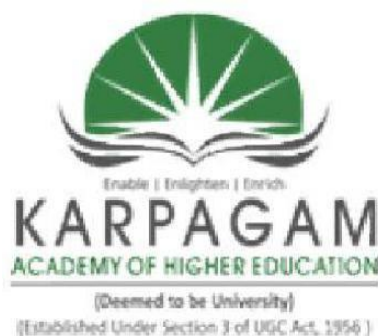# B.E. COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

SYLLABI 2022-2023

(CHOICE BASED CREDIT SYSTEM)

Department of Computer Science and Engineering

FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act 1956)
(Accredited with A+ Grade by NAAC in Second Cycle)

Pollachi Main Road, Eachanari Post

Coimbatore - 641021.

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Eachanari, Coimbatore - 641 021. INDIA

FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

REGULAR PROGRAMME

REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

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

1. ADMISSION

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 3rd and 4th semester as prescribed by the University.

<div align="center">**OR**</div>

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.

<div align="center">**OR**</div>

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)

<div align="center">**Eligibility criteria for admission in the third semester is given in the table below.**</div>

S. No.	Programme	Eligibility criteria
1.	B.E Bio Medical Engineering	Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks incase of candidates belonging to reserved category) in ANY branch of Engineering and Technology.
2	B. E. Civil Engineering	
3.	B. E. Computer Science and Design	
4.	B. E. Computer Science and Engineering	**OR** Passed B.Sc. Degree from a recognizedUniversity 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.
5.	B.E.Electrical and Electronics Engineering	
6.	B.E.Electronics and Communications Engineering	**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)
7.	B. E. Mechanical Engineering	
8.	B. Tech. Artificial Intelligence and Data Science	
9.	B. Tech Bio - Technology	
10.	B. Tech Food Technology	
11.	B.E Computer Science and Engineering (Cyber Security)	

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 Facultyof Engineering and a nominee of the Registrar.

2 . PROGRAMMES OFFERED

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

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

1. B.E Bio Medical Engineering
2. B. E. Civil Engineering
3. B. E. Computer Science and Design
4. B. E. Computer Science and Engineering
5. B. E. Electrical and Electronics Engineering
6. B. E. Electronics and Communications Engineering
7. B. E. Mechanical Engineering
8. B.Tech. Artificial Intelligence and Data Science
9. B. Tech. Bio-Technology
10. B. Tech Food Technology
11. B.E Computer Science and Engineering (Cyber Security)

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 periods of Value added course per week	1
No. of credits for 3 weeks of in-plant training during semester vacations	1

4.3 In every semester, the curriculum shall normally have a blend of theory courses not exceeding 6 and practical courses not exceeding 3. However, the total number of courses per semester shall not exceed 8.

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. (H. Sc. 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 them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Dean depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course Committee' shall meet to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Where ever feasible, the Course Committee may also prepare a common question paper for the Internal Assessment test(s).

10. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

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:

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

*Evaluation shall be made by a committee.

PATTERN OF TEST QUESTION PAPER (Test I & II)

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

PATTERN OF TEST QUESTION PAPER(Test III)

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

PRACTICAL COURSES:

S. No	CATEGORY	MAXIMUM MARKS
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Model Examination	15
5.	Viva – Voce [Comprehensive]	10
Continuous Internal Assessment: TOTAL		40

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

INTEGRATED THEORY AND PRACTICAL COURSES

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

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

10.3 ATTENDANCE

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

S. No.	Attendance %	Marks
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
Maximum Marks	100
Duration	3 Hours
Part - A	Part A will be online Examination. 20 Objective type Questions. Covering all the 5 units. **20*1= 20 Marks (Online Examination)**
Part- B	21 to 25 Two Mark Questions, uniformly covering the Five units of the syllabus. All the 5 Questions are to be answered. (**5 *2= 10Marks**).
Part- C	Question 26 to 30 will be of either or type, covering Five units of the syllabus. Each Question may have subdivision. **(5*14=70 Marks)**

13. PASSING REQUIREMENTS

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:

Letter grade	Marks Range	Grade Point	Description
O	91 - 100	10	OUTSTANDING
A+	81- 90	9	EXCELLENT
A	71-80	8	VERY GOOD
B+	66- 70	7	GOOD
B	61 – 65	6	ABOVE AVERAGE
C	55 - 60	5	AVERAGE
D	50 - 54	4	PASS
RA	<50	-	REAPPEARANCE
AB		0	ABSENT

14.2 GRADE SHEET

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

  i.   The list of courses enrolled during the semester and the grade scored,
  ii. The Grade Point Average (**GPA**) for the semester and
  iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from 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.

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

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

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, is 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.

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

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

17.1 A candidate may for valid reasons and on 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 forspecial 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 Clause17). 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 maybe eligible for the award of the degree.

18.5 If any student is detained for want of requisite attendance, progress and good conduct, the periodspent in that semester shall not be considered as permitted 'Withdrawal' or 'Break of Study' (Clause18and 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 University.

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act 1956)
Accredited with A+ Grade by NAAC in the Second cycle
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

List of PEOs, POs and PSOs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. To perform well in their professional career by acquiring enough knowledge in the domain of Artificial Intelligence and Data Science.

II. To improve communication skills, follow professional ethics and involve in team work in their profession.

III. To update with evolving technology and use it for career advancement.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

a) **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) **Problem Analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) **Design/ Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f) **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECFIC OUTCOMES (PSOs):

1.The ability to apply, analyse, design and develop the application software that meet the automation needs of society and industry.

2. The ability to understand the evolutionary changes in computing, apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success, real world problems and meet the challenges of the future.

MAPPING:

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO I	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
PEO II	✓	✓	✓	✓	✓			✓	✓	✓				✓
PEO III	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓

Credit Distribution:

S.No.	Course Category	Credit Distribution	Percentage
1	Basic Science	21	13.1
2	Engineering Science	11	6.9
3	Humanities and Science	13	8.1
4	Professional Core	73	45.6
5	Professional Elective	18	11.3
6	Open Elective	6	3.8
7	Project Work	18	11.3
	Total	160	100

FACULTY OF ENGINEERING (FOE)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UG PROGRAM (CBCS) – B.E COMPUTER SCIENCE AND ENGINEERING

(CYBER SECURITY)

(2022-2022 Batch and Onwards)

COURSEC ODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
SEMESTER I										
22BECY101	Technical English – I	**HS**	2	0	2	3	40	60	100	1
22BECY102	Mathematics-I (Matrices and Calculus)	**BS**	3	1	0	4	40	60	100	3
22BECY103	Environmental Studies	**HS**	3	0	0	3	40	60	100	5
22BECY141	Programming Logic and Design	**ES**	4	0	2	5	40	60	100	8
22BECY111	Engineering Practices for Computer Sciences	**ES**	0	0	4	2	40	60	100	11
SEMESTER TOTAL			**12**	**1**	**8**	**17**	**200**	**300**	**500**	**1**
SEMESTER II										
22BECY201	Mathematics-II (Vector Calculus andIntegral Transforms)	**BS**	3	1	0	4	40	60	100	13
22BECY202	Basics of Cyber Crime And CyberSecurity	**PC**	3	0	0	3	40	60	100	16
22BECY203	Basics of Cyber Forensics	**PC**	3	0	0	3	40	60	100	18
22BECY241	Technical English–II	**HS**	3	0	2	4	40	60	100	20
22BECY242	Engineering Physics	**BS**	3	0	4	5	40	60	100	23
22BECY243	Object Oriented Programming with Python	**ES**	3	0	2	4	40	60	100	26
SEMESTER TOTAL			**18**	**1**	**8**	**23**	**240**	**360**	**600**	**1**
SEMESTER III										

Code	Title	Category	L	T	P	C				
22BECY301A/ 22BECY301B/ 22BECY301C	Discrete Mathematics/ Numerical Methods/Numerical Linear Algebra	BS	3	1	0	4	40	60	100	29,32, 34
22BECY302	Computer Architecture	PC	3	0	0	3	40	60	100	36
22BECY341	Database Management Systems	PC	3	0	2	4	40	60	100	39
22BECY342A/ 22BECY342B	Data Structures and Algorithms/ Design and Analysis of Algorithms	PC	3	0	2	4	40	60	100	42,45
22BECY343A/ 22BECY343B	Java Programming/ Object Oriented Programming	PC	3	0	2	4	40	60	100	48,51
22BEMC351	Aptitude and Reasoning	MC	1	0	0	0	100	-	100	255
22BECY391	Field project / Internship I	PC	0	0	2	1	100	-	100	263
SEMESTER TOTAL			**16**	**1**	**8**	**20**	**400**	**300**	**700**	

				SEMESTER IV						
22BECY401A/ 22BECY401B	Statistics and Optimizations Techniques /Probability and Statistics	BS	3	1	0	4	40	60	100	54,57
22BECY402	Cryptography and Network Security	PC	3	1	0	4	40	60	100	59
22BECY4EXX	Professional Elective I	PE	3	0	0	3	40	60	100	105-114
22BECY441	Operating Systems	PC	3	0	2	4	40	60	100	62
22BECY442A/ 22BECY442B	Web Application Development/ Low code application development	PC	3	0	2	4	40	60	100	65,68
22BECY443A/ 22BECY443B	Advanced algorithms /Design and Analysis of Algorithms	PC	3	0	2	4	40	60	100	71,74
22BEMC451	Foundation of Entrepreneurship	MC	1	0	0	0	100	-	100	257
22BEMC452	Essence of traditional Indian knowledge and Heritage	MC	1	0	0	0	100	-	100	259
SEMESTER TOTAL			**20**	**2**	**6**	**23**	**440**	**360**	**800**	

SEMESTER V

22BECY501	Formal Languages and Automata theory	PC	3	1	0	4	40	60	100	77
22BECY502	Information Security	PC	3	1	0	4	40	60	100	80
22BECY5EXX	Professional Elective II	PE	3	0	0	3	40	60	100	115-121
22BECY5EXX	Professional Elective III	PE	3	0	0	3	40	60	100	123-129
22BECY541	Network Architecture and security	PC	3	0	2	4	40	60	100	83
22BECY542A/ 22BECY542B	Advanced Web Frameworks / Business data processing	PC	3	0	2	4	40	60	100	85,88
22BEMC551	Mobile Application development	MC	2	0	0	0	100	-	100	260
22BECY591	Field project / Internship II	PW	0	0	2	1	100	-	100	264
SEMESTER TOTAL			**20**	**2**	**6**	**23**	**440**	**360**	**800**	

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SEMESTER VI

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22BECY601	Machine Learning for Cyber Security	PC	3	1	0	4	40	60	100	91
22BECY6EXX	Professional Elective IV	PE	3	0	0	3	40	60	100	132-141
22BECY6EXX	Professional Elective V	PE	3	0	0	3	40	60	100	144-152
22BECY6E0X	Open Elective I	OE	3	0	0	3	40	60	100	174-253
22BECY641	Cyber Security Threats and Countermeasures	PC	3	0	2	4	40	60	100	93
22BECY642	Digital and Mobile Forensics	PC	3	0	2	4	40	60	100	96
22BECY691	Mini Project	PW	0	0	4	2	100	-	100	265
SEMESTER TOTAL			**18**	**1**	**8**	**23**	**340**	**360**	**700**	

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SEMESTER VII

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22BECY701	Principles of Management and Engineering Ethics	HS	3	0	0	3	40	60	100	99
22BECY702	Ethical Hacking	PC	3	1	0	4	40	60	100	101
22BECY703	Devops	PC	3	1	0	4	40	60	100	104

Course Code	Name	Category	L	T	P	Credit	CIA	ESE	Total	Page
22BECY7EXX	Professional Elective VI	PE	3	0	0	3	40	60	100	105-163
22BECY7E0X	Open Elective II	OE	3	0	0	3	40	60	100	174-253
22BECY791	Project Work Phase I	PW	0	0	8	4	40	60	100	**267**
SEMESTER TOTAL			**15**	**2**	**8**	**21**	**240**	**360**	**600**	
SEMESTER VIII										
22BECY891	Project Work and Viva Voce Phase II	PW	0	0	20	10	80	120	200	**268**
SEMESTER TOTAL			**0**	**0**	**20**	**10**	**80**	**120**	**200**	
PROGRAM TOTAL			**119**	**10**	**72**	**160**	**2280**	**2520**	**4900**	

			Instruction hours/week				Maximum Marks			
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**L**	**T**	**P**	**CREDIT(S)**	**CIA**	**ESE**	**TOTAL**	**Page No.**
LIST OF PROFESSIONAL ELECTIVES										
PROFESSIONAL ELECTIVE I										
22BECY4E01	Advanced Data Structures	PE	3	0	0	3	40	60	100	106
22BECY4E02	Block Chain and Cyber Security	PE	3	0	0	3	40	60	100	108
22BECY4E03	Cloud Security	PE	3	0	0	3	40	60	100	111
22BECY4E04	Fundamentals of Web Design	PE	3	0	0	3	40	60	100	113
PROFESSIONAL ELECTIVE II										
22BECY5E01	Fundamentals of Artificial Intelligence	PE	3	0	0	3	40	60	100	**115**
22BECY5E02	Robotic Process Automation	PE	3	0	0	3	40	60	100	**117**
22BECY5E03	OS Security	PE	3	0	0	3	40	60	100	**119**
22BECY5E04	Cyber Laws and Intellectual Property Rights	PE	3	0	0	3	40	60	100	**121**

PROFESSIONAL ELECTIVE III									
22BECY5E05	Cognitive Psychology in Cyber Security	**PE**	3	0	0	3	40	60	100	**123**
22BECY5E06	Internet Security	**PE**	3	0	0	3	40	60	100	**125**
22BECY5E07	Hardware Security	**PE**	3	0	0	3	40	60	100	**127**
22BECY5E08	Data Warehousing and Data Mining	**PE**	3	0	0	3	40	60	100	**129**
PROFESSIONAL ELECTIVE IV									
22BECY6E01	Forensic Audio and Video Analysis	**PE**	3	0	0	3	40	60	100	**132**
22BECY6E02	Agile Methodologies	**PE**	3	0	0	3	40	60	100	**135**
22BECY6E03	Advanced Java Programming	**PE**	3	0	0	3	40	60	100	**137**
22BECY6E04	Biometric Security	**PE**	3	0	0	3	40	60	100	**139**
22BECY6E05	Vulnerability Assessment and Penetration Testing	**PE**	3	0	0	3	40	60	100	**141**
PROFESSIONAL ELECTIVE V									
22BECY6E06	Internet of Things	**PE**	3	0	0	3	40	60	100	**144**
22BECY6E07	Human Computer Interaction	**PE**	3	0	0	3	40	60	100	**146**
22BECY6E08	Storage Management and Security	**PE**	3	0	0	3	40	60	100	**148**
22BECY6E09	Secure Coding	**PE**	3	0	0	3	40	60	100	**150**
22BECY6E10	3D Printing and Design	**PE**	3	0	0	3	40	60	100	**152**
PROFESSIONAL ELECTIVE VI									
22BECY7E01	Social Network Security	**PE**	3	0	0	3	40	60	100	**154**
22BECY7E02	Secure Software Engineering and Risk Management	**PE**	3	0	0	3	40	60	100	**156**

22BECY7E03	UI/UX design	**PE**	3	0	0	3	40	60	100	**158**
22BECY7E04	Web Application Security	**PE**	3	0	0	3	40	60	100	**160**
22BECY7E05	Game Development	**PE**	3	0	0	3	40	60	100	**162**

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS FROM CYBER SECURITY

22BECYOE01	Basics of Cyber Crime And Cyber Security	**PE**	3	0	0	3	40	60	100	**165**
22BECYOE02	Basics of Cyber Forensics	**PE**	3	0	0	3	40	60	100	**167**
22BECYOE03	Cyber Laws and Intellectual Property Rights	**PE**	3	0	0	3	40	60	100	**169**
22BECYOE04	Block Chain and Cyber Security	**PE**	3	0	0	3	40	60	100	**171**

