository and JPA Repository Methods in JPA - Custom Queries in JPA - Spring Boot Profiles - Spring Web MVC - Thymeleaf – Spring boot application with CRUD operation.

**TOTAL: 45****TEXT BOOKS:**

1. “J2EE: The complete Reference”, Jim Keogh, McGraw-Hill, 2017.
2. “Spring and Hibernate (2<sup>nd</sup> Edition)”, Santhosh Kumar, McGraw Hill, 2013.
3. “Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot”, Shagun Bakliwal, Packt Publishing Ltd, 2018.

**REFERENCE BOOKS:**

1. “Servlet & JSP: A Tutorial (2nd Edition)”, Budi Kurniawan, Brainy Software, 2015.
2. “Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot”, Rajput.D, Packt Publishing, 2018.
3. “Developing Java Applications with Spring and Spring Boot”, Claudio and Greg, Packt Publishing Ltd, 2018.

**WEBLINKS:**

1. <https://docs.oracle.com/javaee/7/tutorial/index.html>
2. <https://javaee.github.io/tutorial/>
3. <https://hibernate.org/orm/documentation/6.1/>
4. <https://docs.spring.io/spring-framework/docs/3.2.x/spring-framework-reference/html/mvc.html>
5. <https://docs.spring.io/spring-boot/docs/current/reference/htmlsingle/>

## SEMESTER-V

23BEEE5E07

LOW-CODE APPLICATION DEVELOPMENT

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 identify the key components of no-code development and explain their applications.
- To demonstrate the ability to use various no-code platforms and tools to create and publish applications.
- To analyze data using machine learning tools and present results in a meaningful way.
- To create voice applications and bots that integrates with external services to enhance functionality.
- To develop basic UI/UX design skills to create and design effective and aesthetically pleasing applications.

**COURSE OUTCOMES:**

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

- Illustrate no-code tools in web scraping
- Build no-code platforms applications with Zapier, Voice Flow and Figma.
- Experiment with the machine learning algorithm.
- Construct voice based applications using voice API
- Develop UI/UX design for application using Figma.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	1	2	2	-	2	-	2
CO2	3	2	2	1	2	-	-	1	2	2	-	2	-	2
CO3	3	2	2	1	2	-	-	1	2	2	-	2	-	2
CO4	3	3	2	1	2	-	-	1	2	2	-	2	-	2
CO5	3	3	2	1	2	-	-	1	2	2	-	2	-	2
Avg.	2.8	2.2	1.6	0.8	1.8	-	-	1	2	2	-	2	-	2

3-Strong; 2-Medium; 1-Low

## **UNIT I WEB SCRAPING AND API PARABOLA WITH NO CODE (9)**

No-Code Stacks - No-Code Fundamentals. Web Scraping: Scrape Data from WEBLINKS- Initial Scraper Setup- Defining our data- using our Scraped Data. Work with APIs: Filtering Data- Numerical Formatting- Exporting Data - Publishing

## **UNIT II BUILD AUTOMATIONS AND CREATE BOTS WITH NO CODE (9)**

Automations using Zapier: Introduction - Connecting Google sheets - Connecting twitter- Publishing Zapier Automation. Bots: Configuring Slack - Creating First bot using slack - Including conditional and helper functions - Connecting Giphy -Connecting slack to bot - Publishing our bot.

## **UNIT III DATA SCIENCE (9)**

Introduction to Data science: Data flow- Machine learning. Obviously AI: Introduction- Sourcing our data-Uploading our data-Analyze our data - Publish using Obviously AI.

## **UNIT IV VOICE APP (9)**

Voice App: Introduction-Voice Flow-Initial setup-Create the launch sequence for voice application-Querying the user-Calling API for data-Returning Data to the user-Testing the application-Publish the voice app.

## **UNIT V UI / UX DESIGN FOR APPLICATION (9)**

UI/UX: Introduction-Business Use case-Tools. Figma: Introduction-File setup-Placing Images- Add logo to the Frame- Body copy- Building Forms- Profile Image- Proportions- Project.

**TOTAL : 45**

### **TEXT BOOKS:**

1. Paul E Love ,”Mastering No-Code: Create Professional Quality Apps Without Coding” (Vol. 1), 2021.
2. Mikhail Zhilkin,” Data Science Without Makeup 1st Edition”, 2021.

### **REFERENCE BOOKS:**

1. Mittal Akhil,” Getting Started with Chatbots”, 2019.
2. Fabio staiano,” Designing and Prototyping Interfaces with Figma”, 2022.

### **WEBLINKS:**

1. <https://www.udemy.com/course/no-code-developer/>
2. <https://www.nocode.tech/academ>



## SEMESTER-V

23BEEE5E08

ADVANCED ALGORITHMS

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 learn programming and mathematical backgrounds for design and analysis of algorithm.
- To study the concept of designing an algorithm.
- To have a complete understanding of the various advanced data structures.
- To implement advanced algorithms using appropriate design techniques.
- To inculcate advanced graph algorithms and applications.

## COURSE OUTCOMES:

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

- Explain data structures and mathematical background in the programming.
- Solve problems using algorithm technique.
- Compare backtracking techniques with branch and bound techniques.
- Discover Eulerian and Hamiltonian paths in graphs
- Analyze searching and pattern matching algorithms.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	2	-
CO2	3	2	1	1	-	-	-	-	2	2	-	2	2	-
CO3	3	3	2	1	-	-	-	-	2	2	-	2	2	-
CO4	3	3	2	1	-	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	2	2	-
Avg.	2.8	2.4	1.7	0.8	-	-	-	-	2	2	-	2	2	-

3-Strong; 2-Medium; 1-Low

## **UNIT I PROGRAMMING LANGUAGE BACKGROUNDS (9)**

Programming language backgrounds: STL in C++ – Data structures support in python. Mathematical backgrounds: Logarithmic exponentiation – Efficient prime factorization – Combinatorics – Sieve of Eratosthenes–Geometry–Co-ordinate compression–Binomial coefficients–Euclid's extended algorithm – Line intersections

## **UNIT II ADVANCED ALGORITHMS (9)**

Probability – Modular multiplicative inverse – Matrix exponentiation –Millerabin primality test– Heavy light decomposition–Convex hull –Hungarian algorithm –Sweep line algorithm – Gaussian algorithm – Pollard rho factorization – Euler's totient function –Burnside lemma.

## **UNIT III DYNAMIC PROGRAMMING (9)**

Recursion – Dynamic programming – Backtracking – Branch and bound – Suffix automata – Game theory – Meet in the middle – Arbitrary precision integer – Square root decomposition. Knapsack problem – Stable marriage problem – N-queen problems – Tug of wars – Sudoku problem. Advanced Trees: Binary indexed tree – Segment tree – Lowest common ancestors – Counting inversions – Suffix tree –Interval tree–Sparse table–K-Dtree–Treap–Link/cuttree

## **UNIT IV GRAPH ALGORITHMS (9)**

Advanced Graph Algorithms: Union find/disjoint set – Cycle detection – Bellman ford – Maxflow –Ford-fulkerson – Edmonds karp algorithm – Min cut – min cost flow – Dinic's algorithm – Maximum bipartite matching–Topological sorting– Eulerian and Hamiltonian paths– Graph coloring–Blossom's algorithm – Jarvis algorithm – Graham Scan – Johnson's algorithm.

## **UNIT V SEARCHING AND PATTERN MATCHING (9)**

Searching and pattern matching: Rabin-karp algorithm – Z-algorithm – Aho-corasick string matching algorithm – Manacher's algorithm–Kasai's algorithm – Levenshtein distance. Sorting: Quick select.

**TOTAL : 45**

### **TEXT BOOKS:**

1. Cormen TH, Leiserson CE and Stein C, Introduction to Algorithms, PHI Learning, Third Edition, 2011
2. Yonghui Wu, Jiande Wang, "Data structure Practice for Collegiate Programming Contests and Education",2016
3. Steven Halim, Felix Halim, "Competitive Programming, The New Lower Bound of Programming Contests," Lulu publication, Third Edition,2013

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**REFERENCE BOOKS:**

1. Jon Kleinberg, Eva Tardos,” Algorithm design”, Pearson Education, First Edition,2006
2. Jeff Edmonds, How to Think about Algorithms, Cambridge University, First Edition,2014
3. Anany Levitin, Introduction to Design and Analysis of Algorithm, Pearson Education, Third Edition, 2017

**WEBLINKS:**

1. [www.cpbook.net/methodstosolve](http://www.cpbook.net/methodstosolve)
2. [www.codechef.com/certification/prepare#foundation](http://www.codechef.com/certification/prepare#foundation)
3. [www.people.cs.clemson.edu/~bcdcan/dp\\_practice/](http://www.people.cs.clemson.edu/~bcdcan/dp_practice/)
4. [www.infoarena.ro/blog/meet-in-the-middle](http://www.infoarena.ro/blog/meet-in-the-middle)
5. [www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advancedalgorithms-fall-2005/](http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advancedalgorithms-fall-2005/)

## SEMESTER-VI

23BEEE6E01

SPECIAL ELECTRICAL MACHINES

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 expose the students to the concepts of synchronous reluctance motors
- To understand the construction and performance of Stepper motors.
- To know about the Principle of operation and performance of Switched reluctance motors.
- To gain the knowledge on construction and operation of permanent magnet brushless D.C. motors.
- To learn the construction, principle of operation and performance of permanent magnet synchronous motors.

**COURSE OUTCOMES:**

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

- Identify the performance of synchronous reluctance motors
- Make use of Stepper motors for specific applications
- Experiment with microprocessor based control of Switched reluctance motors.
- Apply the principle of Permanent magnet brushless D.C motor in appropriate field.
- Apply the control schemes for Permanent magnet synchronous motors.

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low**

## **UNIT I SYNCHRONOUS RELUCTANCE MOTORS**

**(9)**

Constructional features – Types – Axial and radial air gap motors – Operating principle – Reluctance–Phasordiagram–Characteristics–Verniermotor–Drivercircuits–Applications of AC motors.

## **UNIT II STEPPING MOTORS**

**(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 SWITCHED RELUCTANCE MOTORS**

**(9)**

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

## **UNIT IV PERMANENT MAGNET BRUSHLESS DC MOTORS**

**(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 MAGNET SYNCHRONOUS MOTORS**

**(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 control schemes.

**TOTAL:45**

### **TEXT BOOKS:**

- 1.P.P.Acarnley,SteppingMotors, 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.

### **WEB LINKS:**

- 1.<https://nptel.ac.in/courses/108102156>

## SEMESTER-VI

23BEEE6E02

MEMS AND NEMS

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 introduce the diverse technological and functional approaches of MEMS/NEMS and applications.
- To understand the microstructures and fabrication methods.
- To provide an insight of micro and nano sensors, actuators.
- To emphasis the need for NEMS technology.
- To update the ongoing trends and real time applications of MEMS and NEMS technology

**COURSE OUTCOMES:**

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

- Explain the material properties and the significance of MEMS and NEMS for industrial automation.
- Experiment with micromachining and micro fabrication.
- Apply the fabrication mechanism for MEMS sensor and actuators.
- Make use of the concepts of MEMS and NEMS to models, simulate and process the sensors and actuators.
- Develop employability and entrepreneurship capacity due to knowledge up gradation on MEMS and NEMS technology.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	-	-	-	-	-	-	-	-	2
CO2	3	3	2	2	2	-	-	-	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	-	2
CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	-	-	-	2
Avg.	2.8	2.8	1.8	1.8	1.8	-	-	-	-	-	-	-	-	2

**3-Strong; 2-Medium; 1-Low**

**UNIT I INTRODUCTION TO MEMS and NEMS (9)**

Overview of Micro electro mechanical systems and Nano Electro mechanical systems, devices and technologies, Laws of scaling- Materials for MEMS and NEMS - Applications of MEMS and NEMS.

**UNIT II MICRO-MACHINING AND MICRO FABRICATION TECHNIQUES (9)**

Photolithography- Micro manufacturing, Bulk micro machining, surface micro machining, LIGA.

**UNIT III MICRO SENSORS AND MICRO ACTUATORS (9)**

Micromachining: Capacitive Sensors- Piezoresistive Sensors- Piezoelectric actuators.

**UNIT IV NEMS TECHNOLOGY (9)**

Atomic scale precision engineering- Nano Fabrication techniques – NEMS for sensors and actuators.

**UNIT V MEMS AND NEMS APPLICATION (9)**

Bio MEMS- Optical NEMS- Micro motors- Smart Sensors - Recent trends in MEMS and NEMS.

**TOTAL:45**

**TEXT BOOKS:**

1. Marc F madou “Fundamentals of micro fabrication” CRC Press 2002 2nd Edition Marc Madou.
2. M.H.Bao “Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes”, Elsevier, Newyork, 16 Oct 2000, 1st Edition.

**REFERENCE BOOKS:**

1. Maluf, Nadim “An introduction to Micro Electro-mechanical Systems Engineering “AR Tech house, Boston, June 30 2004, 2nd Edition.
2. Mohamed Gad – el – Hak “MEMS Handbook” Edited CRC Press 2001, 1st Edition.

**WEBLINKS:**

1. [https://www.academia.edu/Lectures\\_on\\_MEMS\\_and\\_MICROSYSTEMS\\_DESIGN\\_AND\\_M ANUFACTURE](https://www.academia.edu/Lectures_on_MEMS_and_MICROSYSTEMS_DESIGN_AND_MANUFACTURE)
2. <https://nptel.ac.in/courses>
3. <https://www.iitk.ac.in/me/mems-fabrication>
4. <http://mems.iiti.ac.in/>
5. [https://onlinecourses.nptel.ac.in/noc22\\_ee36/preview](https://onlinecourses.nptel.ac.in/noc22_ee36/preview)

## SEMESTER-VI

23BEEE6E03

BIO MEDICAL INSTRUMENTATION

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- 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 electrical origin.
- To provide the latest ideas on devices of non-electrical devices.
- To bring out the important and modern methods of imaging technique.
- To provide latest knowledge of medical assistance / techniques and therapeutic equipment.

**COURSE OUTCOMES:**

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

- Illustrate the human physiology and types of transducers
- Demonstrate the different electrode placement for various electro-physiological recordings
- Explain various technique for non-electrical physiological measurements
- Interpret the construction and operation of medical imaging systems (X ray machine, computer tomography, MRI, Ultrasound)
- Select suitable therapeutic devices for specific situation.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	1	-	1	-	-	-	-	-	2
CO2	2	2	1	1	1	1	-	1	-	-	-	-	-	2
CO3	2	2	1	1	1	1	-	1	-	-	-	-	-	2
CO4	2	2	1	1	1	1	-	1	-	-	-	-	-	2
CO5	3	3	2	2	1	1	-	1	-	-	-	-	-	2
Avg.	2.8	2.8	1.2	1.2	1	1	-	1	-	-	-	-	-	2

3-Strong; 2-Medium; 1-Low



## **UNIT I PHYSIOLOGY AND TRANSDUCERS (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 –Piezoelectric, ultrasonic, resistive, capacitive and inductive transducers– Selection criteria.

## **UNIT II ELECTRO–PHYSIOLOGICAL MEASUREMENTS (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 CO<sub>2</sub>, O<sub>2</sub> in exhaust air – pH of blood, ESR and GSR measurements –Plethysmography.

## **UNIT IV MEDICAL IMAGING AND PATIENT MONITORING SYSTEM (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 AND THERAPEUTIC EQUIPMENT (9)**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart-Lung machine – Audiometers – Dialyzers.

**TOTAL:45**

### **TEXT BOOKS:**

1. Leslie Cromwell, Fred J Weibell, Erich A P Feiffer Bio–Medical Instrumentation and Measurements Pearson Education, India 2002
2. Khandpur, R.S Handbook of Bio–Medical instrumentation Tata McGraw Hill Publishing Co.Ltd., India 2003.

### **REFERENCE BOOKS:**

1. Arumugam M Bio–Medical Instrumentation Anuradha Agencies, Kumbakonam, 2003.
2. Webster, J Medical Instrumentation John Wiley and Sons, New York 1995.
3. Rajarao.C. and Guha, S.K Principles of Medical Electronics and Bio–medical Instrumentation Universities Press India Ltd., India 2000.
4. Khandpur, R.S Biomedical Instrumentation: Technology and Applications McGraw–Hill Education, Europe, 2004.

## SEMESTER-VI

23BEEE6E04

UNDERGROUND CABLE ENGINEERING

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To understand the Power Cable Characteristics and Applications.
- To know the physical and electrical characteristics of the UG cable
- To learn the different types of cable in distribution system.
- To study the underground cables used in transmission system.
- To know about the testing and maintenance of Underground cable system.

**COURSE OUTCOMES :**

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

- Outline the fundamentals of underground cable system.  
Summarize the architecture of UG cable and physical and electrical characteristics of the UG cable
- Utilize the different types of cable in distribution system.
- Make use of underground cables used in transmission system
- Illustrate the cable installations procedures and practices, methodology of cable fault detection and rectification, testing and maintenance.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	2	1	-	2	2	-	3	2
CO2	2	1	-	-	-	-	2	1	-	2	2	-	3	2
CO3	3	2	-	-	-	-	2	1	-	2	2	-	3	2
CO4	3	2	-	-	-	-	2	1	-	2	2	-	3	2
CO5	2	1	2	2	-	-	2	1	-	2	2	-	3	2
Avg.	2.4	1.4	0.4	0.4	-	-	2	1	-	2	2	-	3	2

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION TO ELECTRICAL POWER CABLES (9)**

Development of Underground Cables - Electric Lighting- Distribution of Energy for Lighting - Paper Insulated Cables - Underground Residential Distribution Systems Underground Residential Distribution Systems- Medium Voltage Cable Development.

## **UNIT II CABLE ARCHITECTURE, DIELECTRIC THEORY AND CABLE CHARACTERISTICS (9)**

Architecture of Underground Cabling System - Basic Dielectric Theory of Cable – Conductors - Armour and Protective Finishes - Cable Characteristics: Electrical Fundamentals of Electrical Insulation Materials - Electrical Properties of Cable Insulating Materials - Cable Standards and Quality Assurance - Cable design parameters- Current Carrying Capacity - Short-circuit Ratings.

## **UNIT III SUPPLY DISTRIBUTION SYSTEMS AND CABLES (9)**

Supply Distribution Systems - Distribution Cable Types, Design and Applications - Paper Insulated Distribution Cables - PVC Insulated Cables - Polymeric Insulated Distribution Cables for 6-30 kV - Manufacture of Distribution Cables - Joints and Terminations for Distribution Cables - Testing of Distribution Cables.

## **UNIT IV TRANSMISSION SYSTEMS AND CABLES (9)**

Basic Cable Types for A.C. Transmission - Self-contained Fluid-filled Cables - Gas Pressure Cables - High Pressure Fluid-filled Pipe Cables - Polymeric Insulated Cables for Transmission Voltages - Techniques for Increasing Current Carrying Capacity - Transmission Cable Accessories and Jointing for Pressure-assisted and Polymeric Cables.

## **UNIT V CABLE INSTALLATION, TESTING, MAINTENANCE (9)**

Installation of Transmission Cables -Splicing, Terminating, and Accessories - Sheath Bonding and Grounding-Testing of Transmission Cable Systems - Underground System Fault Locating - Field Assessment of Power Cable Systems- Condition monitoring tests – PD measurements.

**TOTAL:45**

### **TEXT BOOKS:**

1. William Thue, 'Electrical Power Cable Engineering', CRC Press Taylor & Francis Group., 6000 Broken Sound Parkway NW, Suite 300Boca Raton, FL 33487-2742, 3rd Edition 2017.
2. G. F. Moore, 'Electric Cables Handbook' -Third edition, Blackwell Science Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK., January 2017.

### **REFERENCE BOOKS:**

1. Leonard L. Grigsby, 'Electrical Power Cable Engineering' - CRC Press, Marcel Dekker, 3rd Edition 2012.
2. Christian Flytkjaer Jensen, Online Location of Faults on AC Cables in Underground Transmission Systems (Springer Theses), 2014, March.

**WEB LINKS:**

1. <https://kafactor.com/content/technical-resources/kerite-underground-cable-engineering-handbook.pdf>
2. Handbook on Cable Fault Localization (April 2020)  
[https://rdso.indianrailways.gov.in/works/uploads/File/Handbook%20on%20Cable%20Fault%20Localization\(2\).pdf](https://rdso.indianrailways.gov.in/works/uploads/File/Handbook%20on%20Cable%20Fault%20Localization(2).pdf)
3. K. H. Ali et al.: Industry Practice Guide for Underground Cable Fault-Finding in the LVDN: <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9807279>, June 2022.
4. R. W. Deltenre, J. J. Schwarz, and H. J. Wagnon, “Underground cable fault location: A handbook to TD-153,” BDM Corp., Albuquerque, NM, USA, Final Rep. EPRI EL-363, 1977. [Online]. Available: <https://www.osti.gov/servlets/purl/7233049>, doi: 10.2172/7233049, January 1997.

## SEMESTER-VI

23BEEE6E05

COMMUNICATION ENGINEERING

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To introduce the fundamental techniques of analog, digital and data communication.
- To explain satellite and fibre optic communication and Networking systems.
- To understand basic signals, analog modulation, demodulation and radio receivers.
- To explain the characteristics and model of transmission medium.
- To introduce different methods of analog communication and their significance

**COURSE OUTCOMES:**

At the end of the course the student will be to

- Summarize the different modulation systems.
- Explain transmission lines and losses.
- Compare the various media for digital communication.
- Explain the data communication.
- Summarize the Optical Fibre Communication.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	1	-	-	1	-	-
CO2	2	1	1	1	-	-	-	-	1	-	-	1	-	-
CO3	2	1	1	1	-	-	-	-	1	-	-	1	-	-
CO4	2	1	1	1	-	-	-	-	1	-	-	1	-	2
CO5	2	1	1	1	-	-	-	-	1	-	-	1	-	2
Avg.	2	1	1	1	-	-	-	-	1	-	-	1	-	0.8

**3-Strong; 2-Medium; 1-Low**

**UNIT I MODULATION SYSTEM****(9)**

Time and frequency domain representation of signals, amplitude modulation and demodulation, frequency modulation and demodulation, superheterodyne 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 fiber, fiber loss, light sources and detectors.

**TOTAL: 45****TEXT BOOKS:**

- 1.Wayne Tomasi Electronic Communication Systems Pearson Education New Delhi 2002.
- 2.Roy Blake Electronic Communication Systems Thomson Delmar, New Delhi 2002.

**REFERENCE BOOKS:**

- 1 William Schweber Electronic Communication Systems Prentice Hall of India, New Delhi. 2002.
2. Kennedy, G. Electronic Communication Systems Prentice Hall of India, New Delhi.2002
3. Miller,M.Modern Electronic Communication Prentice Hall of India, New Delhi.2003.
4. John G Proakis and Masoud Salehi Communication Systems Engineering Prentice Hall of India, New Delhi.2001

## WEBLINKS

1. [www.complextoreal.com/tutorial.htm](http://www.complextoreal.com/tutorial.htm)
2. [www.discogs.com/artist/Nephlim+Modulation+Systems](http://www.discogs.com/artist/Nephlim+Modulation+Systems)

**SEMESTER-VI****23BEEE6E06****DIGITAL SIGNAL PROCESSING****3H-3C****Instruction Hours/week:L:3 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

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

**COURSE OUTCOMES:**

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

- Explain various types of signals and systems.
- Analyze the mathematical operations on signals and systems.
- Analyze various transformation techniques.
- Design of IIR and FIR digital filters.
- Explain the programmable digital signal processor and multi-rate signal processing

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	-	-	-	1	1
CO2	3	3	2	2	-	-	-	-	1	-	-	-	2	1
CO3	3	3	2	2	-	-	-	-	1	-	-	-	2	1
CO4	3	2	1	1	-	-	-	-	1	-	-	-	1	2
CO5	2	1	1	1	-	-	-	-	1	-	-	-	2	2
Avg.	2.4	2	1.2	1.2	-	-	-	-	1	-	-	-	1.6	1.4

**3-Strong; 2-Medium; 1-Low**



## **UNIT I DISCRETE-TIME SIGNALS AND SYSTEMS (9)**

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

## **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, Inverse Z-transforms.

## **UNIT III DISCRETE FOURIER TRANSFORM (9)**

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

## **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, Band stop 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 Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

**TOTAL: 45**

### **TEXT BOOKS:**

1. S.K.Mitra, "Digital Signal Processing: A computer-based approach", McGrawHill, 2011.
2. A.V.Oppenheim and R.W.Schafer, "Discrete Time Signal Processing", 3rd Edition Prentice Hall, 2009.

**REFERENCE BOOKS:**

1. J.G.Proakis and D.G.Manolakis,“Digital Signal Processing: Principles, Algorithms and Applications”,4th Edition, Prentice Hall, 2007.
2. L.R.Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, Pearson India, 2015.
3. J.R.Johnson, “Introduction to Digital Signal Processing”, PHI Learning, 2009.
4. D.J.DeFatta, J.G.LucasandW.S.Hodgkiss,“Digital Signal Processing”, Wiley India Pvt Ltd, 2009.

**WEBLINKS**

- 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****23BEEE6E07****ADVANCED WEB FRAMEWORKS****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 learn the fundamental concepts of Git and JavaScript.
- To gain knowledge of Node.js.
- To understand the concepts of working with MongoDB.
- To gain knowledge of ReactJS.
- To create Restful web Services.

**COURSE OUTCOMES:**

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

- Utilize the syntax, semantics of JavaScript for a web application.
- Apply the knowledge of Node.js concepts in web applications.
- Develop JavaScript's Shell using MongoDB.
- Apply the ReactJS to web based applications.
- Analyze the back end connection in react web applications.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO3	3	2	1	-	2	-	-	1	2	2	-	2	-	2
CO4	3	2	1	-	2	-	-	1	2	2	-	2	-	2
CO5	3	3	2	1	2	-	-	1	2	2	-	2	-	2
Avg.	3	2.2	1.2	0.2	1.2	-	-	0.6	2	2	-	2	-	2

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION TO GIT AND JAVASCRIPT (9)**

Introduction to Full Stack Development - Intro to Git - Git Commands using CLI - Git vs. GitHub - Git Work Flow - Pull Requests. JavaScript: Variables – Datatypes - Operators - Expressions – Data structures – Control statements – Functions – this keyword – AJAX – Callbacks – Promises – Classes – Modules – Debugging.

## **UNIT II NODE JS BASICS (9)**

Introduction to Node.js – Modules: Common JS – ESM – Custom Modules. Package Manager: npm. Error Handling: Types of Errors – Handling Async Errors – Stack Trace – Asynchronous Programming – Command Line Apps – Working with APIs – Templating Engines.

## **UNIT III WORKING WITH MONGODB (9)**

Introduction to MongoDB – MongoDB through the JavaScript’s Shell – Creating and Querying through Indexes – Collections and Documents – MongoDB Query Language – Connecting node.js with MongoDB.

## **UNIT IV FRONTEND DEVELOPMENT WITH REACT JS (9)**

Introduction to ReactJS – CLI tools – Components: Component Basics – Functional Components. Rendering – Hooks: Basic Hooks – Common Hooks – Custom Hooks – Routing using React Router – State Management with Context – Styling using Material UI and Tailwind.

## **UNIT V REST API AND TESTING (9)**

API calls: Axios – react-query – SWR – Testing: React Testing Library – Jest – Playwright – Forms with React Hook Form – Connecting react application to the backend.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Jennifer Niederst Robbins, “Fullstack React: The Complete Guide to ReactJS and Friends”, Fullstack.IO, First Edition, 2017.
2. Vasan Subramanian, “Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node”, Apress Media LLC, Second Edition, 2019.

### **REFERENCE BOOKS:**

1. Alex Banks and Eve Porcello, “Learning React: Functional Web Development with React and Redux”, O'Reilly Media, First Edition, 2017.
2. Sebastian Springer, “Node.js: The Comprehensive Guide to Server-Side JavaScript Programming”, Shroff publishers, First Edition, 2022.
3. Shannon Bradshaw, Eoin Brazil and Kristina Chodorow, “MongoDB: The Definitive Guide”, O'Reilly Media, Third Edition, 2020.

**WEBLINKS:**

1. <https://www.w3schools.com/jsrEF/default.asp>
2. <https://devdocs.io/javascript/>
3. <https://reactjs.org/docs/getting-started.html>
4. <https://nodejs.org/en/docs/>

## SEMESTER-VI

23BEEE6E08

PROGRAMMABLE LOGIC CONTROLLER  
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:

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

## COURSE OUTCOMES:

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

- Outline the basics of PLCs.
- Develop the process control systems.
- Design PLC based system for process control.
- Make use of data handling functions for PLC.
- Apply the PID principles for PLC operation.

## CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	-	-	1
CO2	3	2	1	1	-	-	-	1	1	1	-	-	-	1
CO3	3	2	1	1	-	-	-	1	1	1	-	-	-	1
CO4	3	2	1	1	-	-	-	1	1	1	-	-	-	1
CO5	3	2	1	1	-	-	-	1	1	1	-	-	-	1
Avg.	2.8	1.8	0.8	0.8	-	-	-	1	1	1	-	-	-	1

3-Strong; 2-Medium; 1-Low

**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 to I/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

**TOTAL:45****TEXT BOOKS:**

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

## SEMESTER-VII

23BEEE7E01

INDUSTRIAL AUTOMATION

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 provide the student with basic skills useful in identifying the concepts of automation using hydraulics, pneumatics and industrial sensors
- To gain knowledge about controller tuning methods.
- To provide the student with basic skills useful in identifying the concepts of PLC
- To provide the student with basic skills useful in identifying the concepts of SCADA
- To provide the student with basic knowledge of advanced controller design.

**COURSE OUTCOMES:**

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

- Identify the sensors and actuators for automation.
- Experiment with the controller tuning methods and its implementation
- Design PLC program for the given application
- Utilize SCADA for the given application
- Design and implement advanced control techniques for automation.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	1	1	1	-	-	2	1
CO2	3	2	1	1	-	-	-	1	1	1	-	-	2	1
CO3	3	3	2	2	1	-	-	1	1	1	-	-	2	1
CO4	3	2	1	1	1	-	-	1	1	1	-	-	2	1
CO5	3	3	2	2	1	-	-	1	1	1	-	-	2	1
Avg.	3	2.4	1.4	1.4	0.6	-	-	1	1	1	-	-	2	1

**3-Strong; 2-Medium; 1-Low**



## **UNIT I SENSORS, ACTUATORS**

**(9)**

Sensors, Actuators and Signal conditioning Sensors: Displacement sensors, Force sensors, Ultrasonic sensors, Temperature sensors, Pressure sensors etc Actuators: DC motors, Servomotors, Stepper motors, Piezoelectric actuators, Pneumatic actuators etc. 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 Nichols tuning method, Cohencon tuning method, Implementation of PID controllers (digital and analog).

## **UNIT III PLC**

**(9)**

PLC (Programmable logic controllers): Overview, operation and architecture, PLC programming, 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, Duplexer split range control, Over ride control, internal mode control.

### **TEXT BOOKS:**

1. Krishna Kant Computer-Based Industrial Control, 2nd edition Prentice Hall of India Ltd, 2003.
2. Stephanopoulos Chemical Process Control–Theory and Practice Prentice Hall of India Ltd, 2014

### **REFERENCE BOOKS:**

1. Noble, David. Forces of production: A social history of industrial automation. Routledge, 2017.
2. Introduction to programmable logic controller by Gary Dunning, Thomson Asia Pvt Ltd. Publication, Singapore, Third Edition, 2016.

### **WEBLINKS**

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

## SEMESTER-VII

23BEEE7E02

SUBSTATION ENGINEERING AND AUTOMATION

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 help engineering students to have a holistic understanding of the concepts behind substation engineering and design.
- To learn about the sizing and selection of equipment which forms part of substation.
- To study the different protection and control scheme involved in substation design
- To enhance the knowledge, and give the practical guidelines for composite layout design aspects of the substation
- To provide knowledge about state-of-the-art technology in substation automation system

**COURSE OUTCOMES:**

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

- Explain the key deciding factors involved in substation design and operation
- Select the size of equipments which forms part of substation
- Develop the protection and control scheme involved in substation design
- Design the composite layout of the substation with different services, Interdisciplinary aspects involved in substation design and the challenges including statutory clearances.
- Illustrate the substation automation system and different communication protocol involved for efficient operation of a substation

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	2	1	2	2	-	-	-	2	2	1
CO2	2	2	2	2	2	2	-	1	2	-	-	2	2	1
CO3	2	2	2	2	-	2	2	1	1	-	-	2	2	1
CO4	2	2	2	2	1	2	-	2	2	-	-	2	2	1
CO5	-	2	2	2	-	2	-	1	-	-	-	2	2	1
Avg.	1.4	2	2	1.6	1	1.8	0.8	1.4	1	-	-	2	2	1

**3-Strong; 2-Medium; 1-Low**

## **UNIT I SUBSTATION DESIGN DEVELOPMENT**

**(9)**

Substation Introduction and Classifications, Different bus bar switching schemes for Substation. Standards and Practices, Factors Influencing Substation Design - Altitude, Ambient Temperature, Earthquake and seismic zones, pollution and corrosion etc., Testing of Electrical Equipment, Concept and development of Single Line Diagram. Requirement of substation calculation.

## **UNIT II SUBSTATION EQUIPMENT**

**(9)**

Selection and sizing of main substation equipment: Transformer, Isolator, Circuit Breaker, surge arrester, Instrument transformers, classification of equipment with a practical overview, and the performance parameters. Classifications of MV Switchgear and Key Design Parameters, MV/LV Switchgear construction and design of control scheme. Station Auxiliary equipment: Diesel Generator System, Basics of AC/DC Auxiliary Power System & Sizing of Aux. Transformer, DC System Components, Battery Sizing & charger Sizing, DG Set Classification, and sizing. Introduction to gas insulated substation: Operating principle of GIS, Advantage over AIS, construction of GIS.

## **UNIT III PROTECTION AND SUBSTATION AUTOMATION**

**(9)**

Power System protection, Overcurrent and Earth Fault protection and coordination. Distribution Feeder Protection, Transformer – Unit/Main Protection, Familiarization of NUMERICAL Relays, distance/differential protection for transmission line. Substation Automation: Evolution of Substation Automation, Communication System Fundamentals-Protocol fundamental and choosing the right protocol. Substation integration and automation functional architecture, Substation signal list - DI, DO, AI, AO– Bay Control Unit (BCU), Remote Terminal Unit RTU.

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## **UNIT IV SUBSTATION DESIGN & LAYOUT ENGINEERING**

**(9)**

Layout aspects of Outdoor Air Insulated Substation and GIS: Statutory Clearances, Equipment Layout engineering aspects for Outdoor Substation/GIS and related calculations, and guide lines, Cable routing layout, Erection Key Diagram (EKD), switchyard earthing design as per IEEE80, Importance and Types of Earthing, Earthing Design, Types of Earthing Material, Direct stroke Lightning Protection for switchyard with IS/ IEC 62305. LV Cables - Power & Control, MV Cables, Methods for Cable Installation, Practical aspects of Cable Sizing, Cable accessories, Illumination System Design.

## **UNIT V INTERFACE ENGINEERING**

**(9)**

Civil & Structural Engineering - Familiarization of site development plan, equipment supports structures, foundation for equipment, familiarization of control building and substation building, infrastructure development, Mechanical System- Fire Detection, Alarm System and Fire Suppression System for transformer, Heating, Ventilation and Air-conditioning (HVAC) for Substation.

**TEXT BOOKS:**

1. McDonald John D, “Electric Power Substations Engineering”, CRC Press, 3rd Edition, 2012.
2. Partap Singh Satnam, P.V. Gupta, “Sub-station Design and Equipment”, Dhanpat Rai Publications, 1st Edition, 2013.

**REFERENCE BOOKS:**

1. Sunil S. Rao, “Switchgear Protection and Power Systems (Theory, Practice & Solved Problems)”, Khanna Publications, 14th Edition, 2019.
2. Electrical substation and engineering & practice by S.Rao, 3rd Edition, Khanna Publishers 2015.
3. Manual on Substation by Central Board of irrigation and Power (CBIP) Publication No 342., 2006.
4. Substation automation system Design and implementation by Evelio Padilla by Wiley Publications, 1st Edition, 2015 November.

## SEMESTER-VII

23BEEE7E03

POWER SYSTEM OPERATION AND CONTROL

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 understand the power system load variation and control.
- To apply the load frequency control in single and multi- area power system.
- To know the voltage control schemes on power system.
- To find solution for the unit commitment and economic dispatch problems
- To study the monitoring and control of a power systems.

**COURSE OUTCOMES:**

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

- Explain the power system load variation and control
- Apply the load frequency control in single and multi- area system.
- Examine the voltage control schemes on power system.
- Solve the unit commitment and economic dispatch problems.
- Utilize SCADA for data monitoring and control of power system.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	1	3	2
CO2	3	2	1	1	-	-	-	1	-	1	-	1	3	2
CO3	3	2	1	1	-	-	-	1	-	1	-	1	3	2
CO4	3	2	1	1	-	-	-	1	-	1	-	1	3	2
CO5	3	2	1	1	-	-	-	1	-	1	-	1	3	2
Avg.	2.8	1.8	0.8	0.8	-	-	-	1	-	1	-	1	3	2

3-Strong; 2-Medium; 1-Low

## **UNIT I 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 system derivation.

## **UNIT III REACTIVE POWER–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 transmission loss.

## **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  $\lambda$ -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, in-extremis and restorative. State transition diagram showing various state transitions and control strategies.

**TOTAL 45**

### **TEXT BOOKS:**

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 Hill Publishing Company Limited, New Delhi.3rd Edition,2003
3. Kundur, P, Power System Stability and Control, Tata McGraw Hill Publications, 2010.

## SEMESTER-VII

23BEEE7E04

POWER QUALITY AND MANAGEMENT

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 understand the power quality problems and power quality standards.
- To classify the sources of voltage sags and its mitigation techniques.
- To Identify the various cases of over voltages and its mitigation methods
- To solve the harmonic problems in power system.
- To know about the power quality measuring instruments.

**COURSE OUTCOMES:**

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

- Interpret the various classes of power quality problems and power quality standards.
- Classify the sources of voltage sags and its mitigation techniques
- Identify the various cases of over voltages and its mitigation methods
- Solve the harmonic problems in power system.
- Illustrate the harmonics measurements techniques

**CO-PO MAPPING:**

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

3-Strong; 2-Medium; 1-Low

## **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.

### **TEXT BOOKS:**

1. Roger C. Dugan, Mark F. Mc Granaghan, Surya Santoso and H. Wayne Beaty, “Electrical Power Systems Quality”, 3rd 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.

### **REFERENCE BOOKS:**

1. Math H.J. Bollen, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, IEEE Press, New York, 2011.
2. Arrillaga.J, Watson.N. R and Chen.S, “Power System Quality Assessment”, 3rd edition, John Wiley and Sons Ltd., England, 2011.
3. Beaty H. Wayne, McGranaghan and Mark, “Electrical Power Systems Quality”, 3rd edition, 2012.

### **WEB LINKS:**

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



## SEMESTER-VII

23BEEE7E05

VLSI

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3Hours

**COURSE OBJECTIVES:**

- To explain the basic concepts of CMOS.
- To introduce the IC fabrication methods.
- To introduce the Reconfigurable Processor technologies.
- To introduce the basics of analog VLSI design and its importance.
- To learn about the programming of Programmable device using Hardware description Language.

**COURSE OUTCOMES:**

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

- Outline the operation and applications of transmission gate and inverters
- Explain the concept of MOS transistors and its characteristics
- Apply the basics of CMOS fabrication techniques (n well, p well, Twin tub, SOI)
- Make use of I/O structures and VLSI Clocking
- Develop a model for given digital system using Hardware Description Language (VHDL)

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	-	-	-	-	-	-	2
CO2	2	1	1	1	1	-	-	-	-	-	-	-	-	2
CO3	3	2	1	1	1	-	-	-	-	-	-	-	-	2
CO4	3	2	1	1	1	-	-	-	-	-	-	-	-	2
CO5	3	2	1	1	1	-	-	-	-	-	-	-	-	2
Avg.	2.6	1.6	1	1	1	-	-	-	-	-	-	-	-	2

**3-Strong; 2-Medium; 1-Low**

## **UNIT I CMOS LOGIC**

(9)

CMOS Logic: Fan in & Fan out-Transistor Sizing-Basic physical Design of Simple Logic Gates: Inverter, NAND, NOR and Compound gates -Multiplexers and Flip flops-Pass Transistor and Transmission Gate-Layout Design Rules and Stick diagrams.

## **UNIT II MOS TRANSISTOR THEORY**

(9)

nMOS and pMOS Enhancement Transistor-Threshold Voltage and Body Effect-MOS Device Design Equation -Second Order Effects-DC Transfer Characteristics. The Complementary CMOS Inverter-Beta Ratio- Noise Margin-Ratioed Inverter Transfer function-Pass Transistor-Tristate Inverter

## **UNIT III CMOS PROCESSING TECHNOLOGY**

(9)

Silicon Semiconductor Technology- Basic CMOS Technology (N-well, P-well, Twin Tub, SOI)- Inter connect, Circuit Elements - Performance Estimation: Delay Estimation-Transistor Sizing Power Dissipation-Interconnect-Design Margin.

## **UNIT IV VLSI I/O STRUCTURES CLOCKING AND TESTING OF VLSI CIRCUITS**

(9)

I/O Structures, Clocked Flip Flops, CMOS Clocking Styles, Pipelined Systems, Clock Generation and Distribution. Testing of VLSI Circuits: General Concepts, CMOS Testing, Test Generation Methods.

## **UNIT V HDL PROGRAMMING**

(9)

Verilog HDL- Overview - structural and behavioural modeling concepts-Design examples- Carry Look ahead adders, ALU, Shift Registers.

**TOTAL:45**

### **TEXT BOOKS:**

1. Neil H.E. Weste, David Harris & Ayan Banerjee, “CMOS VLSI Design- A Circuits and Systems Perspective”, Third Edition, Pearson education, 2008.
2. John P. Uyemura “Introduction to VLSI Circuits and systems” – John Wiley & Sons, Inc., 2008

### **REFERENCE BOOKS:**

1. Wayne Wolf, “Modern VLSI Design,” 2nd edition, Prentice Hall PTR, 2000.
2. Sung – Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated circuits, Analysis & Design”, 3rd edition, Tata McGraw – Hill Publishing, 2003.
3. J. Bhaskar, “A VHDL Primer”, Third Edition, Addition Wesley, 1999.

### **WEB LINKS:**

1. <https://archive.nptel.ac.in/courses/108/107/108107129/>
2. [http://gn.dronacharya.info/ECEDept/Downloads/QuestionPapers/7th\\_Sem/VLSIDESIGN/U\\_NIT-1/Lecture-3.pdf](http://gn.dronacharya.info/ECEDept/Downloads/QuestionPapers/7th_Sem/VLSIDESIGN/U_NIT-1/Lecture-3.pdf)
3. <https://web.itu.edu.tr/~ateserd/vlsi2/2007/FPGAs&CPLD.pdf>
4. [https://kanchiuniv.ac.in/coursematerials/GSK\\_Notes\\_on\\_PLD\\_in\\_VLSI\\_design.pdf](https://kanchiuniv.ac.in/coursematerials/GSK_Notes_on_PLD_in_VLSI_design.pdf)
5. <https://www.xilinx.com/products/silicon-devices/resources/programming-an-fpga-anintroduction-to-how-it-works.html>
6. <https://www.allaboutcircuits.com/technical-articles/what-is-an-fpga-introduction-toprogrammable-logic-fpga-vs-microcontroller/>.

## SEMESTER-VII

23BEEE7E06

INTERNET OF THINGS

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

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

**COURSE OUTCOMES:**

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

- Summarize the concept of Internet of Things
- Illustrate the architecture of internet of things
- Identify different protocols and wireless technologies for IoT
- Determine the embedded processors for IoT.
- Apply applications of IoT in home Automation and identify the different applications in IoT.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	1	-	-	-	1	-	2
CO2	2	1	1	1	1	-	-	1	-	-	-	1	-	2
CO3	3	2	1	1	1	-	-	1	1	-	-	1	-	2
CO4	3	2	1	1	1	-	-	1	1	-	-	1	-	2
CO5	3	2	1	1	1	-	-	1	2	-	-	1	-	2
Avg.	2.6	1.6	1	1	1	-	-	1	0.8	-	-	1	-	2

**3-Strong; 2-Medium; 1-Low**

## **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 RASPBERRY 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.

### **TEXT BOOKS:**

1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach “Internet of Things”, Universities Press 2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi “ The Internet of Things”,Wiley,2016.

### **REFERENCE BOOKS:**

1. Samuel Greengard, “The Internet of Things”, The MIT press,2015
2. Adrian McEwen and Hakim Cassimally “Designing the Internet of Things “Wiley,2014.
3. Jean- Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: The Next Internet” Morgan Kuffmann Publishers,2010.
4. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley and sons, 2014

## SEMESTER-VII

23BEEE7E07

HVDC AND FACTS

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 understand the fundamentals of FACTS Controllers
- To know the importance of controllable parameters and types of FACTS controllers & their benefits
- To study about combined compensators.
- To understand the control aspects of HVDC System.
- To understand about voltage source converter based HVDC systems.