LIST OF OPEN ELECTIVE COURSES OFFERED FROM OTHER DEPARTMENTS

SCIENCE AND HUMANITIES

| COURSE CODE | NAME OF THE COURSE | CATEGORY | Instruction hours/week | | | CREDIT(S) | Maximum Marks | | | Page No. |
			L	T	P		CIA	ESE	TOTAL	
22BESHOE01 / 22BTSHOE01	Mass communication	OE	3	0	0	3	40	60	100	**175**
22BESHOE02/ 22BTSHOE02	Fuzzy mathematics	OE	3	0	0	3	40	60	100	**177**
22BESHOE03/ 22BTSHOE03	Material sciences	OE	3	0	0	3	40	60	100	**179**
22BESHOE04/ 22BTSHOE04	Green Chemistry	OE	3	0	0	3	40	60	100	**181**

ELECTRICAL AND ELECTRONICS ENGINEERING

| COURSE CODE | NAME OF THE COURSE | CATEGORY | Instruction hours/week | | | CREDIT(S) | Maximum Marks | | | Page No. |
			L	T	P		CIA	ESE	TOTAL	

COURSE CODE	NAME OF THE COURSE	CATEGORY	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
22BEEEOE01	Renewable Energy Systems	OE	3	0	0	3	40	60	100	**184**
22BEEEOE02	Hybrid Electric Vehicles	OE	3	0	0	3	40	60	100	**186**

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
22BEECOE01	Real Time Embedded Systems	OE	3	0	0	3	40	60	100	**189**
22BEECOE02	Consumer Electronics	OE	3	0	0	3	40	60	100	**191**

FOOD TECHNOLOGY

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
22BTFTOE01	Processing Of Food Material	OE	3	0	0	3	40	60	100	**194**
22BTFTOE02	Nutrition And Dietetics	OE	3	0	0	3	40	60	100	**196**
22BTFTOE03	Ready To Eat Food	OE	3	0	0	3	40	60	100	**198**
22BTFTOE04	Agricultural Waste and by products Utilization	OE	3	0	0	3	40	60	100	**200**
22BTFTOE05	Design of Food Process Equipment	OE	3	0	0	3	40	60	100	**202**

MECHANICAL ENGINEERING

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	

COURSE CODE	NAME OF THE COURSE	CATEGORY	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
22BEMEOE01	Battery Management System	OE	3	0	0	3	40	60	100	**205**
22BEMEOE02	Industrial Safety and Environment	OE	3	0	0	3	40	60	100	**207**
22BEMEOE03	Non-Destructive Testing	OE	3	0	0	3	40	60	100	**209**
22BEMEOE04	Operations Research	OE	3	0	0	3	40	60	100	**211**

CIVIL ENGINEERING

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
22BECEOE01	Housing Plan And Management	OE	3	0	0	3	40	60	100	**214**
22BECEOE02	Building Services	OE	3	0	0	3	40	60	100	**216**
22BECEOE03	Repair and rehabilitation of structures	OE	3	0	0	3	40	60	100	**218**
22BECEOE04	Computer-Aided Civil Engineering Drawing	OE	3	0	0	3	40	60	100	**220**
22BECEOE05	Contracts Management	OE	3	0	0	3	40	60	100	**222**
22BECEOE06	Air And Noise Pollution And Control	OE	3	0	0	3	40	60	100	**224**

BIO MEDICAL ENGINEERING

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
22BEBMEOE01	Human Anatomy And Physiology	OE	3	0	0	3	40	60	100	**227**
22BEBMEOE02	Artificial Organs And Implants	OE	3	0	0	3	40	60	100	**229**

			Instruction hours/week				Maximum Marks			
COURSEC ODE	**NAME OF THE COURSE**	**CATEGORY**	**L**	**T**	**P**	**CREDIT(S)**	**CIA**	**ESE**	**TOTAL**	**Page No.**

BIOTECHNOLOGY

COURSEC ODE	NAME OF THE COURSE	CATEGORY	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
22BTBTOE01	Basic Bioinformatics	OE	3	0	0	3	40	60	100	**322**
22BTBTOE02	Fundamentals of Nanobiotechnology	OE	3	0	0	3	40	60	100	**224**

COMPUTER SCIENCE AND ENGINEERING

22BECSOE01	Internet Of Things	OE	3	0	0	3	40	60	100	**237**
22BECSOE02	Machine Learning	OE	3	0	0	3	40	60	100	**239**
22BECSOE03	Blockchain Technologies	OE	3	0	0	3	40	60	100	**241**
22BECSOE04	Cloud Computing	OE	3	0	0	3	40	60	100	**243**

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

22BTADOE01	Fundamentals of Data Science	OE	3	0	0	3	40	60	100	**246**
22BTADOE02	Fundamentals of Artificial Intelligence	OE	3	0	0	3	40	60	100	**248**
22BTADOE03	Internet Programming	OE	3	0	0	3	40	60	100	**250**
22BTADOE04	Robotics And Automation	OE	3	0	0	3	40	60	100	**252**

SEMESTER-I

22BECY101	**TECHNICAL ENGLISH – I**	**4H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- To recall the usage of grammar and understand the basic reading and writing skills.
- To understand the sentence structure and types of sentences.
- To emphasize on listening and develop speaking skills
- To engage in formal writing.
- To enrich the receptive and productive skills.
- To develop fluency in language.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Make use of grammar in reading and writing skills.
- Infer precise transition between sentences, ideas and paragraphs.
- Choose the linguistic parameters in everyday speaking and listening effectively.
- Develop the vocabulary by understanding word formation.
- Rephrase the structure of paragraphs in various aspects of writing.
- Interpret ideas for effective presentation and participate in discussion.

UNIT I   **9**
Grammar: Parts of Speech – Gerunds and infinitives
Reading: Reading comprehension: (vocabulary, referents, and inferences/conclusions).
Writing: Letter Writing (Formal and Informal) – Email Writing

UNIT II   **9**
Grammar: Tenses – Simple Present and Present continuous – Types of Sentences – Direct and Indirect – Connectives.
Reading: Identifying main and secondary information, transferring and interpreting information.

UNIT III   **9**
Writing: Resume writing with cover letter – Check lists – Building Itineraries – Paragraph writing.
Speaking: Describing people, places, jobs and things – Self Introduction – Asking questions.
Listening: Listening comprehension – Telephone conversation – Job description

UNIT IV 9

Grammar: Tenses: Perfect and Perfect continuous tenses – Reported speech – Active Passive - Identifying common errors.
Listening: Critical listening – Listening and Interpretation of ideas.

UNIT V 9

Reading: Reading comprehension: Cause and effect identification, reconstruction, rewording.
Writing: Business letters – Creative writing – Memo – Notice – Agenda.
Speaking: Oral presentations – Group discussions.

Total: 30+30

SUGGESTED READINGS
1. Jack C Richards with Jonathan Hull and Susan Proctor I, Interchange Student's Book 1, Cambridge University Press, Fourth Edition, 2016.
2. Barun K Mitra, Effective Technical Communication, Oxford University Press, First Edition, 2017
3. Jack C Richards, Interchange Student's Book 1, Cambridge University Press, Fourth Edition, 2015.
4. Raymond Murphy, Essential English Grammar, Cambridge University Press, Second Edition, 2016.
5. Ashraf Rizvi M, Effective TechnicalCommunication, McGraw Hill Education,First Edition, 2013.
6. University of CambridgeBEC Preliminary 1 (Exam Papers with answers), Cambridge University Press, 2010.

WEBSITES:
1. www.onestopenglish.com
2. www.britishcouncil.org
3. www.learnenglishtoday.com
4. www.talkenglish.com
5. www.bogglesworldesl.com

22BECY102   **MATHEMATICS - I**   **4H-4C**
(MATRICES AND CALCULUS)

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students is

- To compute eigenvalues and eigenvectors of real symmetric matrix.
- To acquaint the students with the concepts of functions of several variables and optimizing multivariate function.
- To make the students acquire sound knowledge in techniques of solving linear ordinary differential equations.
- To develop the knowledge in integral calculus.
- To impart knowledge in definite integrals and Beta, Gamma integrals.
- To develop the knowledge in multiple integrals and its applications.

COURSE OUTCOMES

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

- Identify a real symmetric matrix and diagonalize it by orthogonal transformation.
- Solve extreme value problems with or without constraints.
- Demonstrate the different methods for finding the solutions of linear differential equations.
- Make use of concept of definite integrals and Beta, Gamma functions in appropriate context of engineering problems.
- Apply the concept of multiple integrals for finding the area and volume of any definite shape.
- Apply the basic knowledge of Mathematics in Engineering fields.

UNIT I   12

Matrices: Eigenvalues and eigenvectors of a real matrix – Properties of eigenvalues – Statement and applications of Cayley-Hamilton theorem – Diagonalization by orthogonal reduction – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II   12

Functions of several variables: Partial derivatives – Total differential coefficients – Implicit functions – Jacobian – Properties – Maxima and minima of functions of two variables – Lagrange's method of constrained maxima and minima.

UNIT III   **12**

Ordinary linear differential equations: Linear differential equation of second and higher order with constant coefficients – Euler-Cauchy linear differential equation – Method of variation of parameters.

UNIT IV   **12**

Definite integrals: Properties of definite integrals – Applications – Bernoulli's extension formula – Beta and Gamma integrals – Properties – Applications.

UNIT V   **12**

Multiple integrals: Evaluation of double integrals – Sketch the region of integration – Change of order of integration – Change of variables – Area using double integrals – Evaluation of triple integrals – Volume of solids.

Total: 45+15

SUGGESTED READINGS

1. Ramana B V, Higher Engineering Mathematics, McGraw Hill Education, Twenty Ninth Reprint, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Tenth Edition, 2017.
3. Kandasamy P,Thilagavathy K and Gunavathy K, Higher Engineering Mathematics, S Chand and Co., First Edition, 2016.
4. Grewal B S, Higher Engineering Mathematics, Khanna Publishers, Forty Forth Edition,2017.
5. Veerarajan T, Engineering Mathematics (For Semesters I and II), McGraw Hill Education, First Edition, 2017.
6. George Brinton Thomas and Ross L Finney, Calculus and Analytic Geometry, Pearson Publishers, Ninth edition, 2002.
7. Bali N.P. and Manish Goyal, (2014), A text book of Engineering Mathematics, Laxmi Publications, New Delhi, India.
8. Veerarajan T**,** (2008), Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,.
9. Ramana B.V**,** (2010), Higher Engineering Mathematics, 11th Reprint, Tata McGraw Hill New Delhi.
10. Michale D. Greenberg, (2011), Advanced Engineering Mathematics, 2nd Edition, Books Pearson Education, First Indian reprint.

WEBSITES:

1. www.nptel.ac.in/courses/122104018/
2. www.nptel.ac.in/courses/122101003/31
3. www.nptel.ac.in/courses/111107098/11
4. www.nptel.ac.in/courses/122101003/16
5. www.nptel.ac.in/courses/122104017/28

SEMESTER-I

22BECY103   **ENVIRONMENTAL STUDIES**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

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

COURSE OUTCOMES

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

- Classify the importance of natural resources
- Rephrase themselves with the various ecosystems
- Build the importance of biodiversity
- Construct and minimize the difference pollutions
- Plan and analyses the social issues
- Interpret the environmental principles in the projects undertaken in field of engineering and technology .

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 biodiversityservices: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

SUGGESTED READINGS

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

SEMESTER-I

22BECY141   **PROGRAMMING LOGIC AND DESIGN**   **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

The goal of this course for the students is to
- Understand the method of developing an algorithm and to understand the simple program design
- Analyse the loop structures
- Apply the concept of console I/O and arrays
- Learn the working of two dimensional arrays
- Evaluate the modularization concepts and storage classes

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Illustrate steps in program development and basics of C programming.
- Identify the working of loop structure.
- Develop the programs in console I/O and arrays
- Solve the programs using functions
- Describe the working of structures and file management in C
- Apply the knowledge of programming to develop application software.

UNIT I   **9**
Logic and Scenarios – Steps in program development – An introduction to algorithm and pseudocode – Structure of C program – Basic data types and sizes – Constants – Variables – Operators – Input/output statements – Algorithms using selection – If and else statements – The CASE Structure – Switch statement – Goto statement, an Introduction to SCRATCH tool.

UNIT II   **9**
Loop -while-do while- for - break – continue – Types of I/O – Formatted I/O – Unformatted I/O functions – Header files – #include – Preprocessor directive – Macros.

UNIT III   **9**
Conditional compilation statements – #line – #error – The minimum field width specifier – Scanset – Arrays – Declaration – Array operations – Declare array size using macro – Index range checking. Two dimensional – multi-dimensional arrays – Application of arrays.

UNIT IV   **9**

Functions – Types – Reusability – User defined functions – Standard library functions. Function calls – Parameter passing – Call by value – Return statements – Arrays and functions – Recursive functions – Indirect – Direct – Tail – Recursion Vs iteration – Storage classes.

UNIT V   **9**

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

Total: 45

TEXT BOOKS

1. Brian W Kernighan and Dennis M Ritchie, The C Programming Language, Prentice Hall, Second Edition, 2015.
2. Jeri R Hanly, Elliot B Koffman, Problem Solving and Program Design in C, Pearson Education, Eighth Edition, 2015.

REFERENCE BOOKS

1. Herbert Schildt, C: The Complete reference, McGraw Hill, Fourth Edition , 2013.
2. David Griffiths and Dawn Griffiths, Head First C O'Reilly Media, First Edition, 2012.
3. Bryon S Gottfried, Programming with C, McGraw Hill, Second Edition, 2010.

WEBSITES:

1. www.hackerrank.com
2. www.codechef.com
3. www.learn-c.org
4. www.udemy.com
5. www.hackearth.com

(ii) LABORATORY

LIST OF EXPERIMENTS
1. Programs on ranges of data types
2. Programs on constants and variables
3. Programs on operators
4. Programs on selection control structure
5. Programs using looping statements
6. Programs on console I/O functions
7. Programs using pre-processor directive
8. Programs on array operation
9. Programs using two dimensional array
10. Programs using inbuilt Functions
11. Programs using User Defined function and recursive function
12. Programs using storage classes

Total: 30

SEMESTER-I

22BECY111   ENGINEERING PRACTICES FOR COMPUTER SCIENCES   4H-2C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- To check and measure Personal Computer's power supply voltage.
- To study the mother boards and various types of interface cards.
- To study and replaces hard disk.
- To study the different network cables and network devices.
- To assemble a Personal Computer.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Identify hardware components in a computer system.
- Predict non working computer system and suggest for repair.
- Explain about assembling and disassembling of a working computer.
- Explain about the Installation of I/O devices, interfacing and device driver.
- Identify the network components.
- Apply the knowledge to assemble and to connect computer in a network.

LIST OF EXPERIMENTS

PC Hardware Servicing
1. Demonstration of power supply requirement of Personal Computer.
2. Demonstration of Mother Boards.
3. Demonstration of various cards used in a Computer System viz. Display Card, Ethernet Card etc
4. Installation of I/O devices, interfacing and device driver.
5. Hard disk partition, defragmentation and installation.
6. Installation of OS (operating System), Software packages and programming development kits installation along with it.
7. Assembling a Personal Computer.
8. Assembling a laptop.

Networking and configuring Networks

1. Demonstration of different types of network cables.
2. Demonstration of network devices in detail.
3. Assigning IP address to the PC.
4. Connects the computer in Local Area Network.
5. Study of basic network commands and configuration commands.
6. WiFi configuration in the PC

Total: 60

SEMESTER-II

22BECY201   **MATHEMATICS -II**   **4H-4C**
(VECTOR CALCULUS AND INTEGRAL TRANSFORMS)

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

COURSE OBJECTIVES

The goal of this course for the students is to
- To familiarize the concept of vector differential operator and its applications.
- To make the students to understand the concept of periodic function and represent them in Fourier series.
- To introduce the concept of Fourier transform techniques.
- To provide knowledge about the Laplace transform and their properties.
- To afford different techniques of finding inverse Laplace transform, which are useful in solving problems in basic engineering sciences.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Make use of concept of vector calculus in appropriate context in engineering fields
- Utilize Fourier series in appropriate context of engineering problems.
- Build the solution of differential equations related to engineering fields with the help of Fourier transforms.
- Infer the knowledge of Laplace transformation techniques to convert time-domain complex systems into simple frequency-domain algebraic equations.
- Apply inverse Laplace transform techniques for solving linear differential equations.
- Apply the basic knowledge of Mathematics in Engineering fields.