**COURSE OBJECTIVES:**

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

- Choose proper FACTS controller for the specific application based on system requirements
- Analyze the control circuits of Shunt controllers, Series controllers & Combined controllers for various functions viz.
- Analyze the concept of Transient stability Enhancement, voltage instability prevention and power oscillation damping
- Compare EHVAC and HVDC system and to describe various types of DC links and various methods for the control of HVDC systems
- Discuss the power flow analysis in AC/DC systems

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	-	-	-	1	2
CO2	3	3	2	2	1	-	-	-	-	-	-	-	1	2
CO3	3	3	2	2	1	-	-	-	-	-	-	-	1	2
CO4	3	3	2	2	1	-	-	-	-	-	-	-	1	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	1	2
Avg.	3	2.8	1.8	1.8	1	-	-	-	-	-	-	-	1	2

**3-Strong; 2-Medium; 1-Low**

### **UNIT I FACTS CONCEPTS**

**(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 COMPENSATOR**

**(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 (TSC), static series synchronous compensator (SSSC), power angle characteristics, and basic operating control schemes.

### **UNIT III COMBINED COMPENSATOR**

**(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 DC links, 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.

**TOTAL:45**

#### **TEXT BOOKS:**

1. Hingorani, L.Gyugyi, Concepts and Technology of Flexible AC Transmission System, "IEEE Press New York, 2000 ISBN –0780334588.
2. Padiyar, K.R. HVDC transmission systems, "Wiley Eastern Ltd., 2010.

#### **REFERENCE BOOKS:**

1. Song, Y.H. and Allan T. Johns, "Flexible AC Transmission Systems (FACTS)", Institution of Electrical Engineers Press, London, 1999.
2. Mohan Mathur R. and Rajiv K. Varma, "Thyristor-based FACTS controllers for Electrical Transmission systems", IEEE press, Wiley Interscience, 2002.
3. Padiyar K.R. FACTS controllers for Transmission and Distribution systems "New Age International Publishers, 1st Edition, 2007.
4. Enrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho 2007 (digital).

## SEMESTER-VII

23BEEE7E08

HYBRID ELECTRIC VEHICLES

3H-3C

Instruction Hours/week:L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To understand the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- To familiarize the plug – in hybrid electric vehicle architecture, design and component sizing and the power electronics devices used in hybrid electric vehicles.
- To analyze various electric drives suitable for hybrid electric vehicles.
- To discuss different energy storage technologies used for hybrid electric vehicles and their control.
- To demonstrate different configurations of electric vehicles and its components, hybrid vehicle configuration by different techniques, sizing of components and design optimization and energy management.

**COURSE OUTCOMES:**

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

- Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals
- Analyze the use of different power electronics devices and electrical machines in hybrid electric vehicles.
- Choose energy storage devices for hybrid electric vehicles, their technologies and control
- Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration.
- Analysis the performance of Energy Management strategies in HEVs.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	1	1	-	1	-	-	-	1	3
CO2	3	3	2	2	1	1	1	-	1	-	-	-	1	3
CO3	3	3	2	2	1	1	1	-	1	-	-	-	1	3
CO4	3	3	2	2	1	1	1	-	1	-	-	-	1	3
CO5	3	3	2	2	1	1	1	-	1	-	-	-	1	3
Avg.	2.8	2.8	1.8	1.8	1	1	1	-	1	-	-	-	1	3

3-Strong; 2-Medium; 1-Low

## **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.

### **TEXT BOOKS:**

1. C.Mi, M.A. Masrur and D.W.Gao, “Hybrid Electric Vehicles: Principles and Applications with 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 Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
4. T.Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.

### **WEBLINKS:**

1. <https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics>
2. [https://swayam.gov.in/nd1\\_noc20\\_ee18/preview3](https://swayam.gov.in/nd1_noc20_ee18/preview3)
3. <https://nptel.ac.in/courses/108103009/>
4. [https://nptel.ac.in/content/storage2/nptel\\_data3/html/mhrd/ict/text/106105166/lec.pdf](https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lec.pdf)
5. <https://nptel.ac.in/courses/106105166/>
6. <https://nptel.ac.in/courses/108108098/>



## OPEN ELECTIVES

**B.Tech. Artificial Intelligence & Data Science**

**2023-2024**

**23BTADOE01**

**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: 3Hours**

### **COURSE OBJECTIVES:**

- 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:**

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

- Express the key concepts in data science and data processing.
- Describe sampling and probabilistic models to a real time application.
- Discuss about data normalization and data management tools.
- Identify the difference between supervised and unsupervised machine learning techniques.
- Illustrate the different analytics used in business intelligence.

### **CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	-	-	2	-	2	2	-	1
CO2	3	3	3	3	3	2	-	-	2	-	2	2	-	1
CO3	3	3	2	2	2	2	-	-	2	-	2	2	-	1
CO4	3	3	3	3	2	2	-	-	2	-	2	2	-	1
CO5	3	3	2	2	2	2	-	-	2	-	2	2	-	1
Avg.	3	3	2.6	2.6	2.2	2	-	-	2	-	2	2	-	1

**3-Strong; 2-Medium; 1-Low**

### **UNIT I INTRODUCTION**

**(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 PROBABILISTIC MODELS (9)**

Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

## **UNIT III NORMALIZATION (9)**

Data Normalization (z-values, transforms) –Random processes –Data Management: Tools for Data Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

## **UNIT IV DATA MINING (9)**

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse–Machine Learning- Supervised Learning, Unsupervised Learning.

## **UNIT V BUSINESS INTELLIGENCE AND ANALYTICS (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.

**TOTAL: 45**

### **TEXT BOOKS:**

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, Second Edition, 2014.
2. Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.

### **REFERENCE BOOKS:**

1. Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition, 2015.
2. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly Publication, First Edition, 2017.

### **WEBLINKS:**

1. <https://www.inferentialthinking.com/chapters/intro>
2. [https://swayam.gov.in/nd1\\_noc20\\_cs36/preview](https://swayam.gov.in/nd1_noc20_cs36/preview)
3. [https://swayam.gov.in/nd1\\_noc19\\_cs60/preview](https://swayam.gov.in/nd1_noc19_cs60/preview)
4. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/>

**23BTADOE02 FUNDAMENTALS ARTIFICIAL INTELLIGENCE****3H-3C****Instruction Hours/week:L:3 T:0 P:0****Marks: Internal: 40 External:60 Total:100****End Semester Exam: 3Hours****COURSE OBJECTIVES:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To represent knowledge in solving AI problems.
- To illustrate the different ways of designing software agents
- To know the various applications of AI.

**COURSE OUTCOMES:**

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

- Identify the performance of search algorithms and its applications.
- Infer the different methods of knowledge representation.
- Discuss about Description logic and conceptional dependencies.
- Make use of strategies for optimal decision-making in the context of game-playing scenarios.
- Illustrate the properties of Markov process and the concept of transition probabilities.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	2	-	-	-	-	-	2	-	1
CO2	3	3	3	2	-	2	-	-	-	-	-	2	-	1
CO3	3	3	2	2	-	2	-	-	-	-	-	2	-	1
CO4	3	2	2	2	-	2	-	-	-	-	-	2	-	1
CO5	3	2	2	2	-	2	-	-	-	-	-	2	-	1
Avg.	3	2.6	2.4	2	-	2	-	-	-	-	-	2	-	1

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION**

**(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 KNOWLEDGE REPRESENTATION**

**(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, inferencing, monotonic and non monotonic reasoning. Introduction to prolog.

## **UNIT III NETWORK-BASED REPRESENTATION**

**(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 GAME THEORY**

**(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 FUZZY LOGIC**

**(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.

**TOTAL: 45**

### **TEXTBOOKS:**

1. "Artificial Intelligence", Elaine Rich, Kevin Knight, Mc-Graw Hill, 2020.
2. "Introduction to AI & Expert System", Dan W. Patterson, PHI, 2020.

### **REFERENCE BOOKS:**

1. "Artificial Intelligence" by Luger (Pearson Education), 2020.
2. Russel & Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2020.

### **WEBLINKS:**

1. <https://www.pluralsight.com/blog/data-professional/fundamentals-of-artificial-intelligence>

**23BTADOE03****INTERNET PROGRAMMING****3H-3C****Instruction Hours/week: L:3 T:0 P:0****Marks: Internal: 40 External:60 Total:100****End Semester Exam:3Hours****COURSE OBJECTIVES:**

- Recall fundamental tags used in HTML5 and CSS to create simple web application.
- Rephrase the concept to create static and dynamic webpage with validation controls and event handling methods.
- Make use of servlets and JSP tag to develop server-side scripting.
- Summarize the tags in PHP and XML to create simple PHP web application.
- Interview the basic concept and tags are used in web service application using ajax.

**COURSE OUTCOMES:**

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

- Develop a basic website using HTML and Cascading Style Sheets.
- Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.
- Examine server-side programs using Servlets and JSP.
- Model a simple web pages in PHP and represent data in XML format.
- Illustrate on simple web service application using Ajax.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	-	-	2	-	-	2	-	1
CO2	3	3	3	2	2	2	-	-	2	-	-	2	-	1
CO3	3	3	3	2	2	2	-	-	2	-	-	2	-	1
CO4	3	3	3	3	2	2	-	-	2	-	-	2	-	1
CO5	3	3	2	2	2	2	-	-	2	-	-	2	-	1
Avg.	3	3	2.8	2.2	2	2	-	-	2	-	-	2	-	1

**3-Strong; 2-Medium; 1-Low****UNIT I – WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0****(9)**

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

## **UNIT II - CLIENT-SIDE PROGRAMMING**

**(9)**

Java Script: An introduction to JavaScript-JavaScript DOM Model-Date and Objects, -Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

## **UNIT III – SERVER-SIDE PROGRAMMING**

**(9)**

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server DATA BASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code

## **UNIT IV – PHP AND XML**

**(9)**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

## **UNIT V – INTRODUCTION TO AJAX AND WEB SERVICES**

**(9)**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Anuratha A Puntebekar, "Internet Programming", Technical Publication, 2020.
2. John Dean, "Web Programming with HTML5, CSS and JavaScript", Jones & Bartlett Learning, 2018.
3. Sriram K Vasudevan, Meenakshi Sundaram, and Chandni Suresh "Essential of Internet Programming" DreamTech Press, Wiley, 2015.

### **REFERENCE BOOKS:**

1. Abiket Nagane, "Internet Programming II", Nirali Prakashan, 2016.
2. Max Bramer, "Web Programming With PHP and MySQL", A Practical guide, Springer, 2015
3. Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.
4. Uttam K. Roy, —Web Technologies, Oxford University Press, 2011.

### **WEBLINKS:**

1. <https://www.geeksforgeeks.org/internet-and-web-programming/>
2. <http://www.eie.polyu.edu.hk/~em/it0506pdf/4%20Internet%20Programming.pdf>
3. <https://www.techopedia.com/definition/23898/web-programming>
4. [https://www.tutorialspoint.com/internet\\_technologies/index.htm](https://www.tutorialspoint.com/internet_technologies/index.htm)

**23BTADOE04****ROBOTICS AND AUTOMATION****3H-3C****Instruction Hours/week: L:3 T:0 P:0****Marks: Internal: 40 External:60 Total:100****End Semester Exam:3Hours****COURSE OBJECTIVES:**

- To introduce the functional elements of Robotics.
- To impart knowledge on the forward and inverse kinematics.
- To interpret the manipulator differential motion and control.
- To educate on various path planning techniques.
- To understand about hydraulics system.

**COURSE OUTCOMES:**

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

- Apply basic concept of robotics fundamental principles, components, and applications of robotic systems.
- Discuss the dynamics of robotic systems and implications for planning and control.
- Outline the principles of state estimation, prediction, and update steps involved in the Kalman filtering process.
- Analyze the components, working principles, and applications of Pneumatic and Hydraulic system.
- Model the principles of fluidic devices and fluidic logic circuits and their applications in automation.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	2	-	2	2	-	1
CO2	2	2	2	2	-	2	-	-	2	-	2	2	-	1
CO3	3	3	3	3	-	2	-	-	2	-	2	2	-	1
CO4	3	3	3	3	-	2	-	-	2	-	2	2	-	1
CO5	3	3	3	3	2	2	-	-	2	-	2	2	-	1
Avg.	2.8	2.8	2.6	2.6	0.4	2	-	-	2	-	2	2	-	1

**3-Strong; 2-Medium; 1-Low**

**UNIT I KINEMATICS CONCEPTS****(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 MOBILE ROBOTS****(9)**

Dynamics – Mobile Robots – Planning and Control – Path & Trajectory planning – Probabilistic Roadmaps – Localization.

**UNIT III PROBABILISTIC METHODS FOR ROBOTICS****(9)**

Basics of probability – Kalman Filtering – Extended Kalman – Particle filter – Localization – Computer Vision – Vision Based Controls.

**UNIT IV AUTOMATION FUNDAMENTALS AND PRINCIPLES****(9)**

Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors – Fluid accessories.

**UNIT V ELECTRICAL AND ELECTRONIC CONTROLS****(9)**

Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders.

**TOTAL: 45****TEXT BOOKS:**

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.

**REFERENCE BOOKS:**

1. “Industrial Automation and Robotics”, Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
2. “Industrial Robotics”, Groover. M.P, Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017.
3. “Embedded Systems & Robotics”, Ghoshal. S, Cengage Learning, First Edition, 2009.
4. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

**WEBLINKS:**

1. [www.nptel.ac.in/courses/112/101/112101099/](http://www.nptel.ac.in/courses/112/101/112101099/)
2. [www.nptel.ac.in/courses/112/101/112101098/](http://www.nptel.ac.in/courses/112/101/112101098/)
3. [www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial](http://www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial)
4. [www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots](http://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/](http://www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/)



23BEBMEOE01

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:3Hours

**COURSE OBJECTIVES:**

- 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 infer basic understanding of the inter connection of various organ systems in human body

**COURSE OUTCOMES:**

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

- Explain basic structure and functions of cells and its organelles
- Elucidate the Nervous Control system of Heart
- Classify respiration types and its function
- Illustrate the functions of Digestion and absorption system
- Differentiate the functions of sensory organs and Endocrine glands of human

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	1	1	-	1	-	-
CO2	2	2	2	2	-	-	-	-	1	1	-	1	-	-
CO3	2	2	2	2	-	-	-	-	1	1	-	1	-	-
CO4	2	2	2	2	-	-	-	-	1	1	-	1	-	-
CO5	2	2	2	2	-	-	-	-	1	1	-	1	-	-
Avg.	2	2	2	2	-	-	-	-	1	1	-	1	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I CELL****(9)**

Structure of Cell– Organelles and description–Function of each component of the cell– Membrane potential–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 CARDIAC AND NERVOUS SYSTEM****(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-Spinal cord–Reflex action.

**UNIT III RESPIRATORY SYSTEM AND MUSCULO SKELETAL SYSTEM (9)**  
Physiological aspects of respiration–Trachea and lungs -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 Sweat Gland–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.

**TOTAL: 45**

**TEXT BOOKS:**

1. Textbook Equity Edition, Anatomy and Physiology : Volume 2 of 3, Lulu.com, 2014

**REFERENCE BOOKS:**

1. William F. Ganong, Review of Medical Physiology, Mc Graw Hill, New Delhi, 26th Edition, 2019
2. Arthur C. Guyton, Text book of Medical Physiology Elsevier Saunders, 12th Edition, 2011

**WEBLINKS**

1. <https://dth.ac.in/medical/course.php>
2. [https://onlinecourses.swayam2.ac.in/cec20\\_bt19/preview](https://onlinecourses.swayam2.ac.in/cec20_bt19/preview)

**23BEBMEOE02****ARTIFICIAL ORGANS AND IMPLANTS****3H-3C****Instruction Hours /week:L:3 T:0 P:0  
Total:100****Marks: Internal:40 External:60****End Semester Exam:3Hours****COURSE OBJECTIVES:**

- 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

**COURSE OUTCOMES:**

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

- Compare the fundamentals of Artificial organs and Transplants
- Explain the implant design parameters and solution in use
- Interpret the response of biomaterials in living system
- Choose blood interfacing implants
- Differentiate soft and hard tissue replacements

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2	2	2	-	-	-	-	1	1	-	1	-	-
<b>CO2</b>	2	2	2	2	-	-	-	-	1	1	-	1	-	-
<b>CO3</b>	2	2	2	2	-	-	-	-	1	1	-	1	-	-
<b>CO4</b>	3	3	3	3	-	-	-	-	1	1	-	1	-	-
<b>CO5</b>	2	2	2	2	-	-	-	-	1	1	-	1	-	-
<b>Avg.</b>	<b>2.2</b>	<b>2.2</b>	<b>2.2</b>	<b>2.2</b>	-	-	-	-	<b>1</b>	<b>1</b>	-	<b>1</b>	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I ARTIFICIAL ORGANS & TRANSPLANTS****(9)**

ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration – Evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individualorgans – 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 &amp; 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.

**TOTAL: 45**

#### **TEXT BOOKS:**

1. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976
2. Park J.B, Biomaterials Science and Engineering, Plenum Press, 2011

#### **REFERENCE BOOKS :**

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.
2. R S Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill, 2003
3. Joon B Park, Biomaterials – An Introduction, Plenum press, New York, 1992.
4. Yannas, I. V, —Tissue and Organ Regeneration in Adults, New York, NY: Springer, 2001.
5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, Clinical Engineering, CRC Press, 1st edition, 2010.
6. Standard Handbook of Biomedical Engineering & Design , Myer Kutz, McGrawHill, 2003

#### **WEBLINKS:**

1. <https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/>

**COURSE OBJECTIVES:**

- Elaborate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Discuss the 3D structure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.
- Illustrate the brief knowledge in Micro array data analysis.

**COURSE OUTCOMES:**

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

- Summarize the basic concepts of bioinformatics.
- Outline the sequence retrieval and analysis tools using bioinformatics.
- Infer the methods used to construct phylogenetic tree for evolution analysis.
- Apply the protein structure knowledge for modeling
- Make use of bio-informatics principles towards biological applications.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	1	-	-	1	-	-	-	-	-	-	1	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	-	1	1	-	-	-	-	-	2	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	2	-	-
Avg.	2.4	1.2	0.8	0.2	0.4	0.2	-	-	-	-	-	1.6	-	-

**3-Strong; 2-Medium; 1-Low**

**UNIT I 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. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

## **UNIT II RETRIEVAL OF BIOLOGICAL DATA (9)**

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system). 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 macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

## **UNIT IV STRUCTURAL BIOINFORMATICS (9)**

Protein sequence data-bases- SwissProt/ TrEMBL, PIR, Sequence motif databases -Pfam, PROSITE, Protein structure databases, Protein Data Bank-SCOP, CATH, KEGG, ChEMBL, 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 & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; introduction to protein structure prediction; Protein structure prediction, modeling.

## **UNIT V MICROARRAY DATA ANALYSIS (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 bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

### **TEXT BOOKS:**

1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. Pearson Education.
2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
3. David W. Mount. (2004). Sequence and Genome Analysis. Cold Spring Harbor Laboratory.

### **REFERENCE BOOKS:**

1. Jonathan Pevsner.(2015). Bioinformatics and functional genomics. wiley-Liss.
2. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta(2013). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt. Ltd.,

### **WEBLINKS:**

1. <https://www.ncbi.nlm.nih.gov/pmc/>
2. <https://biology.mit.edu/faculty-and-research/areas-of-research/computational-biology/>

**23BTBTOE02 FUNDAMENTALS OF NANOBIO TECHNOLOGY****3H-3C****Instruction Hours/week: L:3 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- Impart the skills in the field of nanotechnology and its applications.
- Acquire knowledge in nano particle synthesis and its characterization.
- Gain the basic knowledge on the application of bionanomaterials in biotechnology
- Provide the knowledge in the field of medical nanotechnology.
- Analysis the ethical issues involve in nanotechnology.

**COURSE OUTCOMES:**

After completing the course, the students will be able to

- Summarize the basics of nanotechnology and its applications.
- Outline the techniques involves in nanoparticles synthesis and characterization.
- Apply the principles of biomolecules for the fabrication of nanoparticles
- Develop nanoscale devices for the medical applications.
- Analyze the socio-economic and ethical issues in Nano biotechnology.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	1	1	-	1	-	-	-	-	-	1	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
CO4	2	-	1	1	1	-	-	-	-	-	2	-	-	-
CO5	3	2	2	2	-	-		2	-	-	-	-	-	-
Avg.	2.4	1	1.2	0.8	0.4	-	-	0.4	-	-	1.2	-	-	-

**3-Strong; 2-Medium; 1-Low**

**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 based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

## **UNIT II NANO PARTICLES**

**(9)**

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nano fabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes. X-ray diffraction technique; Scanning Electron Microscopy with EDX; Transmission Electron Microscopy including high-resolution imaging;

## **UNIT III MEDICAL NANOTECHNOLOGY**

**(9)**

Nanomedicine, Nano biosensor and Nanofluidics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine. Case study on drug delivery of gold nanoparticles against breast cancer

## **UNIT IV 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 cancer biology. Nanomedicine. Synthetic retinyl chips based on bacteriorhodopsins. High throughput DNA sequencing with nanocarbon tubules. Nanosurgical devices.

## **UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY**

**(9)**

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

**TOTAL: 45**

### **TEXT BOOKS**

1. Goodsell, D.S. (2004). Bionanotechnology. John Wiley and Sons, Inc.
2. Shoseyov, O. and Levy, I (2008). Nanobiotechnology: Bioinspired Devices and Materials of the Future. Humana Press.

### **REFERENCE BOOKS**

1. Bhushan, B. (2017). Springer Handbook of Nanotechnology. Springer-Verlag Berlin Heidelberg.
2. Freitas Jr R.A (2006) Nanomedicine. Landes Biosciences.
3. Kohler, M. and Fritzsche, W. (2008). Nanotechnology – An Introduction to Nanostructuring Techniques. Wiley-VCH.
4. Niemeyer, C. M., and CA Mirkin, C. A., (2010); NanoBiotechnology II – More concepts, and applications. First edition, Wiley –VCH publications

### **WEBLINKS**

1. <https://mitnano.mit.edu/>
2. <https://nptel.ac.in/courses/118102003>



**23BECEO01****HOUSING PLAN AND MANAGEMENT****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 examine the role and tasks of basic housing policies and building bye laws
- Understand the process of integrated service delivery in the context of economic, social, environmental, and institutional factors.
- Analyze the Innovative construction methods and Materials.
- Analyze city management strategies and strengthen the urban governance through a problem solving approach.
- To know the Importance of basic housing policies and building bye laws
- To use Housing Programmes and Schemes

**COURSE OUTCOME:**

After completing the course, the students will be able to

- Know the Importance of basic housing policies and building bye laws.
- Use Housing Programmes and Schemes
- Plan and Design of Housing projects
- Examine Innovative construction methods and Materials.
- Know Housing finance and loan approval procedures.
- Understand Construction as well as managing techniques.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	-	-	2	-	2	2	-	-
CO2	3	3	3	3	3	2	-	-	2	-	2	2	-	-
CO3	3	3	2	2	2	2	-	-	2	-	2	2	-	-
CO4	3	3	3	3	2	2	-	-	2	-	2	2	-	-
CO5	3	3	2	2	2	2	-	-	2	-	2	2	-	-
Avg.	3	3	2.6	2.4	2.2	2	-	-	2	-	2	2	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I 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, Byelaws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

## **UNIT II 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.

## **UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS (9)**

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

## **UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS (9)**

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation.