UNIT I   12
Vector calculus: Vector differential operator – Gradient, divergence and curl – Identities (Statement only) – Directional derivative – 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   12
Fourier series: Dirichlet's conditions – Odd and even functions – Half range sine and cosine series – Parseval's identity – Harmonic analysis.

UNIT III   **12**

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

UNIT IV   **12**

Laplace transform: Transforms of standard functions – Transform of unit step function – Dirac-Delta function – Properties of Laplace transform – Transforms of derivatives and integrals –Initial and final value theorem – Transforms of periodic functions.

UNIT V   **12**

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

Total: 45+15

SUGGESTED READINGS

1. Ramana B V, Higher Engineering Mathematics, McGraw Hill Education, Twenty Ninth Reprint, 2017.
2. Grewal B S, Higher Engineering Mathematics, Khanna Publishers, Forty Forth Edition, 2017.
3. Kandasamy P, Thilagavathy K and Gunavathy K, Higher Engineering Mathematics, S Chand and Co., First Edition, 2016.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Tenth Edition, 2017.
5. Veerarajan T, Transforms and Partial Differential Equation, McGraw Hill Education, Third Edition, 2016.
6. Manish Goyal and Bali N P, A textbook of Engineering mathematics, Laxmi publications, Eighth edition, 2011.
7. Bali N. P and Manish Goyal, (2011), A Text book of Engineering Mathematics, Eighth Edition, Laxmi Publications Pvt Ltd.
8. Venkataraman, M. K,(2005), Engineering Mathematics, The National Publishing Company, Chennai.
9. Dass, H.K., and Er. Rajnish Verma, (2011), Higher Engineering Mathematics, S. Chand Private Ltd.
10. Glyn James,(2012), Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education

WEBSITES:

1. www.nptel.ac.in/courses/122104017/29
2. www.nptel.ac.in/courses/122107037/24
3. www.nptel.ac.in/courses/122107037/28
4. www.nptel.ac.in/courses/111105035/22
5. www.nptel.ac.in/courses//111105035/24

SEMESTER-II

22BECY202   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

PRE-REQUSITE: Programming Logics and Design

COURSE OBJECTIVES

The goal of this course for the students is to
- To understand the fundamental concepts of cyber crime.
- To explore knowledge on cyber crimes in wireless devices.
- To aware of tools used in the cyber security.
- To familiar with various Indian IT Act in cyber crime and cyber security.
- To enhance the knowledge in handheld devices and digital forensics.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- ExpLain the basics of cyber crime and security
- Describe organizational measures and the Security policies
- Make use of tools and methods used in cyber security.
- Explain the different theoretical and cross-disciplinary approaches in Indian IT Act and in digital devices.
- Demonstrate the impact of cybercrime in digital devices on government, business, individual and society.
- Apply the fundamentals concepts for identifying cyber attacks.

UNIT I   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 Cyber crimes – Categories of Cyber crimes – Criminal plans for attack – Social Engineering – Cyber talking – Cyber cafe and cyber criminals – Botnet – Attack vector – Cloud Computing.

UNIT II   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   **9**

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

UNIT IV   **9**

Cyber Crime and Legal landscape – Indian IT Act – Digital Signature and Indian IT Act – Amendments to the Indian IT Act – Cyber crime 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   **9**

Special tools and techniques –Hand held devices and digital forensics. Cyber security organizational implications: Cost of cyber crimes 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

WEBSITES

1. www.lexology.com/library/
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.itu.int/en/ITU-D/Cybersecurity

22BECY203   **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

The goal of this course for the students is to
- Aware of fundamentals on cyber forensics and usage of cyber forensics tools.
- Familiar with the file systems and challenges in the Linux and mac operating system.
- Explore knowledge on the network and different operating systems on mobile devices.
- Learn various services like FaaS and MaaS.
- Enhance the knowledge on database, email and threats in crypto currency.

COURSE OUTCOMES

- Explain the basic of Forensics investigation process.
- Explain Linux forensics and file systems and the challenges in various devices.
- Apply a solid foundation grounding in networks, operating systems, hardware and mobile devices to digital investigation and network resources from unauthorized activities.
- Experiment with cloud forensics data.
- Explain Bit coin forensics.
- Apply different process involved in cyber forensics.

UNIT I   **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   **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   **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   **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   **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. Marjie Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, Third Edition, 2013
2. Albert Marcella J and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence, Wiley Publisher, .First Edition, 2012

WEBSITES

1. www.champlain.edu/computer-forensics
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.cs.nmt.edu/~df/lectures.html

SEMESTER-II

22BECY241   **TECHNICAL ENGLISH** – **II**   **5H-4C**
                                    (Theory & 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
The goal of this course for the students is to
- Make students realize the importance of writing reading and Listening.
- Understand the contexts of grammar and listening accompanied by fine reading skills in Speaking.
- Emphasize speaking in English through activities.
- Develop reading and writing skills through analysis of the facts between paragraphs.
- Enhance students' ability to listen and speak effectively in formal and informal contexts.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Identify the aspects of writing, reading and listening.
- Explain the contents and reproduce the essence of it.
- Make use of English in speaking and listening skills in the social milieu.
- Develop language skills in written and oral communication.
- Relate grammar in reading contexts.
- Recall the rules of writing and speaking in formal and informal assignments.

UNIT I   **9**
Grammar: Prepositions – Adjectives – Adverbs
Reading: Skimming – Scanning.
Writing: Paragraph writing: Compare and Contrast – Cause and Effect
Listening: Types of Listening – Barriers to listening

UNIT II   **9**
Grammar: Tenses – Use of sequence words – Modal Verbs
Reading: Note making – Mind map – Cohesion and Coherence in reading

UNIT III   **9**
Writing: Paragraph writing – Jumbled sentences – Interpreting visual materials
Speaking: Role-play – Group interaction – Speaking in formal Situations
Listening: Listening and responding to video lectures – Listening to specific tasks – Focused Listening – Note taking

UNIT IV   **9**

Grammar: Concord – Use of Imperatives **–** WH Questions – Identifying common errors

Reading: Reading and Making inference – Reading and interpreting visual materials – Critical Reading –Shifting facts from opinions

Writing: Essay writing - Report **–** Proposals – Free writing

UNIT V   **9**

Speaking: Impromptu Speeches – Making presentations on given topics –Responding to questions – Mock interviews

Listening: Watching videos or documentaries and answering – Listening to different accents– Listening to Speeches

                                                           Total: 45

SUGGESTED READINGS

1. Jack C Richards with Jonathan Hull and Susan Proctor, Interchange Student's Book 2, Cambridge University Press, Fourth Edition, 2016.
2. Rajesh K Lidiya, Communication Skills, Oxford University Press, Second Edition, 2017.
3. Meenakshi Raman andSangeeta Sharma, Fundamentals ofTechnicalCommunication, Oxford University Press, First Edition, 2015.
4. Ashraf Rizvi M, Effective TechnicalCommunication, McGraw Hill Education, First Edition, 2013.
5. Russel Whitehead andMicheal Black, Pass Cambridge BEC Vantage (Self Study Practice tests with key), Summertowm Publishing, Second Edition, 2014.
6. University of Cambridge, BEC Vantage 4 (Exam Papers with answers), Cambridge University Press, Second Edition, 2010.

WEBSITES

1. www.nonverbal.com.
2. www.onestopenglish.com.
3. www.eslflow.com.
4. www.myenglishpages.com.
5. www.ielts.net.com.

(ii)   LABORATORY

LIST OF EXPERIMENTS
1. Skimming and Scanning
2. Listening and Responding
3. Listening to different Accents
4. Movie review
5. Group discussion
6. Listening and paraphrasing.
7. Mock interview
8. Listening and note making
9. Presentation
10. Report Writing.

Total: 30

SEMESTER-I

22BECY242   **ENGINEERING PHYSICS**   **7H-5C**
(Theory & Lab.)

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

(i) THEORY

COURSE OBJECTIVES

The goal of this course for students is to
- Familiarize with fundamentals of physics to understand the engineering concepts effectively.
- Inculcate the basics of properties of matter, sound and its applications.
- Understand the basics of laser and optical fiber with appropriate applications.
- Disseminate the fundamentals of thermal physics and their applications.
- Introduce the concepts of quantum mechanics for diverse applications.
- Impart the basic knowledge of crystal and its various crystal structures.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Identify the elastic nature of materials.
- Infer the characteristics of laser and optical fiber for various engineering applications.
- Identify the thermal properties of materials through various methods.
- Develop the idea of quantum mechanics through applications.
- Identify the different atomic arrangements of crystals and its defects.
- Illustrate the basic ideas of engineering physics for various applications.

UNIT I – PROPERTIES OF MATTER AND SOUND   9

Elasticity – basic definitions, stress - strain diagram - factors affecting elastic modulus and tensile strength – Poisson's ratio – Twisting couple - Torsion pendulum- bending of beams – bending moment – young's modulus – cantilever method, uniform and non-uniform bending – I- shaped girders. Loudness, decibel, echo, reverberation, Sabine's formula, Ultrasonic – Production, Industrial and medical applications.

UNIT II – LIGHT, LASER AND FIBER OPTICS   9

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

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

UNIT III – THERMAL PHYSICS   9

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

UNIT IV – QUANTUM PHYSICS   9

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

UNIT V – CRYSTAL PHYSICS   9

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

Total : 45

SUGGESTED READINGS

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

JOURNALS

1. Nature Physics
2. Journal of Applied Mechanics (ASME)
3. Ultrasonics and sonochemistry (Elsevier)
4. Journal of Light wave Technology (IEEE)
5. Optics and Laser Technology (Elsevier)

WEBSITES

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

(ii)   LABORATORY

LIST OF EXPERIMENTS –(Any 10 Experiments)

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

Total: 60

SEMESTER-II

22BECY243   OBJECT ORIENTED PROGRAMMING WITH PYTHON   5H-4C
(Theory & 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

The goal of this course for the students is to

- Learn about basic python language syntax and semantics, control structures and datastructures in python.
- Be comfortable using the built-in functions and creating user-defined functions in python.
- Understand the object-oriented programming concepts in python.
- Gain knowledge in identifying relationships among classes in python.
- Learn how to handle exception and files in python.

COURSE OUTCOMES

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

- Define and explain the fundamental concepts of python programming.
- Explain about diferrent types of functions in Python.
- Apply the knowledge of python programming concepts and to know about OOPs concepts.
- Apply OOPs concepts to solve engineering probems.
- Explain about file concepts.
- Develop solution using object-oriented concepts in python for a given problem statement.

UNIT I   9
Python Basics: Introduction to Python – Data types – Keywords – Expressions – Comments – Operators – Command line arguments – Control Statements – Break, Continue and Pass statement. Python Data Structures: 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 II   9
Functions: Python built-in functions – User defined functions – Creating function – Calling functions – Types of function arguments – Recursion and lambda or anonymous functions. Packages: Defining, Creating and Accessing a Package, importing packages and user defined modules.

UNIT III   9
OOPS: Elements of OOP-Class, Object, Inheritance, Data 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 IV   9

Inheritance: Implementing inheritance – Types of inheritance. Polymorphism: Implementing polymorphism – Method overloading – Method overriding – Operator overloading. Abstraction: Abstract classes – Association and aggregation.

UNIT V   9

Exception handling: Errors vs exceptions – Handling exceptions – Raising exception – Creating user defined exception-Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position

Total: 45

TEXT BOOKS

1. Allen B Downey, Think Python: How to Think Like a Computer Scientist, O'Reilly, Second Edition, 2016.
2. Guido van Rossum and Fred L Drake Jr, An Introduction to Python Revised and updated for Python 3.2, Network Theory Ltd., First Edition, 2011.
3. Dusty Phillips, Python 3 Object-oriented Programming, Packt Publishing, Third Edition, 2018.

REFERENCE BOOKS

1. Mark Lutz, Learning Python, O'Reilly Media, Fifth Edition 2013.
2. Mark Summerfield, Programming in Python 3, Dorling Kindersley India Pvt. Ltd., First Edition, 2009.

WEBSITES

1. www.docs.python.org/3.5/
2. www.programiz.com/python-programming
3. www.pythonspot.com/
4. www.learnpython.org/
5. www.developers.google.com/edu/python/

(ii) LABORATORY

LIST OF EXPERIMENTS

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

Total: 30

SEMESTER-III

22BECY301A   **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

The goal of this course for the students is to

- Understand the basic concepts of set theory.
- Extend student's logical and mathematical maturity and ability to deal with abstraction.
- Understand the concepts and significance of lattices and Boolean algebra which arewidely used in computer science and Engineering.
- Familiarize the applications of algebraic structures.
- Understand the basic concepts of graph theory.

COURSE OUTCOMES

Upon Completion of this course the students will be able to

- Create awareness of the class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Apply a given logic sentence express it in terms of predicates, quantifiers, and logical connectives.
- Evaluate Boolean functions and simplify expressions using the properties ofBoolean algebra.
- Expose to concepts and properties of algebraic structures such as groups, ringsand fields.
- Develop the given problem as graph networks and solve with techniques of graph theory.
- Apply logical reasoning to solve a variety of problems.

UNIT I - SETS, RELATION AND FUNCTION   9

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

UNIT II -LOGIC AND PROOFS   9

Basic connectives and truth tables – Tautologies – Logical equivalence and Implications – Propositional logic and First order Logic – Laws of logic – Rules of inference – The Predicate calculus – The Statement Function, Variables and Quantifiers – Predicate Formulas– Free and Bound Variables – Introduction to proofs.

UNIT III-LATTICES AND BOOLEAN ALGEBRA   9

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

UNIT IV–ALGEBRAIC STRUCTURES   9

Algebraic systems-Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and co-sets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V - GRAPHS   9

Graphs and graph models – Graph terminology and special types of graphs–Matrix representation of graphs and graph isomorphism– Connectivity – Euler and Hamilton paths.

Total : 45

TEXT BOOKS

1. K. H. Rosen, Discrete Mathematics and its Applications, 7th Edition, Tata McGraw-Hill,Pub. Co. Ltd., New Delhi, Special Indian Edition, 2016.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications toComputer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 38th Reprint, 2011.

REFERENCES

1. N. Deo, Graph Theory, Prentice Hall of India,1974. 8. R. C. Penner, DiscreteMathematics: Proof Techniques and Mathematical Structures, World Scientific,1999.
2. Richard Johnsonbaugh, "Discrete Mathematics", 6th Edition, Pearson Education, 2011.
3. B.Kolman, R.C.Busby and S.C.Ross, "Discrete Mathematical structures", 6th Edition,PHI, 2010.
4. Swapan Kumar Sarkar, A text book of Discrete Mathematics, S.Chand&Co.Ltd, 2018.

WEBSITES

1. www.dmtcs.org/dmtcs-ojs/index.php/dmtcs
2. www. mathworld.wolfram.com
3. www.nptel.com
4. www.math.berkeley.edu
5. www.mathvault.ca

| **22BECY301B** | **NUMERICAL METHODS** | **4H-4C** |

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to
- Inculcate the basic concepts of solving algebraic and transcendental equations.
- Understand the numerical techniques of interpolation in various intervals
- Provide the knowledge of numerical differentiation and integration
- Provide the knowledge of solving ordinary differential equations numerically
- Inculcate various techniques of solving partial differential equations numerically.

COURSE OUTCOMES

Upon completion of this course, the student will be able to
- Solve the systems of linear and nonlinear equations by iterative methods.
- Apply different methods to calculate the value of interpolating polynomial at given point.
- Apply the numerical techniques of differentiation and integration for engineering problems.
- Interpret solutions of ODE using computational methods .
- Make use of the appropriate numerical methods to study phenomena modeled as PDEs.

UNIT I SOLUTION OF EQUATIONS   12

Regula 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 : 45+15

TEXT BOOKS
1. Steven C.Chapra and Raymond P.Canale," Numerical Methods for Engineers", McGraw Hill Education, Seventh Edition,2015.
2. 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

WEBSITES
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

22BECY301C   **NUMERICAL LINEAR ALGEBRA**   **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Import the knowledge of solving system of algebraic equations.
- Provide the concept of Algebraic Structures such as Groups, Ring, Field and Vector spaces.
- Inculcate various spaces namely Null space, Row space, Column space and Range space and its matrix representations.
- Apply the concept of inner product spaces in orthogonalization.
- To afford the adequate knowledge of least square approximation, Singular Value Decomposition and Principal Component Analysis.

COURSE OUTCOMES

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

- Apply numerical methods to obtain approximate solutions to linear equations using direct and indirect methods
- Explain the concepts of vector spaces, subspaces and their properties.
- Relate between a linear transformation and its matrix representation
- Explain the inner product spaces, norms and gram Schmidt orthogonalization process.
- Apply the concept of least square approximation, Singular Value Decomposition and Principal Component Analysis in order to solve engineering problems.

UNIT - I NUMERICAL SOLUTION OF SYSTEM OF ALGEBRAIC EQUATION   12

Solving system of equations – Direct methods: Gauss Elimination and Gauss Jordan Methods –Inverses of Matrix by Gauss Jordan method – LU Factorizations – Iterative method: Gauss Seidel method – Power method for finding Eigen values.

UNIT - II VECTOR SPACES   12

Algebraic Structures – Binary Operation – Semi Group, Monoid and Group – Subgroups – Rings and Fields (Concept only) – Vector Spaces – Subspaces – Linear Span – Linear Independence and dependence of vectors - Basis and Dimension.

UNIT – III LINEAR TRANSFORMATION   12

Linear Transformation – Properties of Linear Transformation –– Null Space and Nullity of a matrix –
Rank-Nullity theorem – Range Space – Dimension Theorem – Matrix Representation of Linear
Transformation

UNIT - IV INNER PRODUCT SPACE   12

Inner Products and Norms – Inner Product Spaces – Cauchy-Schwartz inequality – Orthogonal

Projection –Projection Theorem -Orthogonal Vectors – Gram- Schmidt Orthogonalization Process –

Orthogonal Complement

UNIT - V POSITIVE DEFINITE MATRICES   12

Least Square Approximations – Tests for positive definite, semi definite and indefinite matrices –
Positive Definite Matrices – Singular value Decomposition (SVD) – Principal Component Analysis
(PCA).

Total: 45+15

TEXT BOOKS

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence," Linear Algebra", Pearson
   Education, Fifth Edition,2018
2. Gilbert Strang," Linear Algebra and Learning from Data", Cambridge University Press, First
   Edition.2019

REFERENCE BOOKS

1. Sheldon Axler," Linear Algebra Done Right", Springer Cham, Third Edition,,2016
2. Kenneth Hoffman, Ray Kunze," Linear Algebra", Springer Cham, Third Edition,2018.
3. Williams, G," Linear Algebra with Applications", Jones & Bartlett Learning, First Indian Edition,
   New Delhi.,2019.
4. Gene H. Golub, Charles F. Van Loan," Matrix Computations", The Johns Hopkins University
   Press, Fourth Edition,2013

WEBSITES

1. https://nptel.ac.in/courses/122106033
2. https://nptel.ac.in/courses/127106019
3. https://nptel.ac.in/courses/111105112
4. https://nptel.ac.in/courses/111105111
5. https://nptel.ac.in/courses/111101115
6. https://onlinecourses.nptel.ac.in/noc21_ma38/course

22BECY302   **COMPUTER ARCHITECTURE**   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                 End Semester Exam:3 Hours

COURSE OBJECTIVES

The Goal of this course for the students is to
- Understand the basic principles and organization of computer architecture.
- Impart knowledge of Instruction Level Architecture and Instruction Execution.
- Illustrate how I/O devices are accessed.
- Provide the knowledge on Instruction Level Parallelism.
- Analyze the knowledge on micro programming and advanced pipelining techniques.

COURSE OUTCOMES

Upon completion of this course the student will be able to
- D e s c r i b e the function at the Register Transfer Level (RTL) and addressing modes supported by a CPU's instruction set.
- Compare the strengths and weaknesses of hardwired and microprogrammed design approach.
- Identify different types of peripheral devices and their interactions with the CPU and memory.
- Explain the benefits of pipelining in terms of improved instruction throughput and performance.
- Summarize control flow mechanisms within micro-program sequencer.

UNIT I INTRODUCTION   9

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

UNIT II INTRODUCTION TO X86 ARCHITECTURE **9**

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.Memory system design: semiconductor memory technologies, memory organization.

UNIT III PERIPHERAL DEVICES AND THEIR CHARACTERISTICS **9**

Peripheral devices, Interfaces, Modes of I/O Data Transfer, Accessing I/O Devices, Computer Architecture: I/O Processor- Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access.

UNIT IV PIPELINING **9**

Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel   Processors: Introduction to   parallel   processors, Concurrent access to memory and cache coherency. Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache   size   vs. block   size, mapping   functions, replacement algorithms, write policies.

UNIT V CONTROL LOGIC DESIGN **9**

Control organization – design of hardwired control –control of processor unit –PLA control. Micro-programmed control: Microinstructions –horizontal and vertical micro instructions – micro-program sequencer –micro programmed CPU organization.

Total :45

TEXT BOOKS

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2016.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Eeventh   Edition, Pearson Education, 2018.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.

3. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

WEBSITES

1. https://nptel.ac.in/courses/106103068/
2. https://www.javatpoint.com/computer-organization-and-architecture-tutorial

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

The Goal of this course for the students is to
- Understand the basic concepts of Database Management Systems.
- Learn about the Structured Query Language (SQL) and familiar with subqueries.
- Illustrate the knowledge in control transactions.
- Enhance knowledge in normalization and system privileges.
- Adopt indexing techniques in physical DB design

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Illustrate basic concepts of Database Management Systems.
- Implement Single row and group functions.
- Describe Structured Query Language (SQL) with subqueries to an application.
- Make use of control transactions and maintain consistency of the database.
- Categorize normalization and apply system privileges to a real time application scenario.

UNIT I INTRODUCTION TO DBMS, KEYS AND ER DIAGRAM   **9**

Introduction of DBMS orientation - Data - Information - Knowledge - Need for DBMS - Database VsFile system - Keys and its importance. Data models - ER Diagram - Cardinality of Relationships - Limit the rows that are retrieved by a query -Sorting rows-Substitution variables - Use the SQL row limiting-Pattern matching.

UNIT II - FUNCTIONS AND JOINS   **9**

Single row functions - Character - Number - Date - Conversion - General. Group functions-HAVING class. Joins - Equijoins and non-equi joins - self-join -Outer joins - Generate a Cartesian product.

UNIT III - SUBQUERIES AND SET OPERATORS   9

Subqueries - Single-row and multiple-row subqueries - Subqueries in SELECT, FROM and WHERE clauses. Set operators - UNION, UNION ALL , INTERSECT AND MINUS.

UNIT IV - SCHEMA OBJECT CREATION   9

DML DDL-TCL - Control transactions - Data types - Constraints - Schema objects-Create View, Index -Sequences - Synonyms - Data dictionary views-Grant-Revoke privileges.

UNIT V - DATABASE CONCEPTS AND NORMALIZATION   9

ACID Properties - Transaction Processing - Recovery Technique - Serializability-Concurrency Control -Lock-Normalization- Functional Dependency- INF, 2 NF, 3 NF. BOYCE CODD and 4NF. PLSQL -Cursor and Trigger.

Total :45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Design an ER diagram for a sample database and implement it in SQL.
2. Use SQL statements to retrieve, restrict and sort data.
3. Practice using various single-row functions in SQL.
4. Perform different types of joins (equijoin, non-equijoin, self-join, outer join) on sample
5. tables.
6. Experiment with group functions and HAVING clauses.
7. Create and use single-row and multiple-row subqueries in SQL.
8. Use set operators (UNION, UNION ALL, INTERSECT, MINUS) in SQL.
9. Practice creating and modifying schema objects in SQL, including views, indices,
10. sequences, and synonyms.
11. Application Development-I.
12. Application Development-II.

Total : 30

TEXT BOOKS

1. Abraham Silberschatz,Henry F. Korth, S.Sudarshan, "Database System Concepts",McGraw-Hill Education, 2020
2. Ramez Elmasri, Sham Navathe," Fundamentals of Database Systems", Pearson,2016.

REFERENCES BOOKS

1. Renée m. p. teate," SQL for Data Scientists:A Beginner Guide for Building Datasets for Analysis, Wiley,2021.
2. Raghu Ramakrishnan,,Johannes Gehrke," Database Management Systems", McGraw-Hill Education,2014.

WEBSITES

1. www.oracle.com
2. www.microsoft.com/sql
3. www.nptel.ac.in/courses/106106093/
4. www.udemy.com/sql-and-rdbms/
5. www.infytq.infosys.com

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:

The goal of this course is for the students is to

- 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 implementd sorting, searching and hashing algorithms.
- To apply Tree and Graph structures to real world scenario.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Implement abstract data types for linked list data structure.
- Interpret the concepts of stack, queue and its applications.
- Experiment with operations on binary trees.
- Demonstrate the representation and traversal techniques of graphs and their applications.
- Apply Algorithm for solving problems like sorting, searching and hashing deletion of data.

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

(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

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", CareerMonk 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

WEBSITES

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

SEMESTER-III

22BECY342B   **DESIGN AND ANALYSIS OF ALGORITHMS**   **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

The goal of this course for the students is to
- Understand and apply the algorithm analysis techniques on searching and sorting algorithms.
- Illustrate different algorithm design techniques.
- Critically analyze the efficiency of graph algorithms.
- Solve programming problems using state space tree.
- Examine NP Completeness, Approximation algorithms and randomized algorithms

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Solve the basic problems with asymptotic notations.
- Discuss graph traversal and its applications.
- Apply divide and conquer strategy to sort elements.
- Make use of backtracking strategy in solving real time problems.
- Implement randomized algorithms and its applications.

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

(ii)   LABORATORY

LIST OF EXPERIMENTS

1. Implement Linear Search and Binary Search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
3. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4. Develop a program to implement graph traversal using Breadth First Search and Depth First Search
5. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.

10. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.

11. Implement N Queens problem using Backtracking. Approximation Algorithms Randomized Algorithms

12. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

Total :30

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", CareerMonk 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

WEBSITES

1. www.nptel.ac.in/courses/106105164
2. www.nptel.ac.in/courses/106106131
3. www.coursera.org/specializations/algorithms
4. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
5. www.cs.usfca.edu/~galles/visualization/Algorithms.html

22BECY343A   **JAVA PROGRAMMING**   **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Object Oriented Programming with Python, Data Structures and Algorithms

(i)THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to

- Learn the fundamental concepts of Java programming.
- Gain knowledge of inheritance in Java.
- Understand the concepts of abstraction, exception and packages in Java.
- Infer Java Collection API and Multithreading plugins.
- Implement JDBC and Lambda expression in Java.

COURSE OUTCOMES

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

- Solve basic problems using basic object-oriented programmingconcepts.
- Develop Java programs using inheritance.
- Buid Java programs using interface and package to solve a complex probems.
- Illustrate Collection API for given problem statement and Multithreading.
- Implement an application using JDBC Connections for Java Programming.

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 - StringBuffer class - StringBuilder 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 - Multithreading:Introduction to Multithreading - 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

(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

TEXT BOOKS

1. Herbert Schildt, "Java2: The Complete Reference", Tata McGraw- Hill,Twelth 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.

REFERENCES 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.

WEBSITES

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
5. http://www.javapoint.com/java-8-method-reference

22BECY343B   **OBJECT ORIENTED PROGRAMMING**   **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Fundamental of Computers

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to
- Familiar with programming paradigms.
- Understand classes and objects.
- Understand realization of constructor and destructor.
- Know about inheritance and polymorphism concepts.
- Provide knowledge about pointers and exception handling.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Illustrate the fundamental concepts of object oriented programming.
- Apply the knowledge of programming concepts to optimize basic applications.
- Analyze object oriented programming concepts and use function overloading effectively.
- Develop programs using inheritance to solve simple problems.
- Summarize dynamic memory allocation and allocate and deallocate memory dynamically using operators..

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

(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

TEXT BOOKS

1. Balagurusamy E," Object Oriented Programming with C++", Tata McGraw Hill, Sixth Edition, 2013.

2. YashavantKanetkar," Let us C++", BPB publications, Second Edition, 2017.

REFERENCES BOOKS

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

WEBSITES

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

SEMESTER-IV

22BECY401A   **STATISTICS AND OPTIMIZATIONS 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

The goal of this course For students is to

- Understand the concept of statistical tools and apply in engineering.
- Understand various statistical techniques from both applied and theoretical points of view.
- Provide the concept of linear programming problem and its various solution procedures.
- Impart the knowledge of transportation and assignment models.
- Afford the adequate knowledge on networking models and game theory.

COURSE OUTCOMES

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

- Find measures of central tendency and measures of dispersion.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Solve linear programming models by various methods like Graphical method, simplex method and Dual simples method, given a basic feasible point.

- Interpret solutions by solving transportation and assignment problems.
- Solve two person zero sum games with and without saddle point

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 - Algebric 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 2xn and mx2 games.

Total: 45+15

TEXT BOOKS

1. Robert V. Hogg,Joseph W. McKeanand 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," John E Freund's Mathematical Statistics with Applications", Elsevier,
3. Fourth Edition,2014
4. Frederick S.Hillier Gerald J.Lieberman Bodhibrata Nag Preetam Basu," Introduction to Operations Research", Tata McGraw-Hill Education Private Limited,
5. Tenth Edition,2017
6. Ronald L Rardin," Optimization in Operations Research", Pearson,
7. Second edition,2016
8. Ravindran Phillips Solberg.","" Operations Research – Principles and Practice", Wiley, Second edition,2007

WEBSITES

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

22BECY401B   **PROBABILITY AND STATISTICS**   **4H-4C**

Instruction Hours/week: L:3 T:1 P0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Apply the statistical tools inEngineering problems.
- Introduce the basic concepts of probability and random variables.
- Introduce the basic concepts of two-dimensional random variables.
- Acquaint the knowledge of testing of hypothesis for small and large samples whichplays an important role in real life problems.
- Introduce the basic concepts of classifications of design of experiments which playsvery important roles in the field of agriculture and statistical quality control.

COURSE OUTCOMES

Upon Completion of this course the students will be able to

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

UNIT I   PROBABILITY AND RANDOM VARIABLES   12

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

UNIT II   TWO - DIMENSIONAL RANDOM VARIABLES   12

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

UNIT III   TESTING OF HYPOTHESIS   `   12

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

UNIT IV DESIGN OF EXPERIMENTS   12

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

UNIT V STATISTICAL QUALITY CONTROL   12

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

Total : 60

TEXT BOOKS

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics forEngineers", Pearson Education, Asia, 8th Edition, 2018.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGrawHill, 4th Edition, 2019.

REFERENCES

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, CengageLearning, New Delhi, 8th Edition, 2018.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and StochasticProcesses", McGraw Hill Education India, 4th Edition, New Delhi, 2010.

WEBSITES:

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

22BECY402   **CRYPTOGRAPHY AND CYBER SECURITY**   **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.
- Comprehend the various types of data integrity and authentication schemes
- Understand cyber crimes and cyber security.