## **UNIT V HOUSING FINANCE AND PROJECT APPRAISAL (9)**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

**TOTAL: 45**

### **TEXT BOOKS**

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 2002.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Mumbai (Bombay), 2001.

### **REFERENCE BOOKS**

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS

**COURSE OBJECTIVES:**

- Defining and identifying of engineering services systems in buildings.
- The role of engineering services systems in providing comfort and facilitating life of users of the building.
- The basic principles of asset management in a building & facilities maintenance environment
- Importance of Fire safety and its installation techniques.
- To understand Electrical system and its selection criteria
- To use the principles of illumination & design

**COURSE OUTCOMES:**

After completing the course, the students will be able to

- Machineries involved in building construction.
- Understand Electrical system and its selection criteria.
- Use the Principles of illumination & design.
- Know the principle of Refrigeration and application.
- Importance of Fire safety and its installation techniques
- Know the principle behind the installation of building services and to ensure safety in buildings.

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low**

**UNIT I 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.

## **UNIT II ELECTRICAL SYSTEMS IN BUILDINGS**

**(9)**

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

## **UNIT III PRINCIPLES OF ILLUMINATION & DESIGN**

**(9)**

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – 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 specific features required, and minimum level of illumination required for physically handicapped and elderly in building types.

## **UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS**

**(9)**

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapor – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapor 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

## **UNIT V FIRE SAFETY INSTALLATION**

**(9)**

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Specific 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.

**TOTAL: 45**

### **TEXT BOOKS:**

1. E.R.Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 2002.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

### **REFERENCE BOOKS:**

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
2. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, The Architectural Press, London, 2005.
3. National Building Code.

**23BECEO03****REPAIR AND REHABILITATION OF STRUCTURES****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 learn various distress and damages to concrete and masonry structures
- To know the influence of corrosion in durability of structures
- To understand the importance of maintenance of structures
- To study the various types and properties of repair materials
- To learn various techniques involved in demolition of structures.
- To Assessing damage of structures and various repair techniques.

**COURSE OUTCOMES:**

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

- Various distress and damages to concrete and masonry structures.
- Durability of structures and corrosion mechanism
- The importance of maintenance of structures, types, and properties of repair materials etc.
- Assessing damage of structures and various repair techniques
- the several types and properties of repair materials
- Modern technique and equipment being adopted for the demolition of structures

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low****UNIT I 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.

**UNIT II DURABILITY OF STRUCTURES****(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.

### **UNIT III MAINTENANCE AND REPAIR STRATEGIES (9)**

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

### **UNIT IV MATERIALS FOR REPAIR (9)**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

### **UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES (9)**

Non-destructive Testing Techniques, Corrosion protection techniques ,Gunit and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies.

**TOTAL: 45**

#### **TEXT BOOKS:**

1. Denison Campbell, Allen, and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair," Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
3. Shetty M.S., "Concrete Technology – Theory and Practice," S. Chand and Company, 2008.

#### **REFERENCE BOOKS:**

1. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures," Allied Publishers, 2004.
2. Gambhir.M.L., "Concrete Technology," McGraw Hill, 2013
3. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
4. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
5. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.
6. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.

**23BECEO04      COMPUTER-AIDED CIVIL ENGINEERING DRAWING      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:**

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- 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 engineering artifact.
- To Communicate a design idea/concept graphically/ visually

**COURSE OUTCOMES:**

After completing the course, the students will be able to

- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- 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 engineering artifact
- Planning and designing of structures

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low****UNIT I INTRODUCTION****(9)**

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, 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 SYMBOLS AND SIGN 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 MASONRY BONDS****(9)**

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

**UNIT IV BUILDING DRAWING****(9)**

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.

**UNIT V: PICTORIAL VIEW****(9)**

Principles of isometrics and perspective drawing. Perspective view of building, Software's

**TOTAL: 45****TEXT BOOKS:**

1. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt. Ltd.
2. Subhash C Sharma & Gurucharan Singh (2005), " Civil Engineering Drawing" , Standard Publishers

**REFERENCE BOOKS:**

1. (Corresponding set of) CAD Software Theory and User Manuals.
2. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian.
3. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria & Sons.
4. Ajeet Singh (2002), " Working with AUTOCAD 2000 with updates on AUTOCAD 2001", Tata- Mc Graw-Hill Company Limited, New Delhi



## 23BECEO05

## CONTRACTS MANAGEMENT

## 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 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:**

After completing the course, the students will be able to

- Apply project Procurement management concepts in a project environment.
- Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
- Evaluate the best practices associated with the development of contract parameters.
- Understand the legal aspects of acts governing the contracts
- Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	-	2	1	2	1	-	2	-	-	2	-	-
<b>CO2</b>	3	2	-	2	1	2	1	-	2	-	-	2	-	-
<b>CO3</b>	3	2	-	2	1	2	1	-	2	-	-	2	-	-
<b>CO4</b>	3	2	-	2	1	2	1	-	2	-	-	2	-	-
<b>CO5</b>	3	2	-	2	1	2	1	-	2	-	-	2	-	-
<b>Avg.</b>	<b>3</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

**3-Strong; 2-Medium; 1-Low**

**UNIT I CONTRACT MANAGEMENT****(9)**

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities 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 (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.

**UNIT II CONTRACT PARAMETERS****(9)**

Performance parameters; Delays, penalties, and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

**UNIT III VARIOUS ACTS GOVERNING CONTRACTS****(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,

**UNIT IV BID PROCESS AND BID EVALUATION****(9)**

Bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types of proposals Design Conditions and Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

**UNIT V 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.

**TOTAL: 45****TEXT BOOKS:**

1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.

**REFERENCE BOOKS:**

1. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al, New York: John Wiley & Sons, 2011.
2. Varghese, P.C., "Building Construction," Prentice Hall India, 2007.
3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
4. Chudley, R., Construction Technology, ELBS Publishers, 2007.
5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
6. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006

7. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson EducationIndia, 2015
8. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

23BCEOE06

AIR AND NOISE POLLUTION AND CONTROL

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 impart knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends
- To induce operational considerations under the processing and control monitoring.
- To apply sampling techniques of gaseous contaminants.
- To control noise pollution by specific measurements, standard and preventive measures.
- To enable to evaluate the behavior of air pollutants.
- To have knowledge about appropriate control measures of air pollution

**COURSE OUTCOMES:**

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

- Have knowledge about appropriate control measures of air pollution.
- To apply sampling techniques and suggest suitable air pollution prevention equipment's and techniques for various gaseous and particulate pollutants.
- Have knowledge about the air pollution monitoring and modeling.
- Understand causes of air pollution and Analyze different types of air pollutants.
- Evaluate air pollutant behavior in the atmosphere.
- Enable to evaluate the behavior of air pollutants.

**CO-PO MAPPING:**

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

3-Strong; 2-Medium; 1-Low

**UNIT I INTRODUCTION****(9)**

Structure and composition of Atmosphere – Sources and classification of air pollutants - Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices-Emission Inventories.

## **UNIT II AIR POLLUTION MONITORING AND MODELLING**

**(9)**

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques – Air PollutionClimatology.

## **UNIT III 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.

## **UNIT IV CONTROL OF GASEOUS CONTAMINANTS**

**(9)**

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

## **UNIT V 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. Source types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control.

**TOTAL :45**

### **TEXT BOOKS:**

1. Anjaneyulu D, “Air pollution and control technologies,” Allied Publishers, Mumbai, 2002.
2. Khitoliya R K, “Environmental Pollution,” 2/e, S. Chand Publishing, 2012.

### **REFERENCE BOOKS:**

1. Rao C.S, “Environmental pollution control engineering,” Wiley Eastern Ltd., New Delhi,1996.
2. Rao M.N, and Rao H.V.N, “Air Pollution Control” Tata-McGraw-Hill, New Delhi, 1996.
3. David H. F Liu, Bela G.Liptak, “Air Pollution,” Lewis Publishers, 2000.
4. Mudakavi, J R, “Principles and Practices of Air Pollution Control and Analysis” IK International, 2010.
5. Air Pollution act, India, 1998.

**23BECYOE01 BASICS OF CYBER CRIME AND CYBER SECURITY****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 understand the fundamental concepts of cybercrime.
- To explore knowledge on cybercrimes in wireless devices.
- To infer tools used in the cyber security.
- To familiar with various Indian IT Act in cybercrime and cyber security.
- To enhance the knowledge in handheld devices and digital forensics.

**COURSE OUTCOMES:**

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

- Illustrate basics of cyber-crime and information security.
- Apply the fundamentals concepts for identifying cyber-attacks.
- Make use of tools and methods used in cyber security.
- Analyze theoretical and cross-disciplinary approaches in Indian IT Act and in digital devices.
- Summarize the impact of cybercrime in digital devices on government, business, individual and society.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	-	-	-	2	-	-
CO2	3	3	2	2	-	2	-	-	-	-	-	2	-	-
CO3	3	3	3	3	-	2	-	-	-	-	-	2	-	-
CO4	3	3	3	3	-	2	-	-	-	-	-	2	-	-
CO5	3	3	2	2	-	2	-	-	-	-	-	2	-	-
Avg.	3	3	2	2	-	2	-	-	-	-	-	2	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I INTRODUCTION****(9)**

Introduction to Cyber Crime: Cyber Crime and Information Security – Classifications of Cyber Criminals – Cyber Crime Legal Perspective and Indian Perspective – Cyber Crime and Indian ITA – A Global perspective on Cybercrimes – Categories of Cybercrimes – Criminal plans for attack – Social Engineering – Cyber talking – Cyber cafe and cyber criminals – Botnet – Attack vector – Cloud Computing.

## **UNIT II CYBER CRIME MOBILE AND WIRELESS DEVICES**

**(9)**

Cyber Crime Mobile and Wireless Devices: Proliferation – Trends in Mobility – Credit card frauds – Security challenges – Registry setting – Authentication service – Attacks – Security Implication for Organization – Organizational measures – Organizational Security Policies – Physical security counter measures.

## **UNIT III TOOLS AND METHODS USED IN CYBER SECURITY**

**(9)**

Tools and methods used in cyber security: Proxy servers and anonymizers – Phishing – Password cracking – Keyloggers and spywares – Virus and worms – Trojan horse – Steganography – DoS and DDoS attack – SQL Injection – Buffer overflow – Attacks on wireless networks – Phishing and Identity theft.

## **UNIT IV CYBER CRIME AND LEGAL LANDSCAPE**

**(9)**

Cyber Crime and Legal landscape – Indian IT Act – Digital Signature and Indian IT Act – Amendments to the Indian IT Act – Cybercrime and punishment. Understanding Computer Forensics: Need for computer forensics – Cyber forensics and digital evidence – Digital forensics life cycle – Network forensics – Computer forensics and steganography - Computer forensics from compliance perspective – Challenges

## **UNIT V SPECIAL TOOLS AND TECHNIQUES**

**(9)**

Special tools and techniques –Hand held devices and digital forensics. Cyber security organizational implications: Cost of cybercrimes and IPR – Web threads for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011

### **REFERENCE BOOKS:**

1. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012
2. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, First Edition, CRC Press, First Edition

### **WEBLINKS:**

1. [www.lexology.com/library/](http://www.lexology.com/library/)
2. [www.swayam.gov.in/nd2\\_ugc19\\_hs25/preview](http://www.swayam.gov.in/nd2_ugc19_hs25/preview)
3. [www.educba.com/cyber-security-tools/](http://www.educba.com/cyber-security-tools/)
4. [www.intaforensics.com](http://www.intaforensics.com)
5. [www.itu.int/en/ITU-D/Cybersecurity](http://www.itu.int/en/ITU-D/Cybersecurity)

23BECYOE02

BASICS OF CYBER FORENSICS

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 be aware of fundamentals on cyber forensics and usage of cyber forensics tools.
- To be familiar with the file systems and challenges in the Linux and mac operating system.
- To explore knowledge on the network and different operating systems on mobile devices.
- To learn various services like FaaS and MaaS.
- To enhance the knowledge on database, email and threats in crypto currency.

**COURSE OUTCOMES:**

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

- Infer the basic of Forensics investigation process.
- Discuss popular Linux distributions used for forensic analysis, file systems, processes, and artifacts associated with Linux systems.
- Outline challenges involved in iOS forensics and relevant data extraction procedure from iOS devices
- Analyze the challenges in cloud forensics.
- Describe Bitcoin forensics and Blockchain artifacts.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	-	-	-	2	-	-
CO2	3	3	2	-	2	2	-	-	-	-	-	2	-	-
CO3	3	3	3	3	2	2	-	-	-	-	-	2	-	-
CO4	3	3	3	3	2	2	-	-	-	-	-	2	-	-
CO5	2	2	2	1	-	2	-	-	-	-	-	2	-	-
Avg.	2.8	2.8	2.4	1.8	1.2	2	-	-	-	-	-	2	-	-

3-Strong; 2-Medium; 1-Low

**UNIT INTRODUCTION**

(9)

Introduction to Cyber forensics: Forensics investigation process – Forensics protocol – Digital forensics standards – Digital evidence – Types of cyber crime – Notable data breaches – Case study - Challenges in Cyber security – Cyber forensics tools. Windows forensics: Digital Evidence – File systems – Time analysis – Challenges- Case Study.



## **UNIT II LINUX FORENSICS AND MAC OS FORENSICS (9)**

Linux forensics: Popular linux – File systems – Process – Artifacts – Linux distribution used for forensics analysis – Challenges – Case study. Mac OS forensics: File systems – Process – Artifacts – Information to collect Mac book forensics investigation – Case study. Anti-forensics: Data wiping and shredding – Trial obfuscation – Encryption – Data hiding – Anti-forensics detection technique

## **UNIT III NETWORK FORENSICS AND MOBILE FORENSICS (9)**

Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip-off – Micro-read – Challenges – iOS operating system.

## **UNIT IV CLOUD FORENSICS AND WEB ATTACK FORENSICS (9)**

Cloud forensics: Cloud computing model – Server-side forensics – Client-side forensics – Challenges – Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis – Tools – Challenges – Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics – Log forensics – Content analysis – File metadata forensics

## **UNIT V EMAILS AND EMAIL CRIMINALS (9)**

Emails and email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components – Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Niranjan Reddy , Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations, Apress, First Edition, 2019

### **REFERENCE BOOKS:**

1. Marjje Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, Third Edition, 2013
2. Albert Marcella J and Frederic Guilloso, Cyber Forensics: From Data to Digital Evidence, Wiley Publisher, .First Edition, 2012

### **WEBLINKS:**

1. [www.swayam.gov.in/nd2\\_ugc19\\_hs25/preview](http://www.swayam.gov.in/nd2_ugc19_hs25/preview)
2. [www.educba.com/cyber-security-tools/](http://www.educba.com/cyber-security-tools/)
3. [www.intaforensics.com](http://www.intaforensics.com)
4. [www.cs.nmt.edu/~df/lectures.html](http://www.cs.nmt.edu/~df/lectures.html)

**23BECYOE03 CYBER LAWS AND INTELLECTUAL PROPERTY RIGHTS****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 understand the need for cyber laws and intellectual property rights.
- To acquire knowledge about the protective measures of Intellectual property such as copyright, patent, Trademark.
- To examine the criminal remedies and defensive measures.
- To provide an insight about the role of certifying authority and cryptography.
- To be aware of Indian IT Act 2000 and 2008 cyber laws.

**COURSE OUTCOMES:**

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

- Outline the fundamental concepts of cyber laws and the various intellectual property rights for criminal activities.
- Illustrate the concept of work of employment and its implications in copyright infringement cases.
- Infer civil remedies available for design infringement and their application in different infringement scenarios.
- Identify the scope and significance of cyber laws that arises from the use of technology.
- Explain Information Technology Act and its subsequent amendments in cyberspace

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	3	2	2	-	2	-	-	-	-	-	2	-	-
<b>CO2</b>	3	3	3	2	-	2	-	-	-	-	-	2	-	-
<b>CO3</b>	3	2	2	2	-	2	-	-	-	-	-	2	-	-
<b>CO4</b>	3	3	3	3	-	2	-	-	-	-	-	2	-	-
<b>CO5</b>	3	3	3	2	-	2	-	-	-	-	-	2	-	-
<b>Avg.</b>	<b>3</b>	<b>2.8</b>	<b>2.6</b>	<b>2.2</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

**3-Strong; 2-Medium; 1-Low**

## **NIT I INTRODUCTION**

**(9)**

Intellectual Property: Introduction – Protection of Intellectual Property – Copyright related rights – Patents – Industrial designs – Trademark – Unfair competition – Information technology related intellectual property rights – Computer software and intellectual property – Copyright protection – Reproducing – Defences – Patent protection.

## **UNIT II INFRINGEMENT**

**(9)**

Ownership and enforcement of intellectual property – Defences in case of infringement copyright – Work of employment infringement – Defences for infringement – Trademarks – Rights – Protection of good will – Infringement – Passing off defences

## **UNIT III IP INTELLECTUAL PROPERTY RIGHTS AND ENFORCEMENT**

**(9)**

Designs – Defences of design infringement. Enforcement of intellectual property rights – Civil remedies – Criminal remedies – Border – Security measures. Practical aspects of licensing – Benefits – Determinative factors – Important clauses – Licensing clauses.

## **UNIT IV CYBER LAW**

**(9)**

Cyber law: Basic concepts of technology and law – Understanding the technology of internet – Scope of cyber laws. Cyber jurisprudence law of digital contracts: The essence of digital contracts – The system of digital signatures – The role and function of certifying authorities

## **UNIT V INTELLECTUAL PROPERTY ISSUES**

**(9)**

The science of cryptography – IT Act 2000 and 2008 – Amendments in IT Act – IPC and Privacy threats in cyber law. Intellectual Property issues in cyber space: Domain names and related issues – Copyright in the digital media – Patents in the cyber world. rights of netizens and e-Governance.

**TOTAL : 45**

### **TEXT BOOKS:**

1. David I Bainbridge, Intellectual Property, Pearson Education, Eighth Edition, 2010
2. Talat Fatima, Cyber Law in India, Wolters Kluwer, First Edition, 2017

### **REFERENCE BOOKS:**

1. Yatindra Singh, Guide to Cyber Laws, Universal Law, Fourth Edition, 2010
2. Information Technology Law and Practice- Cyber Laws and Laws Relating to E-Commerce, Universal Law, Third Edition, 2011

### **WEBLINKS:**

1. [www.core.ac.uk/download/pdf/144527187.pdf](http://www.core.ac.uk/download/pdf/144527187.pdf)
2. [www.nptel.ac.in/courses/110/105/110105139/](http://www.nptel.ac.in/courses/110/105/110105139/)
3. [www.icsi.edu/media/webmodules/FINAL\\_IPR&LP\\_BOOK\\_10022020.pdf](http://www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf)
4. [www.lawshelf.com/videocourses/moduleview/](http://www.lawshelf.com/videocourses/moduleview/)
5. [www.lawfaculty.du.ac.in/files/course\\_material/Old\\_Course\\_Material/](http://www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/)

**23BECYOE04****BLOCKCHAIN AND CYBER SECURITY****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 decompose a block chain system's fundamental components, how they fit together and examine a decentralization using block chain.
- To illustrate how Crypto currency works, from when a transaction is created to when it is considered part of the blockchain.
- To explain the components of Ethereum, programming languages for Ethereum and study the basics Hyperledger and Web3.
- To understand the nature of threats and cyber security management goals and technology
- To infer the landscape of hacking and perimeter defense mechanisms

**COURSE OUTCOMES:**

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

- Illustrate the technology components of Block chain and its working principles.
- Describe Ethereum model and code execution and the architectural components.
- Discuss components of a Hyperledger along with its development framework.
- Demonstrate the nature of threats and cyber security management goals and framework.
- Outline malicious software attack and wireless network attack.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	3	2	2	2	2	-	-	-	-	-	2	-	-
<b>CO2</b>	3	2	2	2	2	2	-	-	-	-	-	2	-	-
<b>CO3</b>	3	2	2	2	2	2	-	-	-	-	-	2	-	-
<b>CO4</b>	3	2	2	2	2	2	-	-	-	-	-	2	-	-
<b>CO5</b>	3	2	2	2	2	2	-	-	-	-	-	2	-	-
<b>Avg.</b>	<b>3</b>	<b>2.2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION OF BLOCKCHAIN TECHNOLOGY (9)**

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization. Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets –Alternative Coins – Theoretical Limitations – Bitcoin Limitations – Name Coin – Prime Coin – Zcash. – Smart Contracts – Ricardian Contracts.

## **UNIT II ETHEREUM NETWORK (9)**

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

## **UNIT III FRAMEWORK FOR HYPERLEDGER FABRIC (9)**

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks – Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda-Alternative Blockchains.

## **UNIT IV CYBER SECURITY (9)**

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security – Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories – perimeter defense and encryption.

## **UNIT V WEB APPLICATION ATTACKS (9)**

Malicious Attacks, Threats, and Vulnerabilities- Malware –malicious software attack – social engineering attack – wireless network attack – web application attack –Countermeasures. Creating Mechanisms for IT Security.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Imran Bashir "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained" Packt Publishing, Second Edition 2018.
2. Arshdeep Bahga, Vijay Madisetti "Blockchain Applications: A Hands-On Approach" VPT Publications, First Edition 2017.
3. David Kim and Michael G. Solomon "Fundamentals of Information Systems Security" Jones & Bartl Learning, Third Edition 2018.
4. Peter Trim and Yang –Im Lee "Cyber Security Management- A Governance, Risk and Compliance Framework" Gower Publishing, First Edition 2014.

### **REFERENCE BOOKS:**

1. Andreas Antonopoulos, Satoshi Nakamoto "Mastering Bitcoin", O'Reilly Publishing, Second Edition 2017.
2. Alex Leverington "Ethereum Programming", Packt Publishing, First Edition 2017.
3. John G. Voeller "Cyber Security" John Wiley & Sons, First Edition 2014.