COURSE OUTCOMES

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

- Describe the substitution and transposition techniques used in traditional encryption.
- Apply the cryptographic operations of symmetric cryptographic algorithms
- Apply the cryptographic operations of public key cryptography
- Apply the various Authentication schemes to simulate different applications.
- Discuss various cyber crimes and cyber security.

UNIT I INTRODUCTION TO SECURITY   9

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis

UNIT II SYMMETRIC CIPHERS   9

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY   9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm.
ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS   9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

UNIT V CYBER CRIMES AND CYBER SECURITY   9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

Total: 45

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh
   Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.

REFERENCE BOOKS

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2. https://www.geeksforgeeks.org/cryptography-and-network-security-principles/
3. https://www.tutorialspoint.com/data_communication_computer_network/computer_network_security.html
4. https://www.techtarget.com/searchnetworking/definition/network-security

22BECY441 **OPERATING SYSTEMS** **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

The goal of this course for the students is to
- Learn the basic concepts of operating systems.
- Understand the concepts of scheduling techniques.
- Infer different memory management techniques.
- Fmiliarize with the important mechanisms in file systems.
- Appreciate the emerging trends in memory management and networking.

COURSE OUTCOMES

Upon Completion of this course the students will be able to
- Outline the basic services and functionalities of operating systems.
- Analyse scheduling algorithms and deadlock, prevention and avoidance schemes
- Identify operating system-specific memory management techniques.
- Determine the functionality of file systems.
- Compare and contrast Linux, Windows operating systems

UNIT I OPERATING SYSTEM OVERVIEW 9

Operating system structure – Operations – Process – Memory – Storage management – Protection and security – Distributed systems – Computing Environments – Open source operating systems – OS services – User operating system interface – System calls – Types – System programs – OS structure – OS generation –System boot – Process concept – Scheduling – Operations on processes – Cooperating processes – Inter process communication – Examples – Multithreading models – Thread libraries – Threading issues – OS examples.

UNIT II SCHEDULING AND DEADLOCK 9

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Operating system examples – Algorithm evaluation – The critical section problem – Peterson's solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock

UNIT III MEMORY MANAGEMENT 9

Memory management – Swapping – Contiguous memory allocation – Paging – Segmentation – Example: The Intel Pentium – Virtual memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing**.**

UNIT IV   FILE SYSTEMS 9

File concept – Access methods – Directory structure – File system mounting – Protection – Directory implementation – Allocation methods – Free space management – Disk scheduling – Disk management– Swap space management – Protection.

UNIT V   THE LINUX AND WINDOWS SYSTEM 9

The Linux system – History – Design principles – Kernel modules – Process management – Scheduling – Memory management – File systems – Input and output – Inter process communication – Network structure – Security – Windows 7 – History – Design principles – System components – Terminal services and fast user – File system – Networking.

Total:45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Basic UNIX commands.
2. Shell Programming.
3. File system related system calls. (Learn to create, open, read, write, seek into, close files;open,read, write, search, close directories).
4. Process management –Fork, Exec (Learn to create a new process and to overlay anexecutablebinary image on an existing process).
5. Inter–process communication between related processes using pipes.
6. Inter–process communication among unrelated processes using message queues.
7. CPU scheduling algorithms.
8. Contiguous memory allocation strategies –best fit, first fit and worst fit strategies.
9. Page replacement algorithms.

Total: 30

TEXT BOOK

1. Abraham Silberschatz, Peter B Galvin andGreg Gagne, Operating System Concepts Essentials, John Wiley and Sons,Ninth Edition, 2012

REFERNCES BOOKS

1. Andrew S Tanenbaum, Modern Operating Systems, Pearson Education, Fourth Edition, 2015
2. Dhamdhere D M, Operating Systems: A Concept–basedApproach, McGraw–Hill, Second Edition, 2012
3. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall, Seventh Edition, 2011

WEBSITES

1. www.os–book.com/
2. www.williamstallings.com/OperatingSystems/
3. www.cs.hmc.edu/~keller/courses/cs156/s98/
4. www.nptel.ac.in/courses/106108101/2

22BECY442A   **WEB APPLICATION DEVELOPMENT**   **5H-4C**

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

End Semester Exam:3 Hours

Pre requisites: Java Programming

i)THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to

- Understand the concepts of Servlet API.
- Gain knowledge of JSP and its tags.
- Illustrate the concepts of Hibernate for interacting with database.
- Understand Spring container, Modules, Dependency Injection and aspect-oriented programming.
- Understand how to design and develop application using Spring Boot

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Apply web-based applications using Servlet
- Develop JSP based User Interface for web applications
- Illustrate the concept of ORM in web applications.
- Build the web-based applications using effective data base access with Spring MVC
- Explain the concept of Spring Boot profiles and application configuration for different environments.

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 ServletContext and ServletConfig Object, Attributes in Servelt, Response and Redirection using Request Dispacher, sendRedirect Method, Session Tracking: using Cookies, HTTPSession 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

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Developing web application using Servlets
2. Design an application using Servlet and JDBC
3. Developing application using JSP.
4. Design an application using JSP and JDBC
5. Developing application using Hibernate Annotations
6. Developing application using Hibernate Collection Mapping
7. Developing application using Association Mapping in Hibernate.
8. Developing application using spring MVC.
9. Developing application using Spring MVC with database
10. Building application using Maven and Gradle
11. Developing application using Spring Boot
12. Developing application using Spring Boot application with JPA Repositories

TEXT BOOKS

1. "J2EE: The complete Reference", Jim Keogh, McGraw-Hill, 2017.
2. "Spring and Hibernate (2nd 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 Kurniwan, 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.

WEBSITES

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/

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

The goal of this course is for the students is to
- Identify the key components of no-code development and explain their applications.
- Demonstrate the ability to use various no-code platforms and tools to create and publish applications.
- Analyze data using machine learning tools and present results in a meaningful way.
- Create voice applications and bots that integrate with external services to enhance functionality.
- Develop basic UI/UX design skills to create and design effective and aesthetically pleasing applications.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Build a fundamental understanding of no-code tools and their applications in web scraping
- Analyze no-code platforms such as Zapier, Voice Flow, and Figma to create and publish applications.
- Outline how to scrape data from websites, access and manipulate data using APIs, and analyze data using machine learning tools.
- Experiment with the voice applications and bots, including integrating external services such as Giphy and Twitter.
- Apply basic UI/UX design skills, including the ability to create and design forms, profile images, proportions, and overall project layout.

UNIT I – WEB SCRAPING AND API PARABOLA WITH NO CODE   9

No-Code Stacks_No-Code Fundamentals. Web Scraping : Scrape Data From Websites_ 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_Initialsetup_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_Filesetup_Placing Images_ Add logo to the Frame_ Body copy_ Building Forms_ Profile Image_ Proportions_ Project.

Total : 45

(i)   LABORATORY

LIST OF EXPERIMENTS

1. Installation of Knime framework in windows operating system.
2. Implement a Knime workflow or architecture to clean a dataset to preprocess the data.
3. Implement a Knime workflow to narrate instances of confusion matrix, accuracy, precision, sensitivity, specificity
4. Implement a Knime workflow or architecture to execute KNN framework on any medical realtime dataset.
5. Implement a Knime workflow or architecture to execute Decision Tree framework on any online shopping dataset.
6. Implement a Knime workflow or architecture to execute Random Forest framework on any realtime dataset.

7. Implement a Knime workflow or architecture to execute SVM framework on any realtime dataset Simulation of patient flows in hospitals to optimize resource allocation and reduce waiting times.
8. Simulation capabilities to model and spread of information or influence within the network.
9. Eliminate Stop words that do not carry significant meaning in a given language (e.g., "the," "is," "and").
10. Sentiment analysis techniques to analyze player sentiment and feedback.
11. Train regression model and evaluate its performance using various metrics for traffic flow and transportation systems.
12. Simulate virtual experiments for designing and evaluating smart city technologies and initiatives.

Total : 30

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.

REFERENCES BOOKS

1. Mittal Akhil," Getting Started with Chatbots", 2019.
2. Fabio staiano," Designing and Prototyping Interfaces with Figma", 2022.

WEBSITES

1. https://www.udemy.com/course/no-code-developer/
2. https://www.nocode.tech/academ

22BECY443A   **ADVANCED ALGORITHMS**   **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Data Structures and Design Analysis of Algorithms

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to
- learn programming and mathematical backgrounds for design and analysis of algorithm.
- Study the concept of designing an algorithm.
- Have a complete understanding of the various advanced data structures.
- Implement advanced algorithms using appropriate design techniques.
- Inculcate advanced graph algorithms and applications.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Apply Euclid's extended algorithm used in areas of mathematics and computer science.
- Illustrate heavy light decomposition technique to solve the given problems.
- Compare Backtracking and Branch and bound techniques.
- Illustrate Eulerian and Hamiltonian paths in graphs
- Outline Searching and pattern matching algorithms.

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 AGORITHMS   **9**

Probability – Modular multiplicative inverse – Matrix exponentiation –Millerrabin 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

(ii)   LABORATORY

LIST OF EXPERIMENTS:

1. Programs to solve problems using STL.
2. Programs to solve geometric problems.
3. Programs on Convex-Hull optimization.
4. Programs on dynamic programming.
5. Programs involves backtracking methods.
6. Programs involve segment tree.
7. Implementation of k-d Tree.
8. Implementation of finding lowest common ancestors.
9. Program on detecting cycle in a graph.
10. Programs involve topological sorting.
11. Implementation of graph coloring.
12. Implementation of pattern matching algorithms.

Total : 30

TEXT BOOKS

1. CormenTH, 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

REFERENCES 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

WEBSITES

1. www.cpbook.net/methodstosolve
2. www.codechef.com/certification/prepare#foundation
3. www.people.cs.clemson.edu/~bcdean/dp_practice/
4. www.infoarena.ro/blog/meet-in-the-middle
5. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advancedalgorithms-fall-2005/

22BECY443B   **DESIGN AND ANALYSIS OF ALGORITHMS**   **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Data Structures and Algorithms

(iii)   **THEORY**

COURSE OBJECTIVES

The goal of this course for the students is to
- 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

Upon completion of this course the students will be able to
- Solve the basic problems with asymptotic notations.
- Discuss graph traversal and its applications.
- Apply divide and conquer strategy to sort elements.
- Make use of backtracking strategy in solving real time problems.
- Implement randomized algorithms and its applications.

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", CareerMonk 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

WEBSITES:

1. www.nptel.ac.in/courses/106105164
2. www.nptel.ac.in/courses/106106131
3. www.coursera.org/specializations/algorithms
4. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
5. www.cs.usfca.edu/~galles/visualization/Algorithms.html

(iv) LABORATORY

LIST OF EXPERIMENTS:

1. Implement Linear Search and Binary Search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
3. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4. Develop a program to implement graph traversal using Breadth First Search and Depth First Search
5. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
10. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
11. Implement N Queens problem using Backtracking. Approximation Algorithms Randomized Algorithms
12. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

Total :30

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students is

- To develop a formal notation for strings, languages and machines.
- To understand finite automata concepts and to design finite automata to accept a set of strings of a language.
- To Understand and apply context free grammars to generate strings.
- To identify the hierarchy of formal languages, grammars and machines.
- To analyze Turing machines and their capability
- To Distinguish between computability and non-computability and Decidability and Undesirability.

COURSE OUTCOMES

Upon completion of the course the student will be able to

- Identify the concept of abstract machines and their power to recognize the languages.
- Build finite state machines for modeling and solving computing problems.
- Apply concepts of context free grammars to resolve the real-time problems.
- Distinguish between decidability and undecidability of various problems.
- Build Turing machine concept to solve the simple problems.

UNIT I   INTRODUCTION TO FINITE AUTOMATA   9

Introduction to Finite Automata:Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata:Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.Deterministic Finite Automata:Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA, Moore and Melay machines

UNIT II   REGULAR EXPRESSIONS   9

Regular Expressions:Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular expressions. Pumping Lemma for Regular Languages,Statement of the pumping lemma,

Applications of the Pumping Lemma. Closure Properties of Regular Languages:Closure properties of Regular languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT III   CONTEXT-FREE GRAMMARS   9

Context-Free Grammars:Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.Push Down Automata:Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state, Acceptance by empty stack, Deterministic Pushdown Automata. From CFG to PDA, From PDA to CFG.

UNIT IV   NORMAL FORMS FOR CONTEXT- FREE GRAMMARS   9

Normal Forms for Context- Free Grammars:Eliminating useless symbols, Eliminating €-Productions. Chomsky Normal form Griebech Normal form. Pumping Lemma for Context-Free Languages:Statement of pumping lemma, Applications Closure Properties of Context-Free anguages:Closure properties of CFL's, Decision Properties of CFL's

UNIT V   TURING MACHINE   9

Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine.Types of Turing machine:Turing machines and halting Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Modified Post Correspondence problem, Other Undecidable Problems, Counter machines..

Total : 45

TEXT BOOKS

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education, 2008.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI, 2008.

REFERENCE BOOKS

1. Introduction to Languages and The Theory of Computation, John C Martin, TMH,2006.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press,2011
4. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning,2013

5. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson,2009.

WEBSITES

1.https://math.mit.edu/~sipser/book.html
2.http://cse.iitkgp.ac.in/~abhij/course/theory/FLAT/Spring20
3.https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf

SEMESTER-V

22BECY502   **INFORMATION SECURITY**   **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students :
- To understand the basic concepts of information security.
- To gain knowledge in risk management.
- To be aware of policy standards and practices.
- To analyze different security technologies and security tools
- To learn about intellectual property rights and patents

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Analyze security model ,components and need for security.
- Identify the risk associated with security and security planning practices.
- Discuss about Firewall and VPNs.
- Identify Legal, Ethical and Professional issues in information security.
- Outline procedural knowledge to legal system and solving the problem relating to intellectual property rights.

UNIT I INTRODUCTION   9

Introduction to information security: History – Security model – Components of an information system – Balancing information security access – Approaches – The system development life cycle – The security systems development life cycle – Security professionals and the organization – Communities of internet – The need for security

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UNIT II RISK MANAGEMENT   9

Risk management: Introduction – Risk identification – Assessment – Control strategies – Selecting a risk control strategy – Management – Planning for security: Information security planning and governance – Policy, standards and practices – Blueprint – Education, training and awareness – Continuity strategies –

UNIT III   SECURITY TECHNOLOGY   9

Security Technology: Firewalls and VPNs – Intrusion detection, prevention systems and other security tools: Introduction – IDPS – Honeypots – Honeynets and padded cell systems – Scanning and analysis tools – Biometric access controls.

UNIT IV PROJECT MANAGEMENT   9

Implementing information security: Project management – Technical and non-technical aspects of implementation – Legal, Ethical and Professional issues in information security: Law and ethics – International laws and legal bodies – Ethics and information security – Ethics for IT professional organizations

UNIT V   INTELLECTUAL PROPERTY RIGHTS   9

Intellectual Property Rights: Invention and creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (Movable property – Immovable property – Intellectual property) – IP patents – Copyrights and related rights – Trademarks and rights arising from trademark registration.

Total: 45

TEXT BOOKS

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", ikas Publishing House, New Delhi, Fourth Edition,2011
2. Gangul," Intellectual Property Rights: Unleasing theKnowledge Economy", Tata McGraw-Hill, First Edition,2008

REFERENCE BOOKS

1. Charles P Pfleeger andShari LawrencePfleeger," Security in Computing", Pearson Education, Fourth Edition, 2007
2. Micki Krause and Harold F Tipton," Handbook of Information Security Management", CRC Press, Fourth Edition, 2007
3. Subbaram N R," Handbook of Indian Patent Law and Practice" iswanathan Pvt. Ltd, First Edition, 2007
4. Stuart McClure, Joel Scrambray andGeorge Kurtz," Hacking Exposed", Tata McGraw-Hill, Seventh Edition, 2012

WEBSITES

1. www.garykessler.net/library/crypto.html

2. www.itscolumn.com/2012/03/28-types-of-computer-security-threats-and-risks/

3. www.wipo.int/edocs/mdocs/sme/en/wipo_ip_bak_03/wipo_ip_bak_03_www_34147.pdf

4. www.shareyouressays.com/116688/8-most-important-differences-between-movable-property-and-immovable-property

5. www.lawmart.com/forms/difference.html

SEMESTER-V

22BECY541   **NETWORK ARCHITECTURE AND SECURITY**   **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

The goal of this course is for the students is to

- Outline the fundamental concepts, technologies, and protocols used in computer networks
- Gain knowledge in network design, implementation, and management
- Identify the problems related to network performance and security
- Understand about the principles of data transmission, routing, and switching
- Implement network architecture, including local area networks (LANs), wide area networks (WANs), and internet protocols (IP)

COURSE OUTCOMES

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

- Describe the layered architecture of computer networks and comprehend the functions of each layer.
- Apply error detection techniques in the Data Link Layer of a computer network, to ensure data integrity during transmission.
- Demonstrate knowledge of the features and advantages and the transition mechanisms from IPv4 to IPv6.
- Apply networking concepts and protocols to solve real-world problems.
- Build network security concepts and technologies to develop secure network architectures and protect against common network attacks.

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

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Study of different network devices in detail.
2. Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
3. Study of basic network command and Network configuration commands
4. Implement different LAN topologies using Network Simulator.
5. Implement the concept of VLAN using Network Simulator.
6. Implement the concept of static routing
7. Implement the concept of dynamic routing (RIP, OSPF, BGP).
8. Packet capture and header analysis by wire-shark (TCP,UDP,IP)

SEMESTER-V

22BECY542A   **ADVANCED WEB FRAMEWORKS**   **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Web Application Development

i) THEORY

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the fundamental concepts of Git and JavaScript.
- Gain knowledge of Node.js.
- Understand the concepts of working with MongoDB.
- Gain knowledge of ReactJS.
- Create Restful web Services.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Explain the syntax and semantics of JavaScript
- Apply the knowledge of Node.js concepts for developing applications.
- Develop programs using MongoDB through the JavaScript's Shell.
- Apply the concepts of React.JS to develop applications.
- Experiment with connecting react application to the backend for building applications.

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: 30

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.
3.

REFERENCES 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.

WEBSITES

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/

ii)   LABORATORY

LIST OF EXPERIMENTS

1.   Demonstrate the Git Commands for Version Controlling
2.   Programs using flow control statements, arrays and arrow functions.
3.   Develop simple application using NodeJS.
4.   Develop Rest API with NodeJS.
5.   Develop simple application using MongoDB.
6.   Develop Rest API with NodeJS and MongoDB.
7.   Develop simple application using ReactJS.
8.   Develop simple application using ReactJS Components.
9.   Develop simple application using React Context with styles.
10. Develop Rest API with Axios.
11. Develop Rest API with react-query and SWR.
12. Developing full stack application using ReactJS and MongoDB.

Total: 30

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to
- Understand the fundamentals of business data processing and its significance in modern organizations.
- Gain knowledge of database management systems, including database design principles, relational database concepts, and SQL fundamentals.
- Develop skills in data analysis and visualization techniques for business decision-making and reporting.
- Learn data analysis and visualization techniques.
- Summarize the applications of robotic process automation.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Outline the significance of business data processing in modern organizations and recognize the different types of data (structured, unstructured, and semi-structured).
- Design a relational database and SQL using appropriate principles and normalization technique
- Apply various data analysis and data visualization techniques to support business decision-making.
- Identify the applications of Robotic Process Automation (RPA) in business data processing.
- Implement secure data transmission and storage practices, including user authentication, access control, data backup, and disaster recovery measures.

UNIT I INTRODUCTION TO BUSINESS DATA PROCESSING   9

Introduction - Overview of business data processing - significance in modern organizations - structured - unstructured - and semi-structured data - Data processing lifecycle - data collection - data entry - data storage - data processing - data output - information systems - Ethical and legal considerations.

UNIT II DATABASE MANAGEMENT SYSTEMS 9

Introduction to database management systems - Database design principles - Relational database concepts - tables - relationships - keys - normalization - SQL fundamentals - DDL - DML - Data integrity - Data Security - Privacy

UNIT III DATA ANALYSIS AND VISUALIZATION 9

Introduction - importance in business decision-making - techniques - descriptive - diagnostic - predictive - prescriptive analysis - data visualization tools - techniques - Exploratory data analysis - visualization for business reporting and performance tracking

UNIT IV BUSINESS PROCESS AUTOMATION 9

Introduction to business process automation - Workflow management systems - process modeling - Business process reengineering - process optimization -
Robotic Process Automation (RPA) - its applications in business data processing

UNIT V DATA SECURITY AND PRIVACY IN BUSINESS 9

Overview of data security and privacy concerns - Data protection regulations - compliance - Secure data transmission and storage practices - Access control - user authentication - Data backup - disaster recovery.

Total:45

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Exploring Data Types and Significance in Business
2. Designing a Relational Database Schema
3. SQL Querying and Data Manipulation
4. Visualizing Data for Business Insights
5. Process Modeling for Business Automation
6. Normalizing Tables for Data Integrity
7. Analyzing Descriptive Statistics in Business Data
8. Predictive Analytics for Forecasting Trends
9. Implementing Robotic Process Automation (RPA)
10. Securing Data and Ensuring Compliance

Total:30

TEXT BOOKS

1. Ramesh Sharda, DursunDelen, Efraim Turban, "Business Intelligence and Analytics: Systems for Decision Support", 11th Edition, Pearson, 2021
2. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementation, and Management", 13th Edition, Cengage Learning, 2019

REFERENCE BOOKS

1. Thomas H. Davenport, "Big Data at Work: Dispelling the Myths, Uncovering the Opportunities", Harvard Business Review Press, 2014
2. Alberto Cairo, "The Truthful Art: Data, Charts, and Maps for Communication", New Riders, 2016
3. Randy Krum, "Cool Infographics: Effective Communication with Data Visualization and Design", Wiley, 2013

WEBSITES

1. https://www.coursera.org/specializations/business-data-management-communication
2. https://indiafreenotes.com/business-data-processing/

22BECY601 **MACHINE LEARNING FOR CYBER SECURITY** **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- To provide foundational knowledge in machine learning.
- To implement, train and validate the machine learning models and understand the recent algorithms in machine learning through case studies.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To apply the algorithms to a real-world problem
- To be able to formulate machine learning problems corresponding to different applications.

COURSE OUTCOMES

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

- Illustrate the issues and challenges of machine learning: data, model selection, modelcomplexity.
- Describe the features of supervised machine learning agorithms
- Compare strengths and weaknesses of unsupervised machine learning approaches.
- Outline the concept of neural networks for learning linear and non-linear activation functions
- Apply the paradigms of supervised and un-supervised learning on use cases of security.

UNIT I SUPERVISED LEARNING   9

Foundations of supervised learning - Decision trees and inductive bias, Regression Vs Classification, Supervised: Linear Regression, Logistic Regression, Generalisation, Training, Validation and Testing, Problem of Overfitting, Bias vs Variance, Performance metrics, Decision Tree, Random Forest, Perceptron, Beyond binary classification. Case study: Anomaly detection

UNIT II ADVANCED SUPERVISED LEARNING   9

Advanced supervised learning - Naive Bayes, Bayesian Belief Network, K-Nearest Neighbour, Support vector machines, Markov model, Hidden Markov Model, Parameter Estimation: MLE and Bayesian Estimate, Expectation Maximisation.

UNIT III UNSUPERVISED LEARNING   9

Unsupervised Learning: Curse of Dimensionality, Dimensionality Reduction Techniques, Principal component analysis, Linear Discriminant Analysis Clustering: K-means, Hierarchical, Spectral, subspace clustering, association rule mining. Case Study: Spam filtering / machine learning for end point protection/network protection/ Application security

UNIT IV NEURAL NETWORKS   9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V MACHINE LEARNING IN SECURITY   9

Machine Learning in Security: Applications of Machine Learning in Cyber Security Domain, nomaly Detection, Privacy Preserving Nearest Neighbour Search, Machine Learning Applied to Intrusion Detection, Online Learning Methods for Detecting Malicious Executables.

Total: 45

TEXT BOOKS

1. Tom Mitchell. Machine Learning. First Edition McGraw Hill Education; 2017.

REFERENCE BOOKS

1. Christopher M Bishop. Pattern Recognition and Machine Learning. Springer 2010
2. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. Wiley, Second Edition;2007
3. Kevin P. Murphey. Machine Learning, a probabilistic perspective. The MIT Press Cambridge, Massachusetts, 2012.

22BECY641   CYBER SECURITY THREATS AND COUNTERMEASURES   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

The goal of this course s for the students is to

- Learn cybercrime and cyberlaw.
- Understand the cyber attacks and tools for mitigating them.
- To Identify information gathering.
- To infer ways to detect a cyber attack.
- To analyze the possibility to prevent a cyber attack.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Explain the basics of cyber security, cyber crime and cyber law
- Classify various types of attacks and learn the tools to launch the attacks
- Apply various tools to perform information gathering
- Apply intrusion techniques to detect intrusion
- Apply intrusion prevention techniques to prevent intrusion

UNIT I INTRODUCTION   9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime andPunishment.

UNIT II ATTACKS AND COUNTERMEASURES   9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach– Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineeringAttack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Informationfrom E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

Total: 45

TEXTBOOKS:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)

REFERENCES BOOKS:

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3)
3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3)
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition,
   Pearson Education, 2015 (Units 4 and 5)
5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab)

WEBSITES:

1. https://owasp.org/www-project-top-ten/
2. https://www.w3schools.com/cybersecurity/cybersecurity_web_applications.php

ii) LABORATORY:

LIST OF EXPERIMENTS

1. Install Kali Linux on Virtual box
2. Explore Kali Linux and bash scripting
3. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
4. Understand the nmap command d and scan a target using nmap
5. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
6. Use Metasploit to exploit an unpatched vulnerability
7. Install Linus server on the virtual box and install ssh
8. Use Fail2banto scan log files and ban Ips that show the malicious signs
9. Launch brute-force attacks on the Linux server using Hydra.
10. Perform real-time network traffic analysis and data pocket logging using Snort

Total:30

22BECY642   **DIGITAL AND MOBILE FORENSICS**   **5H-4C**

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

End Semester Exam:3 Hours

   i)   **THOERY**

COURSE OBJECTIVES

The goal of this course for the students is to

To understand basic digital forensics and techniques.

- Undertand the basic digita forensics process.
- Identify digital crime and investigation.
- Understand how to be prepared for digital forensic readiness.
- Interpret forensics tools for iOS devices and Android devices.
- Infer Challenges in Digital Forensics.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Explain the basics of digital forensics process.
- Describe about digital crime and investigations procedures.
- Outline the Frameworks, Standards and Methodologies for digitall forensics.
- Identify the digital evidences and tools for iOS devices.
- Discuss digital evidences and forensic procedure for Android devices.

UNIT I INTRODUCTION TO DIGITAL FORENSICS   **9**

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process –
Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The
Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION   **9**

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods
for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS   **9**

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS   **9**

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

UNIT V ANDROID FORENSICS   **9**

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling.

Total: 45

TEXT BOOKS
1. Andre Arnes, "Digital Forensics", Wiley, 2018.
2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

REFERENCE BOOKS
1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

WEBSITES
1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2. https://www.coursera.org/articles/computer-forensics
3. https://resources.infosecinstitute.com/topic/mobile-forensics-process-steps-types/

ii)LABORATORY

LIST OF EXPERIMENTS

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2. Data extraction from call logs using Sleuth Kit.
3. Data extraction from SMS and contacts using Sleuth Kit.
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
5. Process and parse records from the iOS system.
6. Extract installed applications from Android devices.
7. Extract diagnostic information from Android devices through the adb protocol.
8. Generate a unified chronological timeline of extracted records.

Total: 30

SEMESTER-VII

22BECY701   PRINCIPLES OF MANAGEMENT AND ENGINEERING 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

The goal of this course for the students is to

- Enable the students to study the evolution of Management
- Learn the functions and principles of management.
- Learn the application of the principles in an organization.
- Infer the effective and barriers communication in the organization
- Study the system and process of effective controlling in the organization.

COURSE OUTCOMES

Upon completion of the course, students will be able to

- Discuss about managerial functions like planning, and have same basic knowledge on international aspect of management.
- Infer the planning process in the organization.
- Demonstrate the ability to directing, leadership and communicate effectively.
- Discuss best control methods.
- Apply the ethical responsibilities of the engineers

UNIT I   MANAGEMENT FUNCTIONS AND STRUCTURE   9

Management – Definition – Basic Functions – Contributions of Taylor and Fayol. Types of structure – Line, Staff, Line and Staff, Functional, Committee, Project and Matrix Structures. Departmentalization – Centralization – Decentralization – Span of Control – Management by Objectives – Management by Exception.

UNIT II   MANAGEMENT OF ORGANISATION   9

Forms of Business – Industrial Ownership, Sole Trade, Partnership, Company. Performance Appraisal – Basic principles – Pitfalls – Methods to overcome. Industrial Safety – Causes of accidents – How to minimize accidents. Plant Layout and Maintenance – Need, Types and Managerial Aspects

UNIT III   ORGANISATIONAL BEHAVIOUR   9

OB-Definition-Nature & Scope- Contributing Disciplines-Importance of OB to Managers. Personality-Definition-Theories-Factors Influencing Personality. Motivation-Definition-Theories. Theory X & Y-Transactional Analysis. Morale & Job Satisfaction-Factors Influencing Job Satisfaction

UNIT IV GROUP DYNAMICS   9

Group-Definition-Types-Determinants of group cohesiveness. Communication-Process- Barriers-Effective Communication. Leadership Theories-Factors Contributing to effective Leadership. Role of Trade Union in Organizations-Functions of trade Union-Why Trade Unionis Required? - Types of Trade Union

UNIT V PROFESSIONAL ETHICS   9

Ethics in Workplace - Formulation of Ethics - Managerial Ethics - Managing Ethical Behavior - Codes of Ethics - Encouraging Ethical Behavior - Ethical Leadership - Ethical Decision making. Corporate Social Responsibility (CSR) - Intellectual Property Rights (IPR)- Meaning-Laws relating to Intellectual Property Rights (IPRs)

Total:45

TEXTBOOKS:

1. Stephen P. Robbins, David A. Decenzo, 2016. Fundamentals of Management, Pearson Education, 9th Edition
2. Harold Koontz, O'Donnell and Heinz Weihrich, 2012. Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill

REFERENCE BOOKS:

1. Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage. 2014
2. Richard L. Daft, Principles of Management, Cengage Learning. 2009
3. Robbins, Management, 9th edition Pearson Education. 2008

WEBSITES:

1. https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_introduction.htm
2. https://www.mtdtraining.com/blog/the-four-principles-of-ethical-management.html

SEMESTER-VII

22BECY702   **ETHICAL HACKING**   **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To identify hacking options available in Web and wireless applications.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

COURSE OUTCOMES

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

- Analyze the basics of computer based vulnerabilities.
- Discuss about foot printing, reconnaissance and scanning methods.
- Demonstrate the enumeration and vulnerability analysis methods
- Outline the hacking options available in web and wireless applications.
- Identify the options for network protection and firewall protection.

UNIT I INTRODUCTION   9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS   9

 Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS   **9**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING   **9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade –

UNIT V NETWORK PROTECTION SYSTEMS   **9**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - NetworkBased and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

                                                             Total :45

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOKS:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

WEBSITES:

1. https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_quick_guide.htmL
2. https://www.udemy.com/course/web-security-fundamentals-how-to-hack-and-secure-web-apps/
3. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

SEMESTER-VII

22BECY703   **DEVOPS**   **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students **is to**

- Introduce DevOps terminology, definition & concepts
- Understand the different Version control tools like Git, Mercurial
- Identify the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment
- Understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Apply different actions performed through Version control tools like Git.
- Outline the steps in Continuous Integration,Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
- Describe the steps in Automated Continuous Deployment.
- Experiment with configuration management using Ansible.
- Apply Cloud-based DevOps tools using Azure DevOps.