**WEBLINKS:**

1. [www.nptel.ac.in/courses/106/104/106104220/](http://www.nptel.ac.in/courses/106/104/106104220/)
2. [www.icaew.com/technical/technology/blockchain/blockchain-articles/what-isblockchain/history](http://www.icaew.com/technical/technology/blockchain/blockchain-articles/what-isblockchain/history)
3. [www.ibm.com/topics/blockchain-security](http://www.ibm.com/topics/blockchain-security)
4. <https://blockgeeks.com/guides/ethereum/>
5. <https://world101.cfr.org/global-era-issues/cyberspace-and-cybersecurity/what-are-cyberspaceand-cybersecurity>

23BEC SOE01

INTERNET OF THINGS

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To understand the basics of Internet of Things.
- To identify an idea of some of the application areas where Internet of Things can be applied.
- To infer the middleware for Internet of Things.
- To express the concepts of Web of Things .
- To examine the concepts of Cloud of Things with emphasis on Mobile cloud computing.
- To inspect the IOT security protocols.

**COURSE OUTCOMES:**

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

- Explain about IoT architecture and its applications.
- Identify the feasibility and potential impact of IoT solutions in different industries.
- Apply a systematic and structured approach to designing IoT solutions.
- Summarize techniques to secure the elements of an IoT device.
- Illustrate security protocols in various domains of industrial applications.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	2	-	-	-	-	-	2	-	2	2	-	1
<b>CO2</b>	3	3	2	2	2	-	-	-	2	-	2	2	-	1
<b>CO3</b>	3	3	2	2	2	-	-	-	2	-	2	2	-	1
<b>CO4</b>	3	2	2	2	-	-	-	-	2	-	2	2	-	1
<b>CO5</b>	3	2	2	2	2	-	-	-	2	-	2	2	-	1
<b>Avg.</b>	<b>3</b>	<b>2.4</b>	<b>2</b>	<b>1.6</b>	<b>1.2</b>	-	-	-	<b>2</b>	-	<b>2</b>	<b>2</b>	-	<b>1</b>

3-Strong; 2-Medium; 1-Low

**UNIT I INTRODUCTION TO IoT****(9)**

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, Smart Objects, Sensor networks. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security, WSN and Sensing Model.

## **UNIT II IoT COMMUNICATION**

**(9)**

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – Application Transport Methods.

## **UNIT III DESIGN METHODOLOGY**

**(9)**

Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

## **UNIT IV DATA ANALYTICS FOR IoT**

**(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.

## **UNIT V IoT IN INDUSTRY**

**(9)**

Manufacturing, Architecture, Security Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, Use cases – Transportation, Architecture, Use cases.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Honbo Zhou “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2013
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things”, Springer Berlin, 2011
3. David Easley, Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010

### **REFERENCE BOOKS:**

1. Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to the Smart Grid and Building Automation”, Wiley, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2019

### **WEBLINKS:**

1. <https://www.javatpoint.com/iot-internet-of-things>
2. <https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/>
3. [https://www.tutorialspoint.com/internet\\_of\\_things/index.htm](https://www.tutorialspoint.com/internet_of_things/index.htm)
4. <https://www.startertutorials.com/blog/physical-design-of-iot.html>
5. <https://www.guru99.com/iot-tutorial.html>



## 23BEC SOE02

## MACHINE LEARNING

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To introduce the basic concepts and techniques of Machine Learning.
- To understand Supervised and Unsupervised learning techniques.
- To study the various probability based learning techniques.
- To learn Dimensionality Reduction Techniques.
- To infer Evolutionary Models and Graphical models of machine learning algorithms.

**COURSE OUTCOMES:**

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

- Discuss basics of machine learning concepts and its types.
- Classify machine learning techniques to solve any given problem.
- Illustrate Open-source Machine Learning libraries and its uses.
- Outline Similarity based learning for Predictive Data Analytics.
- Explain about online fraud detection and analysis.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	-	-	-	2	-	1
CO2	3	3	3	2	-	2	-	-	-	-	-	2	-	1
CO3	3	3	2	2	-	2	-	-	-	-	-	2	-	1
CO4	3	2	2	2	-	2	-	-	-	-	-	2	-	1
CO5	3	2	1	2	-	2	-	-	-	-	-	2	-	1
Avg.	3	2.6	2	2	-	2	-	-	-	-	-	2	-	1

3-Strong; 2-Medium; 1-Low

**UNIT I: MACHINE LEARNING BASICS**

(9)

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

**UNIT II: MACHINE LEARNING METHODS**

(9)

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

**UNIT III: MACHINE LEARNING IN PRACTICE****(9)**

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon’s Machine Learning Tool Kit: Sagemaker

**UNIT IV: MACHINE LEARNING AND DATA ANALYTICS****(9)**

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

**UNIT V: APPLICATIONS OF MACHINE LEARNING****(9)**

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

**TOTAL: 45****TEXT BOOKS:**

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press, 2015

**REFERENCE BOOKS:**

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

**WEBLINKS:**

1. [https://www.tutorialspoint.com/machine\\_learning/index.htm](https://www.tutorialspoint.com/machine_learning/index.htm)
2. <https://www.hackerearth.com/practice/machine-learning/challenges-winning-approach/machine-learning-challenge-one/tutorial/>
3. <https://www.javatpoint.com/machine-learning>
4. <https://www.geeksforgeeks.org/machine-learning/>

**23BEC SOE03****BLOCKCHAIN TECHNOLOGIES****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 comprehend the importance of the Blockchain framework and its practical uses.
- To scrutinize the verification of Bitcoin transactions through the utilization of the Blockchain.
- To recognize the constituent elements of smart contracts required for achieving consensus in a Permissioned Blockchain.
- To furnish the essential infrastructure and boost the effectiveness, efficacy, and transactions of diverse business procedures by utilizing Hyperledger.
- To examine the scope of utilization of Blockchain in diverse governmental and non-governmental entities.

**COURSE OUTCOMES:**

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

- Explain block chain architecture and its applications.
- Describe the proof of work consensus algorithm used in Bitcoin and its significance in securing the network.
- Discuss consensus algorithms used in permissioned blockchains, including Raft, Byzantine fault tolerance, and Paxos.
- Infer the transaction flow in Hyperledger Fabric and validation processes.
- Illustrate security aspects and its solutions in block chain technology.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	2	-	-	2	-	-	-	-	-	2	-	1
<b>CO2</b>	3	2	2	-	-	2	-	-	-	-	-	2	-	1
<b>CO3</b>	3	2	2	-	-	2	-	-	-	-	-	2	-	1
<b>CO4</b>	3	3	2	-	-	2	-	-	-	-	-	2	-	1
<b>CO5</b>	3	3	3	-	2	2	-	-	-	-	-	2	-	1
<b>Avg.</b>	<b>3</b>	<b>2.4</b>	<b>2.2</b>	<b>-</b>	<b>0.4</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>1</b>

**3-Strong; 2-Medium; 1-Low**

## **UNIT I INTRODUCTION**

**(9)**

Introduction – Block Structure – Architecture – Block Header – Genesis Block – Merkle Trees – Hashing - Signature & Encryption Schemes – Business Applications

## **UNIT II BITCOIN BASICS**

**(9)**

Bitcoin Basics – Wallet - Decentralized Consensus – Aggregate transactions - Proof of Work – Miners – Consensus Algorithms – Double Spending - Verifying Transactions – Fork – Reward

## **UNIT III PERMISSIONED BLOCK CHAIN**

**(9)**

Permissioned Block Chain – Smart Contracts - Consensus – Raft – Byzantine – Paxos – Degree of Decentralization – Asset Transfer - Enterprise Application

## **UNIT IV FABRIC ARCHITECTURE**

**(9)**

Fabric Architecture – Transaction Flow – Channel – Ordering Service –Membership & Identity Management – Network Setup – Hyperledger Composer – Roles – Network Administration

## **UNIT V BLOCKCHAIN USE CASES & SECURITY**

**(9)**

Financial Services – Supply Chain – Government – Digital Identities – Land Record Registry – Security Overview – Membership & Access Control – Privacy

**TOTAL: 45**

### **TEXT BOOKS:**

1. Andreas M. Antonopoulos, “Mastering Bitcoin”, 2nd Edition, O’Reilly Media, 2017
2. Melanie Swan, “Blockchain: Blueprint for a New Economy”, 1st Edition, O’Reilly Media, 2017

### **REFERENCE BOOKS:**

1. Nitin Gaur, Luc Desrosiers, Et al, “Hands-On Blockchain with Hyperledger”, Packt Publisher, June 2018
2. Imran Bashir, “Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks”, Packt Publisher, March 2017

### **WEBLINKS:**

1. <https://nptel.ac.in/courses/106105184>
2. <https://www.hyperledger.org/projects/fabric>
3. <https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>
4. <https://www.javatpoint.com/blockchain-tutorial>

**COURSE OBJECTIVES:**

- To learn the basic concepts of cloud computing.
- To learn types of cloud services and its applications.
- To understand the key components of Amazon Web Services.
- To collaborate with real time cloud services.
- To understand the security risk and application of cloud computing.

**COURSE OUTCOMES:**

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

- Illustrate the basic concepts of cloud computing and its usage.
- Compare different types of cloud computing services.
- Outline the ways of collaborating cloud with web based communication tools..
- Summarise the concept of virtualization and load balancing.
- Demonstrate proficiency in using Google Web Services for cloud management.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	-	-	-	-	-	2	-	1
CO2	3	3	2	2	2	2	-	-	-	-	-	2	-	1
CO3	3	3	2	2	2	2	-	-	-	-	-	2	-	1
CO4	3	2	2	2	2	2	-	-	-	-	-	2	-	1
CO5	3	2	2	2	2	2	-	-	-	-	-	2	-	1
Avg.	3	2.6	2	2	2	2	-	-	-	-	-	2	-	1

3-Strong; 2-Medium; 1-Low

**UNIT I CLOUD INTRODUCTION**

(9)

Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing, usage scenarios and Applications, Business models around Cloud – Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus – Open Nebula, CloudSim.

## **UNIT II CLOUD SERVICES AND FILE SYSTEM**

**(9)**

Types of Cloud services : Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services. Service providers - Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

## **UNIT III COLLABORATING WITH CLOUD**

**(9)**

Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing ,Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

## **UNIT IV ABSTRACTION AND VIRTUALIZATION**

**(9)**

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

## **UNIT V MANAGING AND SECURING CLOUD**

**(9)**

Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence. Case-Studies: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services

**TOTAL: 45**

### **TEXT BOOKS:**

1. John Ritting house & James Ransome, “Cloud Computing Implementation Management and Strategy”, CRC Press, 2018.
2. Rao M.N., Cloud Computing, PHI Learning Private Limited, 2018.

### **REFERENCE BOOKS:**

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz “Cloud Computing for Dummies” (Wiley India Edition), 2015.
2. Anthoy T Velte , Cloud Computing : “A Practical Approach”, McGraw Hill,2018.

### **WEBLINKS:**

1. <https://nptel.ac.in/courses/106105167/>
2. <https://www.javatpoint.com/cloud-computing>

**COURSE OBJECTIVES:**

- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking.
- To study about task management.
- To learn about semaphore management and message passing.
- To study about memory management.

**COURSE OUTCOMES:**

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

- Explain the Embedded system's hardware and software.
- Outline the operating system for embedded applications.
- Analyse the tasks performed by Embedded system.
- Examine the activities of multiple processes in an embedded system.
- Interpret the memory management system.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	2	-	-	-	-	-	-	-	-	1
CO2	2	1	1	-	-	-	-	1	-	-	-	-	-	1
CO3	2	3	2	2	2	-	-	-	-	-	-	-	-	1
CO4	2	3	2	2	2	-	-	-	-	-	-	-	-	1
CO5	1	2	2	-	3	-	-	-	-	-	-	-	-	1
Avg.	1.8	2	1.6	0.8	1.8	-	-	0.2	-	-	-	-	-	1

**3-Strong; 2-Medium; 1-Low**

**UNIT I INTRODUCTION TO EMBEDDED SYSTEM****(9)**

Introduction- Embedded systems description, definition, design considerations & requirements- Overview of Embedded System Architecture (CISC and RISC)-Categories of Embedded Systems-embedded processor selection & tradeoffs- Embedded design life cycle -Product specifications- hardware / software partitioning- iterations and implementation- hardware software integration – product testing techniques–ARM7.

## **UNIT II OPERATING SYSTEM OVERVIEW**

**(9)**

Introduction–Advantage and Disadvantage of Using RTOS–Multitasking–Tasks–Real Time Kernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- Reentrant Functions– Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion– Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- Task Management–Memory Management–Time Management–Clock Ticks.

## **UNIT III TASK MANAGEMENT**

**(9)**

Introduction–µ C/OS-II Features–Goals of µ C/OS-II–Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Under µ C/OS-II–Clock Tick–µ C/OS- II Initialization. Task Management: Creating Tasks–TaskStacks–StackChecking–Task’sPriority–SuspendingTask,ResumingTask.TimeManagement: Delaying a Task–Resuming a Delayed Task–System Time. Event Control Blocks–Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

## **UNIT IV SEMAPHORE MANAGEMENT AND MESSAGE PASSING**

**(9)**

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox –Deleting Mailbox–Waiting for a Message box–Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue–Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue– Flushing a Queue.

## **UNIT V MEMORY MANAGEMENT**

**(9)**

Memory Management: Memory Control Blocks–Creating Partition–Obtaining a Memory Block–Returning a Memory Block. Getting Started with µ C/OS-II–Installing µ C/OS-II–Porting µ C/OS-II: Development Tools–Directories and Files– Testing a Port -IAR Workbench with µ C/OS-II–µ C/OS-II Porting on a 8051CPU– Implementation of Multitasking- Implementation of Scheduling and Rescheduling –Analyze the Multichannel ADC with help of µ C/OS-II.

**TOTAL:45**

### **TEXT BOOKS:**

1. JeanJ. Labrosse, Micro C/OS–II The Real Time Kernel, CMPBOOKS, 2009.
2. David Seal, ARM Architecture, Reference Manual, Addison-Wesley, 2008.

### **REFERENCE BOOKS:**

1. Steve Furbe, ARM System-on-Chip, Architecture, Addison-Wesley Professional, California, 2000.
2. [K.C. Wang](#), Embedded and Real-Time Operating Systems, Springer, 2017.
3. [Janez Puhon](#), Operating systems, Embedded systems and Real-time systems, CIP - Cataloging In Publication, 2015.

### **WEB LINKS**

1. <https://nptel.ac.in/courses/10810505>.
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs98/preview](https://onlinecourses.nptel.ac.in/noc21_cs98/preview).
3. <https://nptel.ac.in/courses/108102045>.
4. <https://archive.nptel.ac.in/courses/106/105/106105193/>



**Instruction Hours/week: L:3 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To study about various speakers and microphone.
- To learn the fundamental of television systems and standards.
- To learn the process of audio recording and reproduction.
- To study various telephone networks.
- To discuss about the working of home appliances.

**COURSE OUTCOMES;**

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

- Explain working of loud speakers and Microphones
- Interpret the fundamentals of Television systems.
- Record the Audio Signal and reproduce it.
- Classify telecommunication networks.
- Examine the working of home appliances.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO4	3	3	2	2	2	-	-	-	-	-	-	1	3	-
CO5	3	2	2	1	2	-	-	-	-	-	-	2	2	-
Avg.	2.6	1.8	1.2	0.8	1.2	-	-	-	-	-	-	1	1.8	-

**3-Strong; 2-Medium; 1-Low****UNIT I LOUDSPEAKERS AND MICROPHONES****(9)**

Introduction Loudspeaker, types of loud speakers, Loudspeaker characteristics, Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Introduction Microphone, Types of Microphone, Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

## **UNIT II TELEVISION STANDARDS AND SYSTEMS**

**(9)**

Introduction to TV system - Components of a TV system–Scanning – types of scanning-interlacing– Colour TV Fundamentals - Additive Mixing- Subtractive Mixing- Need for Synchronization- Aspect Ratio- Video Bandwidth - Positive and Negative Transmission- Advantages of Negative Transmission-composite video signal - Colour TV system– Luminance and Chrominance signal- Monochrome and Colour Picture Tubes- Color TV systems– NTSC, PAL, SECAM.

## **UNIT III OPTICAL RECORDING AND REPRODUCTION**

**(9)**

Introduction to Audio disc - Audio Disc– Processing of the Audio signal–Readout from the Disc – Reconstruction of the audio signal–Introduction to Video Disc recording –video disc mastering and replication - Video disc formats- Recording Systems–Playback Systems.

## **UNIT IV TELECOMMUNICATION SYSTEMS**

**(9)**

Introduction to telecommunication Systems – Modes of telecommunication system-line system characteristics – Radio system characteristics –Signaling- Station Interconnection - Telephone services-telephone networks–switching system principles–PAPX or PBX switching–Data Services - Circuit, Packet and Message Switching, Telephone Networks - LAN, MAN and WAN, Integrated Services Digital Network. Introduction to Mobile radio systems- Wireless Local Loop – the role of WLL – types of WLL - VHF/UHF radio systems- Limited range Cordless Phones –Introduction to cellular communication - cellular modems.

## **UNIT V HOME APPLIANCES**

**(9)**

Introduction to home appliances – types of home appliances- Microwaves - Basic principle and block diagram of microwave oven -Washing Machine- electronic controller for washing machines - washing machine hardware and software –Introduction to air conditioners and refrigerators - Components of air conditioning systems – types of air conditioning systems- Refrigeration –Refrigeration systems – types of Refrigeration systems.

**TOTAL:45**

### **TEXT BOOKS:**

1. S.P. Bali Consumer Electronics Pearson Education 2007
2. J.S.Chitode Consumer Electronics Technical Publications 2007

### **REFERENCE BOOKS:**

1. Philip Hoff, Philip Herbert Hoff Consumer Electronics for Engineers Cambridge University Press 1998
2. R.G.Gupta Audio & Video Systems Tata Mc Graw hill Publishing Company Ltd 2004

### **WEB LINKS:**

1. <https://nptel.ac.in/courses/117105133>
2. <https://archive.nptel.ac.in/courses/117/104/117104127/>
3. <https://nptel.ac.in/courses/117102059>
4. <https://nptel.ac.in/courses/108101091>

**23BTFTOE01 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:**

- To explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oil seeds.
- To summarize the production and processing methods of fruits and vegetables.
- To infer the chemical composition, processing, production, spoilage and quality of milk and milk products.
- To outline the overall processes involved in the production of meat, poultry and fish products.
- To review the production and processing methods of plantation and spice products.

**COURSE OUTCOMES:**

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

- Infer the basics of food processing.
- Demonstrate the various processing technologies involved in fruits and vegetables, dairy, cereals, meat, fish, egg and plantation products.
- Infer the basics on microbiology of food products.
- Describe the process of manufacture of various food products.
- Outline the various methods of food preservation.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	1	2	1	3	2	1	-	2	2	2	-	-	-	-
<b>CO2</b>	1	2	1	3	2	1	-	2	2	2	-	-	-	-
<b>CO3</b>	1	2	1	3	2	1	-	2	-	-	-	-	-	-
<b>CO4</b>	1	2	1	3	2	1	-	2	-	-	2	-	-	-
<b>CO5</b>	1	2	1	3	2	1	-	2	-	2	-	-	-	-
<b>Avg.</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>0.8</b>	<b>1.2</b>	<b>0.4</b>	<b>-</b>	<b>-</b>	<b>-</b>

**3-Strong; 2-Medium; 1-Low****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 of Bread - different processes of manufacture - types of breads - buns, biscuits, cakes and cookies -Pasta products - 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)**

Basic dairy terminology, composition, General tests at reception, Dairy Processing - Method of manufacture of Standardized, toned and double toned milk, milk powder - Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Ice-cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage of milk – 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.

**TOTAL:45**

### **TEXT BOOKS:**

1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co. Lucknow. 3<sup>rd</sup> 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. 1<sup>st</sup> Edition. 2003.

### **REFERENCE BOOKS:**

1. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi. 23<sup>rd</sup> impression. 2016.
2. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany

### **WEBLINKS**

1. <https://www.intechopen.com/chapters/86251>
2. <https://ifst.onlinelibrary.wiley.com/journal/17454549>

**23BTFTOE02****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:**

- To explain the basic concepts of food and nutrition.
- To define the overall classification, function, and source of carbohydrates, lipids and proteins.
- To summarize 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 interpret the recent trends and developments in nutrition.

**COURSE OUTCOMES:**

At the end of this, students will be able to

- Explain the basics in the area of nutritional assessment in health and disease.
- Outline the biological functions of various macromolecules in terms of food and health.
- Summarize the balanced diet for healthy life to avoid or prevent the deficiency disorders.
- Infer an appropriate diet, products that prevent vitamin deficiency disorders.
- Identify the proper foods rich in minerals to live a healthy life.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	1	2	1	3	-	-	-	2	2	2	-	-	-	-
<b>CO2</b>	1	2	1	3	-	-	-	2	2	2	-	-	-	-
<b>CO3</b>	1	2	1	3	-	-	-	2	-	-	-	-	-	-
<b>CO4</b>	1	2	1	3	-	-	-	2	-	-	2	-	-	-
<b>CO5</b>	1	2	1	3	-	-	-	2	-	2	-	-	-	-
<b>Avg.</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	-	-	-	<b>2</b>	<b>0.8</b>	<b>1.2</b>	<b>0.4</b>	-	-	-

**3-Strong; 2-Medium; 1-Low**

**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: Vitamin A, Vitamin D, E & K. Water soluble vitamins: Vitamin C, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, Vitamin B6. 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.

**TOTAL:45**

### **TEXT BOOKS:**

1. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3<sup>rd</sup> edition 2018. (ISBN-13: 9780199489084).
2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1<sup>st</sup> Edition, 2017. (ISBN: 9780128052570).

### **REFERENCE BOOKS:**

1. Ashley Martin. Nutrition and Dietetics. Syrawood Publishing House. 1<sup>st</sup> Edition, 2016. (ISBN: 9781682860588).
2. Robert E. C. Wildman. Handbook of Nutraceuticals and Functional Foods. CRC Press, 2<sup>nd</sup> Edition, 2016. (ISBN-10: 9781498770637).
3. Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6<sup>th</sup> Edition. 2017. (ISBN-13: 9789386418883).

### **WEBLINKS**

1. <https://onlinelibrary.wiley.com/journal/17470080>
2. <https://aub.edu.lb/libguides.com/c.php?g=276518&p=1842999>

23BTFTOE03

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:**

- To outline the current status of snack food Industry.
- To describe the production, processing and marketing trends of potato and tortillachips.
- To outline the overall processing of popcorn.
- To explain the production and processing of fruits involved in snack food preparation.
- To summarize the sensory analysis methods and packaging techniques of snack foods.

**COURSE OUTCOMES:**

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

- Outline the various manufacturing process in snack food industries.
- Summarize the current production and marketing status of Snack foods.
- Explain the advantages of Sensory Evaluation.
- Describe packaging technologies in Snack Food Industries.
- Demonstrate the equipment's involved in the snack production processes.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	1	2	1	3	-	-	-	2	2	2	-	1	-	-
<b>CO2</b>	1	2	1	3	-	-	-	2	2	2	-	1	-	-
<b>CO3</b>	1	2	1	3	-	-	-	2	-	-	-	1	-	-
<b>CO4</b>	1	2	1	3	-	-	-	2	-	-	2	1	-	-
<b>CO5</b>	1	2	1	3	-	-	-	2	-	2	-	1	-	-
<b>Avg.</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>0.8</b>	<b>1.2</b>	<b>0.4</b>	<b>1</b>	<b>-</b>	<b>-</b>

**3-Strong; 2-Medium; 1-Low**

## **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.

**TOTAL:45**

### **TEXT BOOKS:**

1. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1<sup>st</sup> Edition,2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2<sup>nd</sup> Edition, 2013.

### **REFERENCE BOOK:**

1. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys,Books Ltd. 2008.

### **WEBLINKS:**

1. <https://www.sciencedirect.com/book/9780128019160/food-hygiene-and-toxicology-in-ready-to-eat-foods>
2. <https://www.eurofins.in/blog/food-testing/ready-to-eat-food-testing/>



**23BTFTOE04 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:**

- To classify 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 outline 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 agricultural wastes.

**COURSE OUTCOMES:**

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

- Outline the types of agricultural wastes
- Illustrate the collection and generation of value-added products from agricultural wastes
- Demonstrate the techniques involved in the production and utilization of biomass.
- Infer the various parameters considered to be important in the designing of biogas units.
- Illustrate the various methods employed in the production of alcohol from the byproducts of agricultural wastes.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	1	2	1	3	-	1	3	2	2	2	-	-	-	1
<b>CO2</b>	1	2	1	3	-	1	3	2	2	2	-	-	-	1
<b>CO3</b>	1	2	1	3	-	1	3	2	-	-	-	-	-	1
<b>CO4</b>	1	2	1	3	-	1	3	2	-	-	2	-	-	1
<b>CO5</b>	1	2	1	3	-	1	3	2	-	2	-	-	-	1
<b>Avg.</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>0.8</b>	<b>1.2</b>	<b>0.4</b>	<b>-</b>	<b>-</b>	<b>1</b>

**3-Strong; 2-Medium; 1-Low**

## **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 Technology used for the utilization of agricultural wastes: Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat and Steam from Sugarcane Leaf and Bagasse.

## **UNIT III BIOGAS DESIGN AND PRODUCTION**

**(9)**

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogas plant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outlet pipe), Selection and Design of biogas plant.

## **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).

## **UNIT V PRODUCTION OF PAPERBOARD AND PARTICLEBOARDS FROM AGRICULTURAL WASTE**

**(9)**

Biodegradable packing materials: merits and demerits, 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.

### **TEXT BOOKS:**

1. Efthymia Alexopoulou. Bioenergy and Biomass from Industrial Crops on Marginal Lands. Elsevier, 1<sup>st</sup> Edition, 2020. (ISBN: 9780128188644).
2. Navanietha Krishnaraj Rathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1<sup>st</sup> Edition, 2019. (ISBN: 9780128179529).
3. Simona Ciuta, Demetra Tsiamis, Marco J. Castaldi. Gasification of Waste Materials. Academic Press, 1<sup>st</sup> Edition, 2017. (ISBN: 9780128127162).

### **REFERENCE BOOKS:**

1. Nicholas E. Korres, Pdraig O’Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1<sup>st</sup> Edition, 2013. (ISBN-13: 9780415698405).
2. Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1<sup>st</sup> Edition, 2011. (ISBN-13: 9781849025).

**WEBLINKS:**

1. [https://www.researchgate.net/publication/308880744\\_AGRICULTURAL\\_WASTE\\_CONCEPT\\_GENERATION\\_UTILIZATION\\_AND\\_MANAGEMENT](https://www.researchgate.net/publication/308880744_AGRICULTURAL_WASTE_CONCEPT_GENERATION_UTILIZATION_AND_MANAGEMENT)
2. <https://bioresources.bioprocessing.springeropen.com/articles/10.1186/s40643-017-0187-z>

**COURSE OBJECTIVES:**

- To illustrate the types of materials used in the food processing equipments.
- To outline the materials and designing of different storage vessel.
- To explain the importance of reaction vessel and their deskinning techniques.
- To interpret the materials and designing of heat exchanger and evaporators.
- To summarize the importance of dryers in food processing industries.

**COURSE OUTCOMES**

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

- Outline the materials suitable for the construction of equipment's.
- Summarize the vessels used for food storage in the industries.
- Classify types of reaction vessel used for different purposes.
- Infer the importance of heat exchanger in the designing of food processing equipment's.
- Infer the significance of dryers in food processing.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	3	-	1	-	2	2	2	-	-	-	-
CO2	1	2	1	3	-	1	-	2	2	2	-	-	-	-
CO3	1	2	1	3	-	1	-	2	-	-	-	-	-	-
CO4	1	2	1	3	-	1	-	2	-	-	2	-	-	-
CO5	1	2	1	3	-	1	-	2	-	2	-	-	-	-
Avg.	1	2	1	3	-	1	-	2	0.8	1.2	0.4	-	-	-

**3-Strong; 2-Medium; 1-Low**

**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 construction – types – design-consideration – Design of agitators – power requirements – Design based on Torque – critical speed.

## **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

### **TEXT BOOKS:**

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 India Ltd., 1985.

### **REFERENCE BOOK:**

1. Coulson, J.M. and Richardson, J. F, “Chemical Engineering “ Butterworth-Heinemann Elsevier, ISBN-0750644451, 2002.

### **WEBLINKS:**

1. <https://onlinelibrary.wiley.com/toc/17454530/2022/45/6>
2. [https://link.springer.com/chapter/10.1007/978-1-4615-2193-8\\_7](https://link.springer.com/chapter/10.1007/978-1-4615-2193-8_7)

23BEME0E01

BATTERY MANAGEMENT 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:**

- Demonstrate familiarity with alternative energy sources and their role in sustainability.
- Analyze energy requirements for different hybrid and electric vehicles.
- Examine the principles and components of lithium-ion batteries.
- Explore advancements in battery technologies.
- Apply knowledge of battery management systems and ensure safety in high-voltage batteries.

**COURSE OUTCOMES:**

At the end of the course the student would be able:

- Apply the alternative energy and sustainability to electric transportation.
- Analyze energy needs for hybrid and electric vehicles.
- Choose the appropriate operations for manufacturing lithium-ion batteries.
- Outline the advancements in battery technology.
- Utilize battery management system and prioritize safety in high-voltage batteries.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	1
<b>CO2</b>	3	3	2	1	-	-	-	-	-	1	-	1	-	1
<b>CO3</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	1
<b>CO4</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	1
<b>CO5</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	1
<b>Avg.</b>	<b>3</b>	<b>2.2</b>	<b>1.2</b>	<b>0.2</b>	-	-	-	-	-	1	-	1	-	1

**3-Strong; 2-Medium; 1-Low****UNIT I ENERGY STORAGE SYSTEMS****(9)**

General background on alternative energy sources and sustainability, Introduction to electric-based transportation, Overview of on-road vehicle electrification, EVs configuration, Energy and power requirements for various HEVs and EVs Vehicle performance and driving cycles.

## **UNIT II LITHIUM BATTERIES**

**(9)**

Li-ion batteries - Principle of operation, Battery components and design Electrode, cell and battery fabrications, Building block cells, battery modules and packs and applications. All solid-state batteries and future developments, Li-Sulphur battery, Li-Air battery, Sodium-battery, Magnesium battery, Aluminium battery, Silicon battery.

## **UNIT III HIGH TEMPERATURE BATTERIES FOR BACK-UP APPLICATIONS**

**(9)**

Advance Ni-MH batteries for transportation, Future prospects of Ni-MH batteries vs. lithium ion batteries, Zebra cell, Li-iron sulphide cells, Vanadium and iron-based batteries, Semi-fluid flow batteries for large scale grid application, Ni-H<sub>2</sub> cells for space applications.

## **UNIT IV FUEL CELLS AND BATTERY RECYCLING TECHNOLOGY**

**(9)**

Introduction to fuel cells, Proton-exchange membrane and alkaline fuel cells for transportation, Solid oxide fuel cells, Technology and economic aspects of battery recycling, Environmental effect and controlling of poisonous chemicals contamination.

## **UNIT V BATTERY MANAGEMENT**

**(9)**

Fundamentals of battery management systems and controls, Battery Thermal Management - Passive cooling, Active cooling - Liquids & air systems.

Regulations and Safety Aspects of High Voltage Batteries, Code and Standards, Safe handling of Lithium Batteries, Safety of high voltage battery.

**TOTAL:45**

### **TEXT BOOKS:**

1. [Gerardus Blokdyk](#), Battery Management System A Complete Guide, Springer, 2019 Edition.
2. Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications, 1st Edition. Springer, 2018

### **REFERENCE BOOKS:**

1. Alfred Rufer, Energy Storage: Systems and Components, 1st Edition, CRC Press, 2017.
2. Arno Kwade and Jan Diekmann, Recycling of Lithium-Ion Batteries: The LithoRec Way (Sustainable Production, Life Cycle Engineering and Management), 1st Edition. Springer, 2018.

### **WEBLINKS:**

1. <https://nptel.ac.in/courses/108/103/108103009/>
2. <https://web1.eng.famu.fsu.edu/~patelsa/Files/FinalReport.pdf>

23BEMEOE02

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:**

- To provide in-depth knowledge on various techniques of non-destructive testing.
- To acquaint the student with the need and awareness of the safety concepts.
- To understand the importance of various safety techniques involved in industrial sector.
- To introduce the concepts of accident zone and prepare reports related to it.
- To develop an understanding of safety monitoring.

**COURSE OUTCOMES:**

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

- Explain the need of safety.
- Outline the safety techniques involved in industrial sector.
- Develop the report for the accident zones.
- Inspect the safety strategies in industrial sector.
- Illustrate training sessions based on safety.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO4	3	3	2	1	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg.	2.4	1.6	0.6	0.2	-	-	-	-	-	1	-	1	-	-

**3-Strong; 2-Medium; 1-Low****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 ACCIDENT INVESTIGATION AND REPORTING**

**(9)**

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accident prevention, 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, four types of evidences, Records of accidents, accident reports

### **UNIT IV SAFETY PERFORMANCE MONITORING**

**(9)**

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety “t” score, safety activity rate – problems.

### **UNIT V SAFETY EDUCATION AND TRAINING**

**(9)**

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

**TOTAL:45**

#### **TEXT BOOKS:**

1. Accident Prevention Manual for Industrial Operations, 3<sup>rd</sup> edition, N.S.C. Chicago, 2010(digital).
2. Heinrich H.W. “Industrial Accident Prevention”, 2<sup>nd</sup> edition, Tata McGraw-Hill Company, New York, 1941.

#### **REFERENCE BOOKS:**

1. Krishnan N.V, Safety Management in Industry, 1<sup>st</sup> edition, Jaico Publishing House, Bombay, 1997.
2. John R Ridley, Safety at Work, 3<sup>rd</sup> edition, Elsevier, 2014
3. Roland P. Blake, Industrial Safety, 2<sup>nd</sup> edition, Prentice Hall, Inc., New Jersey, 1973
4. L M Deshmukh, Industrial safety management, 1<sup>st</sup> edition, TATA McGraw Hill, 2005.

#### **WEBLINKS:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_me40/preview](https://onlinecourses.nptel.ac.in/noc19_me40/preview)
2. <https://www.studocu.com/in/document/>

23BEME0E03

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.

**COURSE OUTCOMES:**

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

- Summarize the codes, standards and specifications related to NDT.
- Classify the destructive and non-destructive tests and their applications.
- Develop NDT techniques for mechanical components.
- Compare the eddy current and visual testing methods.
- Explain the NDE techniques and its applications.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg.	2.2	1.2	0.2	-	-	-	-	-	-	1	-	1	-	-

**3-Strong; 2-Medium; 1-Low**

## **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.

**TOTAL:45**

### **TEXT BOOKS:**

1. Sadashiva. M – Non - Destructive Testing Paperback – 15 July 2021.
2. Ramachandran. S and Anderson. A - Non-Destructive Testing – Kindle Edition – 2018

### **REFERENCE BOOKS:**

1. J. Prasad and C. G. Krishnadas Nair - Non-Destructive Test and Evaluation of Materials Hardcover – 1 July 2017.
2. Lari and Kumar - Basics of Non - Destructive Testing Paperback – 1 January 2013.

### **WEBLINKS:**

1. <https://ndttrainingonline.com>
2. <https://onlinendts.com/>

23BEME0E04

OPERATIONS RESEARCH

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 provide students the knowledge of optimization techniques and approaches.
- To enable the students, apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- To understand the Engineering and Managerial situations in Transportation.
- To make the student acquire sound knowledge on sequences to perform operation among various alternatives.
- To teach students about networking, inventory, queuing, decision and replacement models.

**COURSE OUTCOMES:**

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

- Solve Linear programming technique in industrial optimization problems.
- Examine transportation problems using OR techniques.
- Explain various OR models for optimization.
- Make use of OR tools in a wide range of applications in industries.
- Identify the advanced techniques for group replacement.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	2
<b>CO2</b>	3	3	2	1	-	-	-	-	-	1	-	1	-	2
<b>CO3</b>	2	1	3	-	-	-	-	-	-	1	-	1	-	2
<b>CO4</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	2
<b>CO5</b>	3	2	1	-	-	-	-	-	-	1	-	1	-	2
<b>Avg.</b>	<b>2.8</b>	<b>2</b>	<b>1.6</b>	<b>0.2</b>	-	-	-	-	-	<b>1</b>	-	<b>1</b>	-	<b>2</b>

**3-Strong; 2-Medium; 1-Low****UNIT I INTRODUCTION TO OPERATIONS RESEARCH****(9)**

Operations research and decision-making – types of mathematical models and constructing the model – Role of computers in operations research –Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, graphical method, simplex method – The Big –M method – the two-phase method.

## **UNIT II TRANSPORTATION PROBLEMS**

**(9)**

Least cost method, North west corner rule, Vogel's approximation method, modified distribution method, unbalance and degeneracy in transportation model, shortest route algorithm– dijkstra algorithm.

## **UNIT III ASSIGNMENT MODELS AND SCHEDULING**

**(9)**

Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case in assignment problems, traveling salesman problem. Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing two jobs through 'm' machines, processing n jobs through m machines.

## **UNIT IV INVENTORY CONTROL AND QUEUING THEORY**

**(9)**

Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi item deterministic model.

Queuing Models: Queues–Notation of queues, performance measures, The M/M/1 queue, TheM/M/m queue, batch arrival queuing system, queues with breakdowns.

## **UNIT V PROJECT MANAGEMENT AND REPLACEMENT MODELS**

**(9)**

Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing

Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

**TOTAL:45**

### **TEXT BOOKS:**

1. Kanti Swarup, Operations Research, 12<sup>th</sup> edition, Sultan Chand and Sons, New Delhi, 2010.
2. Viswanathan N and Narahari Y, Performance Modeling of Automated Manufacturing Systems, 2<sup>nd</sup> edition, Prentice Hall of India, New Delhi, 2005

### **WEBLINKS:**

1. <https://www.techtarget.com/whatis/definition/operations-research-OR>
2. [https://en.wikipedia.org/wiki/Operations\\_research](https://en.wikipedia.org/wiki/Operations_research)

23BESH0E01

MASS COMMUNICATION

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To outline the basic concepts of communication and its types.
- To extend the knowledge with process of mass communication and their relevance.
- To explain the functions of mass communication with real time experience.
- To utilize the mass communication theories in media communication.
- To plan research proposals using international concepts in mass communication.

**COURSE OUTCOMES:**

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

- Identify the process and types of human communication.
- Recognize the function and characteristics of mass communication.
- Describe correlation and culture of mass communication.
- Replicate the concepts of mass communication theories in real life situation.
- Explain the impact of media theory in international communication.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	-	-	-	-	-	-	-	1	2	3	-	2	-	-
<b>CO2</b>	-	-	-	-	-	-	-	2	2	3	-	2	-	-
<b>CO3</b>	-	-	-	-	-	-	-	2	2	3	-	2	-	-
<b>CO4</b>	-	-	-	-	-	-	-	2	2	3	-	2	-	-
<b>CO5</b>	-	-	-	-	-	-	-	2	2	3	-	2	-	-
<b>Avg.</b>	-	-	-	-	-	-	-	<b>1.8</b>	<b>2</b>	<b>3</b>	-	<b>2</b>	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I BASIC CONCEPTS OF COMMUNICATION**

Types of Communication; Functions of Mass Communication; Barriers, Intertextuality.

## **UNIT II MODELS AND THEORIES OF COMMUNICATION**

Various models and theories of communication.

## **UNIT III MEDIA THEORY**

Paradigm Shifts in Mass Communication Theories

## **UNIT IV FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY**

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

### **TEXT BOOKS:**

1. Mass Communication in India – By Keval J. Kumar, 1994
2. Mass Communication Theory: Foundations, Ferment and Future – By Stanley J. Baran and Dennis K. Devis, 2015.

### **REFERENCE BOOKS:**

1. Introduction to Communication Studies – By John Fiske, 2010.
2. Mcquail's Mass Communication Theory – By Denis Mcquail, 2010.

**COURSE OBJECTIVES:**

- To understand basic knowledge of fuzzy sets and fuzzy logic
- To apply basic knowledge of fuzzy operations.
- To know the basic definitions of fuzzy relations
- To apply basic fuzzy inference and approximate reasoning
- To know the applications of fuzzy Technology.
- Provide a firm basis for further reading and study in the subject.

**COURSE OUTCOMES:**

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

- Infer the basics of Fuzzy sets and functions.
- Utilize the method of operations in fuzzy sets.
- Interpret the concept of Fuzzy relations and relational equations
- Make use of the Possibility theory and Probability measures in Fuzzy sets
- Apply Fuzzy logic for decision making.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
Avg.	2.6	1.6	0.6	-	-	-	-	-	-	-	-	1	-	1

3-Strong; 2-Medium; 1-Low

**UNIT I FUZZY SETS**

(9)

Fuzzy Sets : Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

**UNIT II OPERATIONS ON FUZZY SETS**

(9)

Operations on Fuzzy Sets Operations on  $[0,1]$  – Fuzzy negation, triangular norms, tco norms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations



**UNIT III FUZZY RELATIONS****(9)**

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

**UNIT IV FUZZY MEASURES****(9)**

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

**UNIT V FUZZY INFERENCE****(9)**

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

**TOTAL : 45****TEXT BOOKS:**

1. George J Klir and Bo Yuan,(2003) Fuzzy Sets and Fuzzy Logic : Theory and Applications, Prentice Hall of India, New Delhi.
2. Zimmermann H.J.(2001) Fuzzy Set Theory and its Applications, Kluwer Academic publishers, USA.

**REFERENCE BOOKS:**

1. Michal Baczynski and Balasubramaniam Jayaram,(2008) Fuzzy Implications, Springer-Verlag publishers, Heidelberg.
2. Kevin M Passino and Stephen Yurkovich,(1998) Fuzzy Control, Addison Wesley Longman publishers, USA.

23BESH0E03

MATERIALS 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:**

- To inculcate the fundamental principles and concepts of magnetic materials for different engineering applications.
- To impart basic knowledge of superconductivity and associated applications.
- To serve the fundamental concepts of dielectric materials for diverse applications in energy engineering.
- To divulge the basics of crystals, their structures and different crystal growth techniques.
- To make the students familiar in the fundamentals of ceramics, composites and nonmaterial's.

**COURSE OUTCOMES:**

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

- Illustrate the theory of magnetism and magnetic properties of the materials
- Explain the theory of superconductivity and its application in SQUID
- Infer the types of polarization and dielectric breakdown
- Outline the basics of crystals, structures and its defects
- Summarize the types of ceramics, metallic glasses and alloys.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg.	2	1	-	-	-	-	-	-	-	1	-	1	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I MAGNETIC MATERIALS**

**(9)**

Origin of magnetic moment; Bohr magneton; comparison of Dia, Para and Ferro magnetism; Langevin theory of diamagnetism and paramagnetism; Quantum theory of paramagnetism; Curie-Weiss law; Temperature dependence of saturation magnetization; Domain theory; Hysteresis; soft and hard magnetic materials; antiferromagnetic materials; Ferrites and its applications.

## **UNIT II SUPERCONDUCTING MATERIALS**

**(9)**

Superconductivity, properties; Meissner effect; Type I and Type II superconductors; London equation; BCS theory of superconductivity(Qualitative), Flux quantization; High T<sub>c</sub> superconductors; Josephson superconductor tunnelling, DC and AC Josephson effect; Applications of superconductors, SQUID, cryotron, magnetic levitation.

## **UNIT III DIELECTRIC MATERIALS**

**(9)**

Electrical susceptibility, dielectric constant; electronic, ionic, orientational and space charge polarization; frequency and temperature dependence of polarisation; internal field; Clausius -Mossotti relation (derivation); dielectric loss; dielectric breakdown, uses of dielectric materials (capacitor and transformer); ferroelectricity and applications.

## **UNIT IV CRYSTAL PHYSICS**

**(9)**

Lattice, Unit cell, Bravais lattice; Lattice planes; Miller indices; d spacing in cubic lattice; Calculation of number of atoms per unit cell, Atomic radius, Coordination number, Packing factor for SC, BCC, FCC and HCP structures; Crystal imperfections; Crystal growth techniques; solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative).

## **UNIT V NEW MATERIALS**

**(9)**

Ceramics; types and applications; composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics; metallic glasses: types, glass forming ability of alloys, melt spinning process, applications; shape memory alloys: phases, shape memory effect, applications; nanomaterials: preparation (bottom up and top down approaches), properties and applications.

**TOTAL:45**

### **TEXT BOOKS:**

1. C. Kittel, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
2. A. J. Dekker, Solid State Physics, Published by Macmillan India, 2000.

### **REFERENCE BOOKS:**

1. William D Callister Jr, "Materials Science and Engineering – An Introduction", John Wiley and Sons Inc., 7th edition, New York, 2006
2. S.O. Pillai, Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. M.A. Wahab, Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
4. M. Arumugam, Materials Science. Anuradha publishers, 2010.