UNIT I INTRODUCTION TO DEVOPS   9

Devops Essentials - DevOps lifecycle–DevOps tools and technologies- Model–View–Controller– Developing MVC applications- Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE   9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand buildusing Gradle

UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (GitPlugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters).Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkinsworkspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

Total:45

TEXT BOOKS

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner
   to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES BOOKS

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016
4. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

WEBSITES

1. https://www.jenkins.io/user-handbook.pdf
2. https://maven.apache.org/guides/getting-started

B.E COMPUTER SCIENCE AND ENGINEERING
(CYBER SECURITY)

PROFESSIONAL ELECTIVES

SEMESTER-IV

22BECY4E01   **ADVANCED DATA STRUCTURES**   **3H–3C**

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

End Semester Exam:3 Hours

PRE–REQUISITES: Data Structures

COURSE OBJECTIVES

The goal of this course for the students is to

- Infer the basics of algorithm analysis and notations.
- Understand the concept of tree data structure along with its elementary operations.
- Learn about the advanced tree data structures like threaded trees, tournament trees, B–trees, splay trees, red black trees and tries.
- Analyze the basic concept of the graph data structures and many algorithms associated with it.
- Know the basics of advanced randomized algorithms, parallel algorithms and string pattern matching algorithms.

COURSE OUTCOMES

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

- Analyze the basics of problem solving techniques using greedy algorithm.
- Apply the concepts of heap and its real–time applications.
- Discuss multi way tree structure and its operations..
- Outline single source shortest path algorithm and its application.
- Demonstrate KMP Pattern matching algorithm.

UNIT I INTRODUCTION TO ALGORITHM DESIGN TECHNIQUES   **9**

Introduction to algorithm design techniques: Fundamentals of algorithmic problem solving – Important problem types – Problem solving techniques – Greedy algorithms – Divide and conquer – Dynamic programming – Backtracking – Branch and bound – Randomized algorithms. Introduction to algorithm analysis: Asymptotic notations– Recurrences – Iterative and recursive algorithms.

UNIT II TREES   **9**

Trees: Introduction – Terminologies – Array and linked representation – Binary search tree Vs Threaded binary tree – Tournament trees. Balanced trees: Applications. Heaps: Array based heaps – Min, max heap – Binary heap – Operations – Binomial heap.

UNIT III MULTI WAY TREES   9

Multi way trees: 2–3 trees – 2–4 trees – Operations. B–tree: Definition – B–Tree of order m – Operations – Insertion, Searching– B+ trees. Red Black Tree – Splay Tree – Elementary operations – Introduction to tries and compressed tries – Dictionaries – Suffix trees – Suffix arrays.

UNIT IV GRAPHS   9

Graphs: Introduction – Traversals. Applications of graphs: Articulation Point – Connectivity – Biconnected graph – Eulerian path and circuit – Strongly connected components. Spanning trees: Minimum spanning tree algorithms – Prim's algorithm – Kruskal's algorithm – Applications. Single source shortest path algorithms: Dijkstra's – Bellman ford. Floyd warshalls all pair shortest path.

UNIT V ADVANCED ALGORITHMS   9

 Advanced algorithms: Network flow problem – Ford fulkerson algorithm. Introduction to parallel algorithms – Parallel sorting algorithms. Randomized algorithms – Randomness to hide worst cases – Optimization problems with a random structure. Pattern matching algorithms: Brute force string matching – KMP string matching algorithm – Boyer moore string matching.

Total: 45

TEXT BOOKS

1. Cormen T H,Leiserson C E and Stein C,"Introduction to Algorithms", PHI Learning, Third Edition 2012.

2. Anany Levitin "Introduction to Design and Analysis of Algorithm", Pearson Education, Third Edition,2017.

REFERENCES BOOKS

1. Jeff Edmonds,"How to Think about Algorithms", Cambridge University Press, Second Edition 2014.

2. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C++",Pearson Education, Fourth Edition 2014.

3. Seymour Lipschutz and VijayalakshmiPai G A, "Data Structures" Tata McGraw–Hill, First Edition 2011.

WEBSITES

1. www.nptel.ac.in/course.php
2. www.web.engr.illinois.edu/~jeffe/teaching/algorithms/
3. www.oseindia.net/tutorial/datastructure/index.htmlwww.web.stanford.edu/class/cs166/
4. www.cs.usfca.edu/~galles/visualization/Algorithms.html

SEMESTER-IV

22BECY4E02   **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

PRE-REQUISITES: Network Security

COURSE OBJECTIVES

The goal of this course for the students is to
- Decompose a blockchain system's fundamental components, how they fit together and examine a decentralization using block chain.
- Illustrate how Crypto currency works, from when a transaction is created to when it is considered part of the blockchain.
- Analyze the components of Ethereum, programming languages for Ethereum and study the basics Hyperledger and Web3.
- Categorize the nature of threats and cyber security management goals and technology
- Inspect the landscape of hacking and perimeter defense mechanisms

COURSE OUTCOMES:

Upon completion of the course, the student will be able to
- Analyze 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.

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. ArshdeepBahga, 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.

WEB SITES

1. www.nptel.ac.in/courses/106/104/106104220/
2. www.icaew.com/technical/technology/blockchain/blockchain-articles/what-isblockchain/history
3. 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

22BECY4E03 **CLOUD SECURITY**

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

End Semester Exam:3 Hours

PRE-REQUISITE: Network Security

COURSE OBJECTIVES

The goal of this course for the students is to

- Familiar with the architecture of the cloud computing.
- Know the security and the secure operations provided in cloud computing.
- Explore some important cloud computing driven commercial systems and applications.
- Aware of private cloud infrastructure.
- Understand the information security framework.

COURSE OUTCOMES

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

- Analyze various the concepts of cloud computing, policy and compliance in cloud environment.
- Illustrate cloud securitypatterns and architectural element in cloud.
- Identify the limits of security controls and enhance best practices for security monitoring.
- Apply the fundamental concepts in infrastructure security facilities in cloud computing.
- Summarize security operations activities to solve problems on the cloud.

UNIT I INTRODUCTION 9

Introduction to Cloud computing and security: Understanding cloud computing – The IT foundation for Cloud. An historical view: Roots of Cloud computing – A brief primer on architecture. Security architecture: Cloud computing architecture – Cloud reference architecture – Control over security in the cloud model – Making sense of cloud deployment – Making sense of services models – Real- world cloud usage scenarios.

UNIT II SECURING THE CLOUD 9

Security concerns – Risk issues and legal aspects – Security concerns – Assessing risk tolerance in Cloud Computing – Legal and regulatory issues – Securing the Cloud: Architecture – Security patterns and architectural element – Cloud security architecture – Planning key strategies for secure operation.

UNIT III CLOUD DATA SECURITY   9

Securing the cloud: Data security – Overview of data security in Cloud Computing. Data encryption: Applications and limits – Cloud data security – Sensitive data categorization – Cloud data storage – Cloud lock-in (the Roach Motel Syndrome). Securing the cloud: Key strategies and Best practices – Overall strategy – Effectively managing risk – Overview of security controls – The limits of security controls – Best practices – Security monitoring.

UNIT IV SECURITY CRITERIA   9

Security criteria: Building an internal cloud – Private clouds – Motivation and overview – Security criteria for ensuring a private cloud – Security criteria – Selecting an external cloud provider – Selecting a CSP – Overview of assurance – Selecting a CSP – Overview of risks – Selecting a CSP

UNIT V EVALUATING CLOUD SECURITY   9

Security criteria – Evaluating cloud security – An information security framework – Evaluating cloud security – Checklists for evaluating cloud security – Metrics for the checklists – Operating a cloud – Architecture to efficient and secure operations – Security operations activities.

Total : 45

TEXT BOOKS
1. Raghuram Yeluri and Enrique Castro-Leon, Building the Infrastructure for Cloud Security: A Solutions View, Apress, First Edition,2014
2. Ronald L Krutz andRussell Dean Vines, Cloud Security: A ComprehensiveGuide to Secure Cloud Computing, Wiley, First Edition,2010

REFERENCE BOOKS
1. Chris Dotson, Practical Cloud Security A Guidefor Secure Design and Deployment, O'Reilly Media,First Edition,2019
2. Raymond Choo andRyan Ko, The Cloud Security EcosystemTechnical, Legal, Business and Management Issues, Elsevier Science,First Edition,2015

WEBSITES
1. www.oreilly.com/library/view/securing-the-cloud
2. www.infoq.com/articles/cloud-security-architecture-intro/
3. www.techbeacon.com/security/5-critical-features-cloud-security-controls
4. www.omg.org/cloud/deliverables/CSCC-Security-for-Cloud-Computing-10-Steps-to-Ensure-Success.pdf
5. www.ibm.com/cloud/learn/cloud-security

	SEMESTER-IV
22BECY4E04 **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

The goal of this course for the students is to
- 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

Upon completion 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.
- Model responsive web pages by using Bootstrap.

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.

WEBSITES

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/

22BECY5E01   **FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in AI
- Illustrate to represent knowledge in solving AI problems
- Understand the different ways of designing software agents
- Infer about the various applications of AI.

COURSE OUTCOME

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

- Identify the efficiency and effectiveness of search algorithms using appropriate metrics and analysis techniques.
- Analyze the importance of knowledge representation in artificial intelligence systems and its role in problem-solving and decision-making.
- Discuss network-based representations and their significance in knowledge representation and reasoning in AI systems.
- Outline the concept of adversarial search and its applications in game playing and decision-making scenarios.
- Apply Hidden Markov models and their applications in recognizing patterns and making predictions in dynamic environments.

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, in ferencing, 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

TEXT BOOKS

1. Elaine Rich & Kevin Knight ,"Artificial Intelligence", Mc-GrawHill,Third Edition, 2017.
2. Dan W.Patterson, "Introduction to AI & Expert System, PHI, 2020.

REFERENCES

1. "Artificial Intelligence" by Luger (Pearson Education) , 2020.
2. Russel&Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2020.

WEBSITES

1. https://nptel.ac.in/courses/112/103/112103280/
2. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artifciial-intelligence

SEMESTER-V

22BECY5E02   **ROBOTIC   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

The goal of this course is for the students
- Introduce the functional elements of Robotics
- Impart knowledge on the forward and inverse kinematics
- Infer the manipulator differential motion and control
- Educate on various path planning techniques
- Illustrate working of control valve of hydraulic system.

COURSE OUTCOMES

Upon completion of this course, the students will be able to:
- Demonstrate coordinate systems used in robotics with its applications.
- Identify planning and control process in mobile robots.
- Outline the steps in vision based controls and their applications.
- Summarize the working of hydraulic system.
- Apply the principles of operation and applications of sensors, actuators, and electronic control components.

UNIT I INTRODUCTION   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 COMPUTER VISION   9

Basics of probability – Kalman Filtering – Extended Kalman – Particle filter – Localization – Computer Vision – Vision Based Controls.

UNIT IV LAWS AND PRINCIPLES 9

Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors – Fluid accessories

UNIT V CONTROL VALVES 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.

WEBSITES

1. www.nptel.ac.in/courses/112/101/112101099/
2. www.nptel.ac.in/courses/112/101/112101098/
3. www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial
4. www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots
5. www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

SEMESTER-V

22BECY5E03   OS 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

The goal of this course for the students is to
- Study the basic concepts of OS security.
- Understand the concepts of various information flow secrecy models.
- Illustrate the secure communication processor.
- Understand the working of secure capability systems.
- Familiarize with security kernel and access controls.

COURSE OUTCOMES

Upon completion of the course, the students will be able to
- Identify the security goals of operating systems and their significance in protecting computer systems and data.
- Discuss information flow secrecy models and their principles and applications.
- Analyze the concept of Scomp architecture and its key components that contribute to its enhanced security features.
- Apply the knowledge gained to assess and enhance the security of operating systems .
- Apply the concept of a security kernel, its role as the core component of an operating system responsible for enforcing security policies.

UNIT I IINTRODUCTION   9
Introduction – Secure Operating Systems – Security goals – Trust model – Threat model – Access control fundamentals – Reference models. Multics: Fundamentals and system models – Unix security – Windows security.

UNIT II INTEGRITY MODELS   9
Verifiable security goals – Information flow – Information flow secrecy models – Denning's lattice model – Bell-LaPadula model – Information flow integrity models – Security kernels – Secure communications processor

UNIT III SECURING OS   9
Scomp architecture – Scomp hardware – Scomp trusted operating program – Scomp kernel interface package – Scomp applications – Scomp evaluation – Securing commercial operating systems.

UNIT IV SYSTEM SECURITY   **9**

Secure capability systems – Capability system fundamentals – Capability security – Challenges in secure capability systems – Building secure capability systems – Operating system security and access control – Memory protection – Supervisor mode – Accountability

UNIT V ACCESS CONTROL   **9**

The reference monitor – Access matrix – Security kernel – Object permissions and file-based access control – Setuid bit and Effective Userid (Euid) – Directory permissions and i-node based example – Symbolic links, hard links and deleting files – Role-based and mandatory access control.

Total : 45

TEXT BOOKS

1. Trent Jaeger, Operating Systems Security, Morgan and ClaypoolPublishers, First Edition,2018
2. Michael J Palmer, Guide to OperatingSystems Security, Thomson/Course Technology,First Edition,2014

REFERENCE BOOKS

1. Abraham Silberschatz,Greg Gagne and Peter B Galvin, Operating SystemConcepts, Wiley,Sixth Edition,2014
2. Paul C Van Oorschot, Computer Security and theInternet Tools and Jewels, Springer Publishing, First Edition,2020

WEBSITES

1. www.unf.edu/public/cop4610/ree/Notes/PPT/PPT8E/CH15-OS8e.pdf
2. www.giac.org/paper/gsec/2776/operating-system-security-secure-operating-systems/104723
3. www.nces.ed.gov/pubs98/safetech/chapter8.asp
4. www.mycwt.com/for-suppliers/information-security-requirements/
5. www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/15_Security.html

22BECY5E04   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

The goal of this course for the students is to
- Understand the need for cyber laws and intellectual property rights.
- Acquire knowledge about the protective measures of Intellectual property such ascopyright, patent, Trademark.
- Identify the criminal remedies and defensive measures.
- Provide an insight about the role of certifying authority and cryptography.
- Be aware of Indian IT Act 2000 and 2008 cyber laws.

COURSE OUTCOMES

Upon completion of the course, the students will be able to
- Outline the fundamental concepts of cyber laws and the various intellectual property rightsfor criminal activities.
- Infer the concept of work of employment and its implications in copyright infringement cases.
- Analyze civil remedies available for design infringement their application in different infringement scenarios.
- Identify the scope and significance of cyber laws that arises from the use of technology.
- Discuss Information Technology Act and its subsequent amendments in cyberspace

UNIT 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

WEBSITES

1. www.core.ac.uk/download/pdf/144527187.pdf
2. www.nptel.ac.in/courses/110/105/110105139/
3. www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
4. www.lawshelf.com/videocoursesmoduleview/
5. www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

22BECY5E05 **COGNITIVE PSYCHOLOGY IN 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

The goal of this course for the students is to

- Understand history of scientific Psychology and contributions of prominent scientists.
- Be able to design a psychological experiment.
- Be aware of various type of psychological behavior model.
- Study differ models of memory study in psychology.
- Know about the digital forensic investigations.

COURSE OUTCOMES

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

- Demonstrate cognitive basic principles and concepts in cognitive psychology.
- Infer major concepts in attention, and their impact on perception and behavior.
- Discuss the theories of pain perception and the psychological and physiological factors that contribute to the perception of pain
- Discuss the nature of memory and its importance in cognitive processes.
- Analyze thinking as a cognitive process and the role of concepts in thinking and decision-making.

UNIT I INTRODUCTION 9

Introduction to Cognitive Psychology – History and emergence – Psychology an interdisciplinary field Contributions of various schools of Psychology to cognitive Psychology – Introduction to models of cognitive Psychology – Limitations of laboratory studies and importance of ecological validity – Ethical approach to cyber psychology.