**JOURNALS:**

- Nature Physics
- Journal of Applied Mechanics (ASME)
- Journal of Electronic Materials (IEEE/TMS)
- Applied Thermal Engineering (Elsevier)
- Physical Review B (American Physical Society).
- Nature Nanotechnology

**WEBLINKS:**

1. <https://nptel.ac.in/courses/122/103/122103011/>
2. <https://nptel.ac.in/courses/113/104/113104081/>
3. <https://nptel.ac.in/courses/108/108/108108122/>
4. <http://hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html>

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

**COURSE OBJECTIVES:**

- To make the students conversant about the green chemistry
- To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- To acquaint the student with concepts of green technology.
- To develop an understanding of the basic concepts of renewable energy resources.
- To acquaint the students with the basics information on catalysis.
- To apply the concepts of green catalysts in the synthesis.

**COURSE OUTCOMES:**

After completion of this course, students will be able to

- Outline the basic principles of green chemistry.
- Explain the chemical synthesis in terms of atom efficiency.
- Relate the concepts of green chemistry in biotechnology.
- Illustrate the importance of renewable feedstocks.
- Extend the phenomena of catalysis in green synthesis.

**CO-PO MAPPING:**

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

**3-Strong; 2-Medium; 1-Low****UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES****(9)**

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorosolvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

## **UNIT II ATOM EFFICIENT PROCESSES**

**(9)**

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

## **UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY**

**(9)**

Bio technology and its applications in environmental protection - Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology- Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

## **UNIT IV RENEWABLE RESOURCES**

**(9)**

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

## **UNIT V CATALYSIS IN GREEN CHEMISTRY**

**(9)**

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

**Total: 45**

### **TEXT BOOKS:**

1. Sanjay K. Sharma, Ackmez Mudhoo (2010) Green Chemistry for Environmental Sustainability CRC Press , London
2. Chandrakanta Bandyopadhyay (2019) An Insight into Green Chemistry, Books and Allied (P) Ltd, Kolkata.

### **REFERENCE BOOKS:**

1. Ahluwalia V. K. (2018) Green Chemistry A Textbook 4<sup>th</sup> Reprint Narosa Publishing House Pvt. Ltd, New Delhi.
2. Ahluwalia V. K. and M.Kidwai (2007) New Trends in Green Chemistry 2<sup>nd</sup> edition Anamaya publishers., New Delhi.
3. Dr. Sunita Ratan (2012) A Textbook of Engineering Chemistry S.K. Kataria and Sons., New Delhi
4. Mukesh Doble. Ken Rollins, Anil Kumar (2007) Green Chemistry and Engineering, 1<sup>st</sup> edition Academic Press, Elsevier., New Delhi.
5. Desai K. R. (2005) Green Chemistry Himalaya Publishing House, Mumbai.

**WEBLINKS:**

1. <http://www.organic-chemistry.org/topics/green-chemistry.shtm>
2. <http://www.essentialchemicalindustry.org/processes/green-chemistry.html>
3. [http://www.chm.bris.ac.uk/webprojects2004/vickery/green\\_solvents.html](http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.html)
4. <http://www.epa.gov/research/greenchemistry/>
5. <http://www.amazon.in/Green-Chemistry-Catalysis>

**23BP804ET      PHARMACEUTICAL REGULATORY SCIENCE THEORY      3H-3C**

**Instruction Hours/week: L:3 T:0 P:0**

**Marks: Internal:40 External:60 Total:100  
End Semester Exam:3 Hours**

### **COURSE OBJECTIVES:**

- This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc.
- It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.
- To know the process of drug discovery, development and generic product development
- To understand the regulatory approval process and registration procedures for API and drug products in various countries
- To learn the basic understanding of regulations of India with other global regulated markets
- It gives basic understanding of developing clinical trial protocols

### **COURSE OUTCOMES:**

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

- Explain the process of drug discovery, development and generic product development
- Describe the regulatory approval process and registration procedures for API and drug products in various countries.
- Understand the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals in India and other global regulated markets.
- Explain basic understanding of developing clinical trial protocols
- Understand the concept of pharmacovigilance and its significance.

### **CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	-	-	<b>1</b>	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	-	-	<b>1</b>	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	-	-	<b>1</b>	-	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	-	-	<b>1</b>	-	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	-	-	<b>1</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Avg.</b>	-	-	<b>1</b>	-	-	-	-	-	-	-	-	-	-	-

**3-Strong; 2-Medium; 1-Low**



## **UNIT I NEW DRUG DISCOVERY AND DEVELOPMENT (10)**

Stages of drug discovery, Drug development process, pre- clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

## **UNIT II REGULATORY APPROVAL PROCESS (10)**

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

**Regulatory authorities and agencies:** Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

## **UNIT III REGISTRATION OF INDIAN DRUG PRODUCT IN OVERSEAS MARKET (10)**

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.

## **UNIT IV CLINICAL TRIALS (8)**

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials.

## **UNIT V REGULATORY CONCEPTS (7)**

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book.

**TOTAL :45**

### **TEXT BOOKS:**

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berr y and Robert P. Martin, Drugs and the Pharmaceutical Sciences, Vol.185. Informa Health care Publishers.

### **REFERENCE BOOKS:**

1. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.
2. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
3. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics edited by Douglas J. Pisano, David Mantus.
4. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143.
5. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams.
6. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene.
7. Drugs: From Discovery to Approval, Second Edition By Rick Ng.

23BP809ET

COSMETIC SCIENCE- THEORY

3H-3C

Instruction Hours/week: L:3 T:0 P:0

Marks: Internal:40 External:60 Total:100  
End Semester Exam:3 Hours**COURSE OBJECTIVES:**

- To know the cosmetics in day to day life.
- To understand the formulation characteristics of cosmetic preparations
- To understand the role of herbs in cosmetic science
- To Demonstrate the evaluation procedures in the formulation of cosmetics
- To Identify the problems encountered during the usage of cosmetics
- To illustrate the role of nutraceuticals in day to day life

**COURSE OUTCOMES:**

At the end of this course, the student will able to

- Discover the cosmetics in day-to-day life.
- Formulation's Development and characteristics of various cosmetic products.
- Understand about principles and building blocks of skin and hair care products.
- Understand the role of herbs in cosmetic science
- Understand the principles of cosmetic evaluation including various parameters
- Illustrate the important role of nutraceuticals in day -to -day life.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Avg.	-	-	1	-	-	-	-	-	-	-	-	-	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I****(10)**

Classification of cosmetic and cosmeceutical products definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

**Cosmetic excipients:** Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application.

**Skin:** Basic structure and function of skin.

**Hair:** Basic structure of hair. Hair growth cycle.

**Oral Cavity:** Common problem associated with teeth and gums.

## **UNIT II PRINCIPLES OF FORMULATION AND BUILDING BLOCKS OF SKIN CARE PRODUCTS (10)**

Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. **Antiperspirants & deodorants**- Actives & mechanism of action.

**Principles of formulation and building blocks of Hair care products:** Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phenylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

## **UNIT III (10)**

Sun protection, Classification of Sunscreens and SPF.

**Role of herbs in cosmetics:** Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove

**Analytical cosmetics:** BIS specification and analytical methods for shampoo, skin- cream and toothpaste.

## **UNIT IV (8)**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.

## **UNIT V (7)**

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action

**TOTAL :45**

### **TEXT BOOKS:**

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2. Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3. Text book of cosmeticology by Sanju Nanda & Roop K. Khar, Tata Publishers.

23MBAPOE301

ORGANIZATIONAL BEHAVIOUR

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 understand the basic concepts of organizational behavior.
- To analyze the individual behavior traits required for performing as an individual or group.
- To obtain the perceiving skills to judge the situation and communicate the thoughts and ideas.
- To understand how to perform in group and team and how to manage the power, politics and conflict.
- To recognize the importance of organizational culture and organizational change.
- To realize the importance of groups and teamwork and managing of conflict between the members of the organization

**COURSE OUTCOMES:**

- Analyze organizational behavior issues in the context of the organizational behavior theories and concepts.
- Assess the behavior of the individuals and groups in organization and manage the stress.
- Manage team, power, politics and conflict arising between the members.
- Explain how organizational change and culture affect the working relationship within organizations.
- Understand and exhibit the communication skills to convey the thoughts and ideas of case analysis to the individuals and group.
- Understand the application of OB using appropriate concepts, logic and theoretical conventions

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	3	-	-	-	-	-	-
CO2	-	-	-	-	-	2	1	3	-	-	-	-	-	-
CO3	-	-	-	-	-	2	1	3	-	-	-	-	-	-
CO4	-	-	-	-	-	2	2	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	1	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Avg.	-	-	-	-	-	1.6	1.4	3	-	-	-	-	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I ORGANIZATION BEHAVIOUR : INTRODUCTION**

**(9)**

Organization Behavior: Meaning and definition - Fundamental concepts of OB - Contributing disciplines to the OB field – OB Model - Significance of OB in the organization success - Challenges and Opportunities for OB.

## **UNIT II BEHAVIOUR AND PERSONALITY**

**(9)**

Attitudes – Sources - Types - Functions of Attitudes. Values – Importance - Types of Values. Personality – Determinants of personality- Theories of Personality - psycho-analytical, social learning, job-fit, and trait theories.

## **UNIT III PERCEPTION**

**(9)**

Perception – factors influencing perception - Person Perception – Attribution Theory – Frequently Used Shortcuts in Judging Others- Perceptual Process- Perceptual Selectivity - Organization Errors of perception – Linkage between perception and Decision making.

## **UNIT IV GROUP AND STRESS MANAGEMENT**

**(9)**

Foundation of Group Behavior - Types of Groups - Stages of Group Development - Group Norms - Group Cohesiveness – Stress – Causes of stress – Effects of Occupational Stress- Coping Strategies for Stress.

## **UNIT V ORGANIZATION CULTURE AND CHANGE**

**(9)**

Organizational culture- Characteristics of Culture- Types of Culture – Creating and Maintaining an Organizational Culture. Organizational change – Meaning - Forces for Change - Factors in Organizational Change - Resistance to change- Overcoming resistance to change.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Fred Luthans. (2017). Organizational Behavior: An Evidence - Based Approach, 12th edition, Mcgraw Hill Education, NewDelhi.
2. Steven Mcshane and Mary Ann VonGlinow (2017), Organizational Behavior, 6th edition, McGraw Hill Education, NewDelhi

### **REFERENCE BOOKS:**

1. Robbins, S. P., and Judge, T.A. (2016). Organizational Behaviour.(16<sup>th</sup> edition).New Delhi: Prentice Hall of India.
2. Laurie J. Mullins (2016), Management and Organisationalbehaviour, 10th edition, Pearson Education, NewDelhi
3. Robbins, S. P., and Judge, T.A. (2016). Essentials of Organizational Behavior.13 edition, Pearson Education.

### **WEBLINKS:**

1. <https://nptel.ac.in/courses/110/105/110105033/>

**23PHPOE301****MATERIAL CHARACTERIZATION****3H-3C****Instruction Hours/week: L:3 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To Study materials is always important, for any application, including fabrication of satellites.
- To introduce various methods available for characterizing the materials. The characterization of materials specifically addresses that portfolio with which researchers and educators must have working familiarity.
- To provide an introduction to materials characterization and its importance
- To discuss different types of characterization techniques and their uses.
- To introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques Introduction:
- To understand the materials characterization and available techniques

**COURSE OUTCOMES:**

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

1. Handle with X-ray, thermal, microscopic, and electrical methods of characterization.
2. Understand and describe the fundamental principles behind the methods of characterization which are included in the curriculum
3. Analyze, interpret and present observations from the different methods.
4. Evaluate the uncertainty of observations and results from the different methods.
5. Understand the history of materials science with basic understanding of metals, binary alloys, magnetic materials, dielectric materials and polymers
6. Understand nucleation, growth and phase transformation kinetics

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	-	-	-	3	-	-	-	-	-	-	-	-	-
<b>CO2</b>	3	3	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	-	-	-	2	-	-	-	-	-	2	-	-	-	-
<b>CO4</b>	-	-	-	2	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	2	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO6</b>	3	-	3	-	-	-	-	-	-	-	-	-	-	-
<b>Avg.</b>	<b>1.8</b>	<b>0.5</b>	<b>0.5</b>	<b>0.6</b>	<b>0.5</b>	-	-	-	-	<b>0.3</b>	-	-	-	-

**3-Strong; 2-Medium; 1-Low**

**UNIT I****(9)**

X-ray techniques for materials characterization X-ray diffraction: Principle, measuring system and applications for characterization of powdered materials. X-ray diffraction profile and analysis: FWHM and line broadening, Crystallite size effect and Scherrer formula, Effect of strain (tensile vs compressive, uniform vs. non-uniform) Introduction to Extended X-ray absorption fine structure (EXAFS), Surface extended X-ray absorption (SEXAFS).

**UNIT II****(9)**

Microscopic techniques Principles, instrumentations and applications of Optical microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) for characterization of different samples. Energy dispersive X-ray microanalysis (EDS) - Basic aspects of Atomic force microscopy (AFM).

**UNIT III****(9)**

Spectroscopic methods Principle, instrumentation and applications of UV-Visible Diffuse Reflectance (UV-Vis DRS) spectroscopy, Ft-IR, Raman and Fluorescence spectroscopy. Hand of experience on operation of UV-Vis-DRS, FT-IR, Raman and data analysis..

**UNIT IV****(9)**

Thermoanalytical Methods Principle, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Temperature Analysis (DTA) and Differential Scanning Calorimetry (DSC). Factors affecting the TGA/DTA/DSC results and their interpretations. Hand on experience of operation of TG/DSC and data analysis.

**UNIT V****(9)**

Electroanalytical Techniques Voltammetric principles, hydrodynamic voltammetry, stripping voltammetry, cyclic voltammetry, criteria of reversibility of electrochemical reactions, quasi-reversible and irreversible processes, qualitative and quantitative analysis current-potential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms and parameters obtainable from voltammograms. Hand on experience on operation of CV and data analysis.

**TOTAL:45****TEXT BOOKS:**

1. Theory and Applications of UV Spectroscopy, H.H.Jaffe and M.Orchin, IBH-Oxford.
2. Inorganic spectroscopic methods, A.K. Brisdon, Oxford Chem. Primers, 1997, New York.

**REFERENCE BOOKS:**

1. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L.Ho, Wiley Inter science.
2. Introduction to Spectroscopy, Pavia, Brooks/Cole Cenage, 4th edition, 2009, Belmont.
3. Introduction to Photoelectron Spectroscopy, P.K.Ghosh, John Wiley.
4. Fundamental of Molecular Spectroscopy, C. N. Banwell and E. McCash, Tata McGraw Hill, 4th edition, 1994, New Delhi.

**23PHPOE302****NUMERICAL METHODS AND 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:**

- Computational physics may be broadly defined as 'the science of using computers to assist in the solution of physical problems, and to further physics research.
- To equip the students of M.Sc. Physics with knowledge of programming in C, roots of equation, interpolation, curve fitting, numerical differentiation, numerical integration, solution of ordinary differential equations
- To introduce students to computational methods for simulating physical systems and solving problems arising in physics and astronomy, as well as in other related fields
- Computers now play a role in almost every branch of physics like large scale quantum mechanical calculations in nuclear, atomic, molecular and condensed matter physics, large scale calculations in such fields as hydrodynamics, astrophysics, plasma physics, meteorology and geophysics etc.
- The huge increase in the power of computers in recent years has made an impact on the role of computational physics.
- This paper gives idea about different types of computations involved in Physics, like curve fitting, interpolation, extrapolation, numerical calculations etc.

**COURSE OUTCOMES:**

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

- 1) Programme numerical methods and their implementation like applying to problem in
- 2) physics, including modeling of classical physics to quantum system as well as data analysis (Linear and non linear).
- 3) Analysis techniques for propagating error, representing data graphically. Create, solve and interpret basic mathematical tool.
- 4) Program independently computers using leading-edge tools,
- 5) formulate and computationally solve a selection of problems in physics,
- 6) Use the tools, methodologies, language and conventions of physics to test and Communicate ideas and explanations.



**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-	1	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO6	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	1	0.3	-	-	0.2	-	-	-	-	-	-	1	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I****(9)**

Errors, different type of errors. Representation of numbers in computer, computer arithmetic, zero in floating point number.

**UNIT II****(9)**

Operators –finite differences, average, differential, etc., their inter-relations. Difference of polynomials. Difference equation. Interpolation. Lagrange's methods, error terms. Uniqueness of interpolating polynomial.

**UNIT III****(9)**

Newton's fundamental interpolation. Forward, backward and central difference interpolations. Interpolation by iteration. Spline interpolation, comparison with Newton's interpolation. Hermite's interpolation. Bivariate interpolation, Lagrange and Newton's methods. Inverse interpolation.

**UNIT IV****(9)**

Approximation of function. Least square method. Use of orthogonal polynomials. Approximation by Chebyshev polynomials, Max-min principle. Economization of power series.

**UNIT V****(9)**

Python Programming –Loops- Conditional statements- Functions- Object-oriented programming- Array computing- 2 and 3d visualizations

**TOTAL:45****TEXT BOOKS:**

1. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1999
2. W.H. Press, B.P. Flannery et al., "Numerical Recipes: Art of Scientific Computing", 3rd Edition, Cambridge Press, 2007.

## REFERENCE BOOKS:

1. J. M. Mathews and K. Fink, "Numerical Methods using MATLAB", 4rd Edition, Prentice Hall Publication, 2004
2. Dr. B.S. Grewal, "Numerical Methods in Engineering and Science ", Khanna Publication.
3. Robert J schilling, Sandra l harries , " Applied Numerical Methods for Engineers using MATLAB and C.", Thomson Brooks/cole.
4. Richard L. Burden, J. Douglas Faires, "Numerical Analysis", Thomson / Brooks/cole
5. John. H. Mathews, Kurtis Fink , "Numerical Methods Using MATLAB", Prentice Hall publication
6. JAAN KIUSALAAS , "Numerical Methods in Engineering with MATLAB", Cambridge Publication
7. <https://archive.nptel.ac.in/content/>

**23CAPOE301****ROBOTICS PROCESS AUTOMATION****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:**

- Learn the concepts of RPA, its benefits, types and models
- Gain the knowledge in application of RPA in Business Scenarios
- Identify measures and skills required for RPA
- Adopt to the implementations of Automation
- Able to process information and draw inference
- Understand the concepts of robot skills

**COURSE OUTCOMES (COS)**

- Demonstrate the benefits and ethics of RPA K1, K2
- Understand the Automation cycle and its techniques K2
- Draw inferences and information processing of RPA K3, K4
- Understand the Automation concepts
- Implement & Apply RPA in Business Scenarios K5
- Analyze on Robots & leveraging automation

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	-	-	-	-	-	-	--	-	-	-	-	-	-
<b>CO2</b>	3	3	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO3</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CO4</b>	3	-	3	2	-	-	-	-	-	-	-	-	-	-
<b>CO5</b>	-	-	3	-	-	-	-	-	2	-	-	-	-	-
<b>CO6</b>	-	-	-	-	-	-	-	-	-	3	-	-	-	-
<b>Avg.</b>	<b>1.5</b>	<b>0.5</b>	<b>1</b>	<b>0.3</b>	-	-	-	-	<b>0.3</b>	<b>0.5</b>	-	-	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I – INTRODUCTION****(9)**

Introduction to RPA - Overview of RPA - Benefits of RPA in a business environment - Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA - Centre of Excellence – Types and their applications - Building an RPA team - Approach for implementing RPA initiatives.

## **UNIT II - AUTOMATION**

(9)

Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people

## **UNIT III - AUTOMATION IMPLEMENTATION**

(9)

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows

## **UNIT IV – ROBOT**

(9)

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.

## **UNIT V – ROBOT SKILL**

(9)

Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Tom Taulli, February 2020. “The Robotic Process Automation Handbook” Apress , Reference Books 1 Steve Kaelble” Robotic Process Automation” John Wiley & Sons, Ltd.
2. Alok Mani Tripathi, March 2018. “Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool”, Packet Publishing Limited

### **WEBLINKS**

1. [https://www.tutorialspoint.com/uiopath/uiopath\\_robotic\\_process\\_automation\\_introduction.htm](https://www.tutorialspoint.com/uiopath/uiopath_robotic_process_automation_introduction.htm)
2. <https://www.javatpoint.com/rpa> 3 [https://onlinecourses.nptel.ac.in/noc19\\_me74/preview](https://onlinecourses.nptel.ac.in/noc19_me74/preview)

**23BCPOE301****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**

- Fundamentals of food, nutrients and their relationship to health
- Respect to deriving maximum benefit from available food resources
- Consequences of vitamin and mineral deficiency/excess of vitamin
- Nutrition deficiency diseases and their consequences
- Food adulteration and prevention of food adulteration

**COURSE OUTCOMES**

After successful completion, the students will understand:

- The fundamentals of nutrition and their relationship to health
- To derive maximum benefits from available food resources
- The consequences of vitamin and mineral deficiency/excess of vitamin
- Nutrition deficiency diseases and their consequences
- The sources of food adulteration and measures to prevent it

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	1	-	-	-
Avg.	2	1	-	-	-	-	-	-	-	-	1.2	-	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I****(9)**

Basic concepts in food and nutrition-Understanding relationship between food, nutrition and health, Functions of food-Physiological, psychological and social. Dietary guidelines for Indians food pyramid. Junk foods and its causes.

**UNIT II****(9)**

Nutrients- Functions, dietary sources and clinical manifestations of deficiency/ excess of the following nutrients: Carbohydrates, lipids and proteins, Fat soluble vitamins-A, D, E and K, Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals– calcium, iron and iodine

### UNIT III

(9)

Adult nutrition Physiological changes, RDA, nutritional guidelines, nutritional concerns and healthy food choices-Adult, Pregnant woman, Lactating mother, Elderly. Nutrition during childhood-Growth and development, nutritional guidelines, nutritional concerns and healthy food choices-Infants, Preschool children, School children, Adolescents. Nutritional needs of nursing mothers and infants, determinants of birth weight and consequences of low birth weight, Breastfeeding biology, Breastfeeding support and Counselling, Infant and young child feeding and care-Current feeding practices and nutritional concerns, guidelines for infant and young child feeding, Breastfeeding, weaning and complementary feeding. Assessment and management of moderate and severe malnutrition among children, Micronutrient malnutrition among preschool children. Child health and morbidity, neonatal, infant and child mortality.

### UNIT IV

(9)

Introduction to Nutritional deficiency diseases -Causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Flurosis Nutritional needs during pregnancy, common disorders of pregnancy (Anaemia, HIV infection, Pregnancy induced hypertension), relationship between maternal diet and birth. Maternal health and nutritional status, maternal mortality and issues relating to maternal health.

### UNIT V

(9)

**Dietetics :** Diet for diabetes mellitus-Nutrition recommendations for patient with diabetes, Meal planning, Exchange list of different food groups, Glycemic index based formulation of diet for diabetic individual, Diabetic diets menu wise. Diet for Cardiovascular Diseases -Dietary management and general guidelines for coronary heart disease, Dietary recommendations of WHO. Diet for Acute cardiac diseases. Influence of diet on carcinogenesis, Dietary risk factors and cancers at various sites in the human body, diet therapy, diet for cancer patients, managing eating problems during treatment. Hormonal imbalance-Poly cystic ovarian syndrome, hypogonadism, cushing syndrome. Causes of hormonal imbalance. Treatment- Dietary and stress management protocols to be followed.

**TOTAL: 45**

### TEXT BOOKS:

1. Gordon M, Wardlaw and Paul M. (2012). Perspectives in Nutrition: U.S.A. McGraw Hill Publishers. 9rd Edition. New Delhi
2. Srilakshmi.B. (2014) Nutrition Science: New Age International (P) Ltd. Publishers. 4th Edition. New Delhi.

### REFERENCE BOOKS

1. Srilakshmi.B. (2015) Food Science:. New Age International (P) Ltd. Publishers. 6nd Edition., New Delhi
2. Darshan Sohi (2012). A Comprehensive Textbook of Nutrition & Therapeutic Diets. Jaypee Brothers Medical Publishers Pvt. Ltd.

**23CSPOE301****CYBER FORENSICS****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 understand about computer forensics and investigations.
- To know about digital evidence and crime.
- To analyse and validate forensics data.
- To know about e-mail investigation.
- To understand about Mobile device forensics.

**COURSE OUTCOMES:**

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

- Define, understand and explain various investigation procedures and summarize duplication of digital evidence.
- Apply the knowledge of digital evidences.
- Design and develop various forensics tools and analyze the network forensics.
- Demonstrate the systematic study of high-tech forensics
- Understand the importance of reports.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2	2	2	-	-	-	-	-	-	-	2	-	-
<b>CO2</b>	3	3	3	-	-	-	-	-	-	-	-	2	-	-
<b>CO3</b>	3	2	2	2	-	-	-	-	-	-	-	2	-	-
<b>CO4</b>	2	2	2	2	-	-	-	-	-	-	-	2	-	-
<b>CO5</b>	1	1	1	1	-	-	-	-	-	-	-	2	-	-
<b>Avg.</b>	<b>2.2</b>	<b>2.2</b>	<b>2.2</b>	<b>1.4</b>	-	-	-	-	-	-	-	<b>2</b>	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I COMPUTER FORENSICS AND INVESTIGATIONS****(7)**

Computer forensics and investigations as a profession – Preparing for computer investigations – Taking a systematic approach–Procedures for corporate high-tech investigations–Data recovery work stations and software– Conducting an investigation.

**UNIT II DATA ACQUISITION****(7)**

Data acquisition – Storage formats for digital evidence – Validating data acquisitions – Processing crime and incident scenes–Identifying digital evidence–Collecting evidence in private sector incident scenes – Preparing for search-seizing digital evidence at the scene-storing digital evidence –Reviewing a case.

### **UNIT III COMPUTER FORENSICS TOOLS**

(7)

Current computer forensics tools–Software tools–Hardware tools–The Macintosh file structure and boot process – Computer forensics analysis and validation – Addressing data –Hiding techniques.

### **UNIT IV NETWORK FORENSICS**

(7)

Virtual machines – Network forensics – Developing standard procedures – Live acquisitions – email investigations – Investigating e-mail crimes and violations – Understanding e-mail servers – Cell phone and mobile device forensics.

### **UNIT V MOBILE DEVICE FORENSICS**

(8)

Understanding mobile device forensics – Acquisition procedures –Report writing for high-tech investigations – Importance of reports – Guidelines for writing reports –Expert testimony in high-tech investigations.

#### **TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips and Christopher Steuart. (2018). Computer Forensics and Investigations, Cengage Learning, 5<sup>th</sup> Edition.
2. Eoghan Casey.(2017). “Handbook of Digital Forensics and Investigation”, Academic Press, 1<sup>st</sup> Edition,
3. John R Vacca,.(2016).“Computer Forensics”, Cengage Learning, 2<sup>nd</sup> Edition.

#### **WEB LINKS:**

1. [www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf](http://www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf)
2. [www.forensicsguru.com/devicedataextractionsimcell.php](http://www.forensicsguru.com/devicedataextractionsimcell.php)
3. [www.nptel.ac.in/courses/106101060](http://www.nptel.ac.in/courses/106101060)
4. [www.samsclass.info/121/ppt/ch11.ppt](http://www.samsclass.info/121/ppt/ch11.ppt)
5. [www.garykessler.net/library/role\\_of\\_computer\\_forensics.html](http://www.garykessler.net/library/role_of_computer_forensics.html)
6. [www.ukessays.com/essays/information-technology/computer-forensics-and-crime-investigations-information-technology-essay.php](http://www.ukessays.com/essays/information-technology/computer-forensics-and-crime-investigations-information-technology-essay.php)



**23CMPOE301****PERSONAL FINANCE AND PLANNING****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 familiarize with regard to the concept of Investment Planning and its methods
- To examine the scope and ways of Personal Tax Planning;
- To analyze Insurance Planning and its relevance
- To develop an insight into retirement planning and its relevance.
- To construct an optimal portfolio in real life situations

**COURSE OUTCOMES:**

- Familiarize with regard to the concept of Investment Planning and its methods
- Examine the scope and ways of Personal Tax Planning;
- Analyze Insurance Planning and its relevance
- Develop an insight in to retirement planning and its relevance.
- Construct an optimal portfolio in real life situations

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	-	-	-	-	-	-	-	1	2	2	3	1	-	-
<b>CO2</b>	-	-	-	-	-	-	-	1	2	2	3	1	-	-
<b>CO3</b>	-	-	-	-	-	-	1	1	2	2	3	1	-	-
<b>CO4</b>	-	-	-	-	-	-	1	1	2	3	3	2	-	-
<b>CO5</b>	-	-	-	-	-	-	1	1	2	2	3	2	-	-
<b>Avg.</b>	-	-	-	-	-	-	<b>0.6</b>	<b>1</b>	<b>2</b>	<b>2.2</b>	<b>3</b>	<b>1.4</b>	-	-

**3-Strong; 2-Medium; 1-Low****UNIT I****(9)**

**Introduction to Financial Planning** - Financial goals, Time value of money, steps in financial planning, personal finance/loans, education loan, car loan & home loan schemes. Introduction to savings, benefits of savings, management of spending & financial discipline, Net banking and UPI, digital wallets, security and precautions against Ponzi schemes and online frauds such as phishing, credit card cloning, skimming.

## UNIT II

(9)

**Investment Planning** - Process and objectives of investment, Concept and measurement of return & risk for various assets class, Measurement of portfolio risk and return, Diversification & Portfolio formation. Gold Bond; Real estate; Investment in Green field and brown field Projects; Investment in fixed income instruments-financial derivatives & Commodity market in India. Mutual fund schemes including SIP; International investment avenues.

## UNIT III

(9)

**Personal Tax Planning** -Tax Structure in India for personal taxation, Scope of Personal tax planning, Exemptions and deductions available to individuals under different heads of income and gross total income, Special provision u/s115BAC vis-à-vis General provisions of the Income-tax Act, 1961.Tax avoidance versus tax evasion.

## UNIT IV

(9)

**Insurance Planning** - Need for Protection planning. Risk of mortality, health, disability and property. Importance of Insurance: life and non-life insurance schemes. Deductions available under the Income-tax Act for premium paid for different policies.

## UNIT V

(9)

**Retirement Benefits Planning** - Retirement Planning Goals, Process of retirement planning, Pension plans available in India, Reverse mortgage, New Pension Scheme. Exemption available under the Income-tax Act, 1961 for retirement benefits.

**TOTAL: 45**

### TEXT BOOKS:

1. Indian Institute of Banking & Finance. (2017). Introduction to Financial Planning. New Delhi: Taxmann Publication.
2. Pandit, A. (2014). The Only Financial Planning Book that You Will Ever Need. Mumbai: Network Publications Ltd.

### REFERENCE BOOKS:

1. Sinha, M. (2008). Financial Planning: A Ready Reckoner. New York: McGraw Hill Education.
2. Halan, M. (2018). Let's Talk Money: You've Worked Hard for It, Now Make It Work for You. New York: HarperCollins Publishers.
3. Tripathi, V. (2017). Fundamentals of Investment. New Delhi: Taxmann Publication

23CHEOE301

CHEMISTRY IN EVERYDAY LIFE

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**

- Gain knowledge in the importance of chemistry in food industry.
- Understand the chemistry of medicines and cosmetics.
- Evaluate the solar energy utilization and its storage.
- Knowledge about the production of electricity by a nuclear reactor.
- Know about the chemistry of soaps, detergents and textiles.
- Know about the chemistry behind the polymers, fuel and agriculture.

**COURSE OUTCOMES:**

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

1. Know the importance of chemistry in food industry.
2. Understood the chemistry of medicines and cosmetics.
3. Evaluate the solar energy utilization and its storage.
4. Understood the production process of electricity by a nuclear reactor.
5. Know about the chemistry of soaps, detergents and textiles.
6. Know the chemistry behind the polymers, fuel and agriculture.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	1	1	-	-	2	2	-	-	-	-	1	-	-
<b>CO2</b>	2	1	1	-	-	2	2	-	-	-	-	1	-	-
<b>CO3</b>	2	1	1	-	-	2	2	-	-	-	-	1	-	-
<b>CO4</b>	2	1	1	-	-	2	2	-	-	-	-	1	-	-
<b>CO5</b>	2	1	1	-	-	2	2	-	-	-	-	1	-	-
<b>Avg.</b>	<b>2</b>	<b>1</b>	<b>1</b>	-	-	<b>2</b>	<b>2</b>	-	-	-	-	<b>1</b>	-	-

3-Strong; 2-Medium; 1-Low

**UNIT I IMPORTANCE OF CHEMISTRY IN FOOD****(9)**

Chemicals in food, colouring agents, artificial preservatives, flow stabilizers, binding substance, flavours and sweeteners, antioxidants, minerals, vitamins. Chemistry at the breakfast table, raising agents- gluten, the taste maker- glutamic acid, stimulants-Caffeine, chemistry of onion, garlic and curcumin.

## **UNIT II CHEMISTRY IN MEDICINES AND COSMETICS (9)**

Elements in the human body, drugs and their classification, drug-target interaction, action of different classes of drugs, antiseptics and disinfectants.

Cosmetics: Chemistry behind the lotions, fragrances, talcum powder, sunblock and sunscreen, toothpaste, lipsticks, nail polishes.

## **UNIT III CHEMISTRY IN ENERGY (9)**

Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries - photovoltaics - stealing the sun - nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity and the hazards of radioactivity - living with nuclear power.

## **UNIT IV IMPORTANCE OF CHEMISTRY IN SOAPS, DETERGENTS AND TEXTILES (9)**

Detergents and soaps, types of soaps and detergents, saponification, cleansing action of soaps and detergents, perfumes used in soaps.

Textiles: Chemistry behind wool, silk, jute, cotton, glass fibre, polyester, acrylic, nylon, and other raw materials.

## **UNIT V CHEMISTRY OF POLYMERS, FUEL AND AGRICULTURE (9)**

Polymers, types, polyethylene, plastics, disposal of plastics, degradation of polymers and plastics using nano materials. Petrochemistry, petrol, diesel, LPG, CNG, kerosene, oils, and other fuels. Agriculture: fertilizers, herbicides, insecticides, and fungicides.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Tripathy, S. N., & Sunakar Panda (2004). *Fundamentals of Environmental Studies* (II Edition). New Delhi: Vrianda Publications Private Ltd.
2. Arvind Kumar (2004). *A Textbook of Environmental Science*. New Delhi: APH Publishing Corporation.

### **REFERENCE BOOKS:**

1. Anubha Kaushik, C. P., & Kaushik (2004). *Perspectives in Environmental Studies*. New Delhi: New Age International Pvt. Ltd. Publications.
2. Seymour R. B., & Charles, E. (2003). *Seymour's Polymer Chemistry: An Introduction*. Marcel Dekker, Inc.
3. Stocchi, E. (1990). *Industrial Chemistry* (Vol-I). UK: Ellis Horwood Ltd.
4. Jain, P. C., & Jain, M. (2004). *Engineering Chemistry*. Delhi: Dhanpat Rai & Sons.
5. Sharma, B. K., & Gaur, H. (1996). *Industrial Chemistry*. Meerut :Goel Publishing House.

**23MBPOE301****FERMENTATION TECHNOLOGY****3H-3C****Instruction Hours/week: L:3 T:0 P:0****Marks: Internal:40 External:60 Total:100****End Semester Exam:3 Hours****COURSE OBJECTIVES:**

- To encompass the use of microorganisms in the manufacture of food or industrial products on the basis of employment.
- Get equipped with a theoretical and practical understanding of industrial microbiology
- Appreciate how microbiology is applied in the manufacture of industrial products
- Know how to source microorganisms of industrial importance from the environment
- Know about the design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer
- Understand the rationale in medium formulation & design for microbial fermentation, and sterilization of medium and air.

**COURSE OUTCOMES:**

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

- Provides knowledge in the large scale production of industrial product, and teaches the modern employment trends to cater the needs of industry.
- Students will differentiate the types of fermentation processes
- Understand the biochemistry of various fermentations
- Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms
- Comprehend the techniques and the underlying principles in downstream processing
- Students can able to explore the practical skills in research activities.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	-	-	-	-	-	-	-	-	-	1	1	-	-
<b>CO2</b>	2	1	2	-	-	-	-	-	-	-	1	1	-	-
<b>CO3</b>	2	-	-	-	-	-	-	-	-	-	1	1	-	-
<b>CO4</b>	2	1	2	-	-	-	-	-	-	-	1	1	-	-
<b>CO5</b>	1	-	-	-	-	-	-	-	-	-	1	1	-	-
<b>CO6</b>	1	1	1	-	-	-	-	-	-	-	1	1	-	-
<b>Avg.</b>	<b>1.8</b>	<b>0.5</b>	<b>0.8</b>	-	-	-	-	-	-	-	1	1	-	-

**3-Strong; 2-Medium; 1-Low**

## **UNIT I - BASICS OF FERMENTATION PROCESSES**

**(9)**

Definition, scope, history, and chronological development of the fermentation industry. Component parts of the fermentation process. y. Component parts of fermentation process. Microbial growth kinetics, batch and continuous, direct, dual or multiple fermentations; scaleup of fermentation, comparison of batch and continuous culture as investigative tools, examples of the use of fed batch culture.

## **UNIT II ISOLATION AND PRESERVATION**

**(9)**

Isolation, preservation, and strain improvement of industrially important microorganisms. Use of recombination system (Parasexual cycle, protoplast fusion techniques), application of recombinant strains, and the development of new fermentation products.

## **UNIT III –SCREENING AND INOCULUM DEVELOPMENT**

**(9)**

Screening (primary and secondary screening); detection and assay of fermentation products (Physico-chemical assay, biological assays). Inoculum development, criteria for transfer of inoculum, development of inoculum: Bacteria, Fungi and Yeast.

## **UNIT IV–MICROBIAL PRODUCTION**

**(9)**

Fermentation type reactions (Alcoholic, bacterial, mixed acid, propionic acid, butanediol and acetone-butanol). Microbial production of enzymes (amylases, Proteases, cellulases, pectinases and lipases) primary screening for producers, large scale production. Immobilization methods.

## **UNIT V – ALCOHOLS AND BEVERAGES**

**(9)**

Fermentative production of industrial alcohol, production of beverages. Production of organic acids: citric acid, aminoacids: glutamic acid, production of vitamins. fungal enzymes and Single cell protein.

**TOTAL: 45**

### **TEXT BOOKS:**

1. Casida, L.E.2007. Industrial microbiology, New age international (P) Ltd., New Delhi.
2. Clark, D.P and Pazdernik, N.J.2009. Biotechnology applying the genetic revolution, Elsevier Academic Press, UK.

### **REFERENCE BOOKS:**

1. Glazer, A and Nikaido.1995. Microbial biotechnology fundamentals of applied microbiology, W.H. Freeman and company, USA.
2. Glick, B.R and Pasternak, J.J.2003. Molecular Biotechnology Principles and Applications of Recombinant DNA, 3rd edition, ASM Press, USA.
3. Harider, S.I. and Ashok, A. 2009. Biotechnology, A Comprehensive Training Guide for the Biotechnology Industry, CRC Press, New York.
4. Sridhar, S.2010. Industrial Microbiology, Dominant Publishers, New Delhi.
5. Tanuja. S and Purohit, S.S. 2008. Fermentation Technology, Agrobios Publication, Jodhpur, India.

23EGPOE301

ENGLISH FOR COMPETITIVE EXAMINATIONS

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 train learners to crack competitive exams
- To know of various tools that is essential for Competitive Exams
- To enhance their ability to speak in English and face an interview.
- To make the student apply, prepare and clear the competitive exams.
- To prepare the student to concentrate, stay positive and confident.
- To take even failure at ease and continue the target of clearing competitive exams.

**COURSE OUTCOMES:**

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

- The student may settle in life with a government job.
- The student may develop various skills
- The successful student may guide other students to success.
- Analyse logical reasoning questions, error analysis, and correct usage of words.
- Develop the knowledge of grammatical system of English language.
- Elaborate on the correct structure of sentence

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO2	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO3	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO4	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO5	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO6	-	-	-	-	-	-	-	-	1	2	-	1	-	-
Avg.	-	-	-	-	-	-	-	-	1	2	-	1	-	-

**3-Strong; 2-Medium; 1-Low**

<b>UNIT I GRAMMAR</b>	<b>(9)</b>
Number-Subject, Verb and Agreement-Articles-Sequences of Tenses-Common Errors	
<b>UNIT II WORD POWER</b>	<b>(9)</b>
Idioms and Phrases-One word substitution-Synonyms-Antonyms-Words often confused	
<b>UNIT III PARAGRAPH</b>	<b>(9)</b>
Expansion of an idea	
<b>UNIT IV WRITING</b>	<b>(9)</b>
Essay- Letters-Memos-Agenda-Resume writing	
<b>UNIT V SPEAKING</b>	<b>(9)</b>
Public Speaking-Group discussion-Interview-Spoken English	

**TEXT BOOK:**

V. Saraswathi, Maya K. Mudbhatkal (2014). English for Competitive Examinations. Emerald: Chennai.



**23BTPOE301****SERICULTURE****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 knowledge and skills of seribiotechnology for development new mulberry variety and silkworm breeds suitable for varied agro-climatic zones.
- To apply tools and techniques of biostatistics for critical analysis and interpretation of data accrued.
- To use bioinformatics tools and techniques for the analysis and interpretation of bimolecular data for better understating mulberry and silkworm.
- To demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of seribiotechnology.
- Thorough knowledge and application of good laboratory and good manufacturing practices in sericulture and biotech industries.
- To demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises.

**COURSE OUTCOMES:**

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

- Know the different components and chain link of sericulture industry.
- Understand concepts of sericulture industry and demonstrate interdisciplinary skills acquired in mulberry plant cultivation and silkworm rearing.
- Demonstrating the Laboratory and field skills in mulberry cultivation and
- Silkworm rearing with an emphasis on technological aspects.
- To transfer the knowledge and technical skills to the Seri-farmers.
- To analyze the environmental issues and apply in management of mulberry garden and silkworm rearing at field.
- Demonstrate comprehensive innovations and skills in improvement of mulberry and silkworm varieties for betterment of sericulture industry and human welfare.

**CO-PO MAPPING:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	1	-	-	-	-	1	-	-
CO5	2	2	-	2	-	-	2	-	-	-	-	-	-	-
CO6	2	2	1	-	-	-	-	-	--	-	-	1	-	-
Avg.	2	1	1	1	-	-	1	-	-	-	-	0.3	-	-

**3-Strong; 2-Medium; 1-Low**

**UNIT I****(9)**

Introduction to Sericulture - History of Sericulture – Sericulture organization in India, By products of silk industry. Mulberry and Non – mulberry silkworm types–Morphology and Life cycle of Bombyxmori,

**UNIT II****(9)**

Mulberry Cultivation: Mulberry Varieties – Methods of Irrigation –Nutrient Management and Weed control. Pruning and Harvesting – Crop improvement – Mechanism in Moriculture – Pest and Disease, deficiencies and symptoms in Mulberry.

**UNIT III****(9)**

Rearing of silkworm – Rearing Appliances – rearing operation. Harvesting and marketing of cocoons. Cocoon processing and reeling - Appliances used for reeling. Pre reeling process – Cocoon boiling. Reeling technology – re-reeling technology.

**UNIT IV****(9)**

Non – Mulberry Sericulture Scope of Non-mulberry Sericulture - Non-mulberry silk varieties and fauna, tasar, muga, eri – Silk Production and Marketing – Tropical tasar / muga – Morphology, anatomy grainage

**UNIT V****(9)**

Diseases of silkworm –Pebrine Protozoan, Flacherie bacterial, Nuclear Polyhedrosis viral and Muscardine fungal diseases. Pests of Silkworm.

**TOTAL: 45****TEXT BOOKS:**

1. Krisnamoorthy S., Improved Method of Rearing Young Age Silk Worms: Reprinted by CSB, Bangalore, 1986.
2. Tanaka Y., Sericology, CSB, Pub., Bangalore, 1964.
3. Ullal S.R., and Narasimhan M.N., Hand Book of Practical Sericulture, CSB, Bangalore, 1987.

**REFERENCE BOOKS:**

1. Hisao Aruga, Principles of sericulture, Oxford and IBH Publishing Company, 1994.
2. Hrcrama Reddy, G. 1998. Silkworm Breeding, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Otsuki el.al. 1987. Silkworm Egg Production (Translated from Japanese Language), Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Yasuji Hamamura, 2001 Silkworm Rearing on Artificial Diet (Translated from Japanese Language), Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.

5. Mahadevappa, D. Halliyal, V.G., Sankar, D.G and Bhandiwad, R. 2000. Mulberry Silk Reeling Technology, Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Dandin, S.B et.al. 2003. Advances in Tropical Sericulture, National Academy of Sericulture Sciences India, Central Silk Board, Bangalore, India.
7. Ganga G., Sulochanachetty. J. An Introduction of Sericulture. Oxford, New Delhi – 1977.
8. Johnson M., and Kesary M., Sericulture, CSI Press, Marthandam, 2008.
9. Text Book of Tropical Sericulture, Pub., Japan Overseas Volunteers, 1975