UNIT II ATTENTION 9

Attention – Model of attention – Selective attention – Automaticity – Multi-tasking and division of attention – Major concepts in attention – Theories of attention Filter model.

UNIT III SENSATION AND PERCEPTION 9

Sensation and Perception: Theories of perception – Theories of pattern recognition – Theories of Pain perception – Theories of constancies and illusions – Classical and modern psychophysics – Types of Cognitive modeling – Behavior modeling.

UNIT IV MEMORY 9

Memory: Nature – Methods of Study – Types of Memory – Models of Memory – Atkinson and Shiffrin, Levels of Processing – Parallel Distributed Processing. Autobiographical memory – Eye-Witness Testimony – Mnemonics. Forgetting: Nature – Factors, and Theories.

UNIT V LANGUAGE 9

Language: Properties; Structure; and Processes of Language Acquisition. Thinking: Nature; Concept Formation. Problem Solving: Nature, Strategies of Problem Solving. Reasoning: Nature and Types. Digital Forensics Investigations.

Total : 45

TEXT BOOKS

1. Kellogg RT, Fundamentals of Cognitive Psychology, Sage Publication,First Edition,2013
2. Galotti K M, Cognitive Development, Sage Publication,First Edition,2013

REFERENCE BOOKS

1. Ulric Neisser. Cognitive Psychology, Taylor and Francis,First Edition,2014
2. Robert G Crowder, Principles of Learning and Memory, Taylor and Francis, First Edition,2014
3. Thomas D Parsons, Ethical Challenges in Digital Psychology and Cyberpsychology, Cambridge UniversityPress, First Edition,2019

WEBSITES

1. www. nptel.ac.in/content/storage2/courses/109101015
2. www.routledge.com/An-Introduction-to-Cognitive-Psychology-Processes-and-disorders
3. www.simplypsychology.org/attention-models.html
4. www.ncert.nic.in/ncerts/l/kepy105.pdf
5. www.us.sagepub.com/files/13839_book_item_13839

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn about contemporary knowledge in Internet Security.
- Understand effective measures in providing assurance concerning privacy and security in hardware layers.
- Be aware of flooding attacks and session hijack attacks in transport layer.
- Gain knowledge on the vulnerability occurring in the database layer of an application.
- Impart knowledge on transport layer security handshake and building a Firewall using NetFilter.

COURSE OUTCOMES

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

- Analyze the security issues associated with connecting to unsecured networks and measures to mitigate the risks and protect personal information.
- Compare between active and passive attacks in network security to protect against attacks.
- Discuss spoofing techniques and countermeasures to protect against spoofing attacks.
- Outline the hierarchical structure of the Domain Name System and the role of DNS servers.
- Illustrate principles of Virtual Private Networks and their significance in securing network communications over public networks.

UNIT I   NETWORK SECURITY   9

Malware and viruses – Spam, Phishing and Hacking Digital Footprints. Unsecured Networks: Issues in connecting to unsecure network. Secure Hotspot usage. Cookies: Types of Cookies – Malicious cookies – Benefits of removing cookies from computer – Using Google Chrome, Firefox, Internet Explorer.

UNIT II   PHYSICAL LAYER ATTACKS   9

Jamming attacks – Active and passive attack – hannon's perfect secrecy – Secure communication over Noisy Channels – Channel Coding for secrecy. Data link layer attacks: ARP protocol – ARP cache poisoning – ARP spoofing – Port stealing DHCP attacks.

UNIT III NETWORK LAYER ATTACKS 9

Packet sniffing – Packet spoofing – Spoofing – Endianness – Calculating checksum. Transport layer attacks: TCP protocol – SYN flooding attacks – TCP reset attack – TCP session Hijacking attack.

UNIT IV DOMAIN NAME SYSTEM ATTACKS 9

DNS hierarchy – DNS attack overview – Local and remote cache poisoning attack. Cross site request forgery: Cross site request. SQL injection attack: Introduction – Interacting with web application – Launching SQL injection attacks – Fundamental causes – Counter measures.

UNIT V VIRTUAL PRIVATE NETWORKS 9

Building a VPN – Transport Layer Security (TLS/SSL) – Overview of TLS/SSL – TLS handshake – TLS data transmission – TLS programming (Client and Server side) – Firewalls – Types of firewalls – Net filter – Building firewall using Net Filter. Anti-virus software: Importance of using anti-virus – Need for anti-virus updation.

Total: 45

TEXT BOOKS

1. Wenliang Du, Computer & Internet Security: A Hands-on Approach, Wenliang Du, Second Edition, 2019.
2. Atul Kahate, Cryptography and Network Security, Tata McGraw Hill Second Edition, 2015.

REFERENCES

1. Matthieu Bloch and Joao Barros, Physical Layer Security from Information theory to Security Engineering, Cambridge University Press, First Edition,2011.
2. Gupta Sharma, Computer and Cyber Security: Principles Algorithm Applications and Perspectives, CRC Press, Second Edition,2019.

WEBSITES

1. www.handsonsecurity.net/resources.html
2. www.handsonsecurity.net/video.html
3. www.nptel.ac.in/courses/106/106/106106178/
4. www.cisco.com/c/dam/global/da_dk/assets/docs/presentations/tech2007/Preso_Barbara_Fraser.pdf
5. www.netfilter.org

SEMESTER-V

22BECY5E07   **HARDWARE SECURITY**   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITE: Computer Networks

COURSE OBJECTIVES

The goal of this course for the students is to
- Study the basic concepts of hardware security.
- Understand the mathematical theory of public key cryptography.
- Explore on fault tolerance of cryptographic hardware security.
- Obtain the knowledge inside channel attacks.
- Infer hardware Trojan and trusted integrated circuit (IC) design.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Illustrate fundamental mathematical concepts and algorithms underlying public key cryptography and their applications.
- Discuss Physical Unclonable Functions and their implementations in hardware.
- Outline the verification methods and techniques for finite field arithmetic circuits used in cryptographic hardware.
- Analyze Trojans and techniques to increase the security.
- Apply hardware security concepts that compromise on public infrastructure and the techniques to increase testing sensitivity.

UNIT I INTRODUCTION TO HARDWARE SECURITY   9

Algebra of finite fields – Basics of the mathematical theory of public key cryptography – Basics of digital design on Field – Programmable Gate Array (FPGA) – Classification using support vector machines – Cryptographic hardware and their implementation – Optimization of cryptographic hardware on FPGA – Introduction to IP protection – Watermarking basics – Watermarking examples – Good watermarks – Fingerprinting – Hardware metering.

UNIT II PHYSICALLY UNCLONABLE FUNCTIONS   9

PUF implementations – PUF quality evaluation – Design techniques to increase PUF response quality – Side-channel attacks on cryptographic hardware.

UNIT III INTRODUCTION TO SIDE CHANNEL ATTACKS   9

Current measurement based side channel attacks – Design techniques to prevent side-channel attacks – Improved side-channel attack algorithms – Cache attacks – Power analysis – Modified modular exponentiation – Fault-tolerance of cryptographic hardware – Fault attacks – Verification of finite field arithmetic circuits

UNIT IV HARDWARE TROJANS   9

Hardware trojan nomenclature and operating modes – Hardware trojan detection methods– Logic testing and side-channel analysis based techniques for trojan detection – Techniques to increase testing sensitivity – Trusted IC – Trusted IC design with HT prevention.

UNIT V Infrastructure security   9

Impact of hardware security compromise on public infrastructure – Defense techniques

Total: 45

TEXT BOOKS

1. Debdeep Mukhopadhyay and Rajat Subhra Chakraborty, Hardware Security: Design, Threats, and Safeguards, CRC press, First Edition,2014.
2. Swarup Bhunia and Mark Tehranipoor, Hardware Security: A Hands-on Learning Approach, Katey Birtcher, First Edition,2018.

REFERENCE BOOKS

2. Mohammad Tehranipoor and Cliff Wang Editors, Introduction to Hardware Security and Trust, Springer-Verlag New York,2012.
3. Ted Huffmire Cynthia and Timothy Sherwood, Handbook of FPGA Design Security, Springer, First Edition,2010.
4. Ahmad-Reza Sadeghi and David Naccache, Towards Hardware-intrinsic Security: Theory and Practice, Springer, First Edition,2010.

WEBSITES

1. www.coursera.org/learn/hardware-security
2. www.nptel.ac.in/courses/106/105/106105194/
3. www.coursera.org/learn/hardware-security
4. www.cylab.cmu.edu/research/hardware-security.html
5. www.kullabs.com/class-miscellaneous/caomputer-basics/computer-security-system/hardwaresecurity

22BECY5E08   DATA WAREHOUSING AND DATA MINING   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand various data mining functionalities.
- Inculcate knowledge on data mining query languages.
- Know in detail about data mining algorithms.
- Be familiar with the concepts of data warehouse and data mining,
- Be acquainted with the tools and techniques used for Knowledge Discovery in Databases

COURSE OUTCOMES

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

- Summarize the Multidimensional data model and Schemas.
- Illustrate the architecture and implementation of data warehouse.
- Discuss the basic approaches of data mining technique.
- Apply appropriate classification and clustering techniques for data analysis.
- Analyze spatial databases, spatial data mining techniques and extract knowledge from spatial datasets.

UNIT I   INTRODUCTION TO DATA WAREHOUSING   9

Evolution of Decision Support Systems- Data warehousing Components –Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations.

UNIT II   DATA WAREHOUSE PROCESS AND ARCHITECTURE   9

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

UNIT III   INTRODUCTION TO DATA MINING   9

Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – 90 Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

UNIT IV   CLASSIFICATION AND CLUSTERING   9

Decision Tree Induction - Bayesian Classification – Rule Based Classification –Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods - Clustering techniques – , Partitioning methods- k-means Hierarchical Methods - distance-based agglomerative and divisible clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

UNIT V   ADVANCED TOPICS IN DATA MINING   9

Mining complex data objects, Spatial databases, temporal databases, Multimedia databases, Time series and Sequence data; Text Mining –Graph mining-web mining-Application and trends in data mining.

Total: 45

TEXT BOOKS

1. Cormen T H, Leiserson C E and Stein C, Introduction to Algorithms, PHI Learning,ThirdEdition,2011
2. Anany Levitin, Introduction to Design and Analysis of Algorithm, PearsonEducation, ThirdEdition,2017

REFERENCES

1. Mehmed kantardzic,"Datamining concepts,models,methods, and lgorithms", Wiley Interscience,2003
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
3. George M Marakas, Modern Data Warehousing, Mining and Visualization, Prentice Hall, 2003.

WEBSITES

1. https://nptel.ac.in/courses/106105174/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/110105076/lec28.pdf

22BECY6E01   FORENSIC AUDIO AND VIDEO ANALYSIS

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

End Semester Exam:3 Hours

PRE-REQUISITES: Basics of Programming

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the concepts of digital signal processing and pattern recognition application to identify and verify speakers automatically using speech recognition.
- Examine and authenticate recorded videos by various speech analysis.
- Perform image enhancement and restorations by knowing various video standards and editing process.
- Make forensic analysis of audio/video in video recordings.
- Infer the principles and techniques of video authentication

COURSE OUTCOMES

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

- Illustrate the anatomical structures involved in speech production and their functions
- Outline the concept of digital audio formats and their significance in storing and transmitting audio data.
- Compare text-dependent and text-independent speaker recognition approaches and understanding their respective strengths and limitations.
- Infer the process of linear and non-linear editing and the tools and techniques used in each.
- Apply the principles and techniques of video authentication and the visual examination techniques used to detect potential tampering or alterations.

UNIT I SPEECH ANATOMY   **9**

Speech anatomy – Mechanism of speech production – Acoustic properties of vocal tract – Uniqueness in person's voice – Interspeaker and intraspeaker variation. Articulation – Phonetics in speaker identification – IPA (The International Phonetic Alphabets) – Forensic phonetics – Effect of context – Audio enhancement – Sound recording/Playback devices.

UNIT II DIGITAL AUDIO PROCESSING   **9**

Quantization – Digital audio formats – Coding and decoding – Computer representation of speech. Speaker recognition: Principles of speaker recognition/identification – Methods – Various approaches

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in forensic speaker identification – Interpretation of result – Concept of test and error in speaker identification.

UNIT III PATTERN RECOGNITION 9

Pattern recognition application – Different algorithm of automatic speaker identification. Audio evidence examination: Handling of audio recording evidence – Phonetic transcription – Analysis of linguistic and phonetic characteristics – Temporal measurement – Text-dependent and text independent speaker recognition. Authentication of recorded audio: Type of alterations – Auditory examination. Waveform analysis – Speech spectrographic analysis – Optical method.

UNIT IV VIDEO STANDARDS 9

Video standards – Recording formats – Introduction to video devices – Linear and non-linear editing – Concept of video film production – Graphics and animation technique. Image perception – Color space and representation – Storage, Image processing application. Introduction to image enhancement – Image restoration – Concept of digital water marking – Image compression – Retrieval of video files – Integrity of images – Facial image recognition.

UNIT V VIDEO AUTHENTICATION 9

Authentication of video recording – Visual examination technique – Video image analysis – Facial image recognition from video frame image – Video signal analysis. Action representation approaches: Classification of various dimension of representation – View invariant methods – Gesture recognition and analysis – Action segmentation. Case study: Face detection and recognition – Natural scene videos and crowd analysis.

Total:45

TEXT BOOKS

1. Robert C Maher, Principles of Forensic Audio Analysis, Springer, First Edition,2018.
2. Francesco Camastra and Alessandro Vinciarelli, Machine Learning for Audio, Image and Video Analysis, Springer, Second Edition,2015.

REFERENCES BOOKS

1. Ben Gold, Nelson Morgan and Dan Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, John Wiley, Second Edition,2011.
2. Mark T Maybury, Multimedia Information Extraction, John Wiley, First Edition,2012.

WEBSITES

1. www.forensicsciencesimplified.org/av/AudioVideo.pdf
2. www.annamalaiuniversity.ac.in/studport/download/engg/it/resources/Cyber%20Forensics.pdf
3. www.forensicsciencesimplified.org/av/
4. www.onlinecourses.swayam2.ac.in/cec20_lb06/preview
5. www.forensicsciencesimplified.org/

SEMESTER-VI

22BECY6E02   **AGILE METHODOLOGIES**   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Software Engineering

COURSE OBJECTIVES

The goal of this course for the students is to

- To understand agile methods and roles.
- To understand the XP lifecycle processing.
- To learn different types of planning anddevelopment methodology.
- To learn issues in real time problems
- To be familiarized with development environment.
- To gain knowledge on delivery and cyclicality.

COURSE OUTCOMES

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

- Discuss agile software development and XP concepts.
- Demonstrate releasing, planning and development phases of XP.
- Analyze globalization, reflection, change and leadership phases.
- Analyze the global software development
- Identify the value and principles of globalization

UNIT I INTRODUCTION   **9**

Agile development – Agile classification methods – Principles – Project Management – Modeling –Story – Evidence – Scrum: Lifecycle, Work products, roles and practices

UNIT II EXTREME PROGRAMMING   **9**

Understanding the XP – Life cycle – XP Team – XP concepts – Adopting XP – Theory of constraints XP prerequisite and recommendation – The challenge of change – Applying XP to a brand new project, existing project, phase – Base organization – Planning – Vision – Release planning – Pair programming – Collaborating

UNIT III VERSION CONTROL   **9**

Releasing: No bugs, Version control – Ten minute build, Collective code ownership, Documentation Planning: Vision, Release Planning – Risk management – Estimating, Developing: Incremental requirements – Customer tests – Refactoring – Incremental design and architecture.

UNIT IV AGILE VALUES AND PRINCIPLES   **9**

Values and principles – Improve the process – Rely on people – Eliminate waste – Deliver value – Technical excellence – Globalization: Agile approach in global software development – Communication in distributed agile teams.

UNIT V AGILE REFLECTION   **9**

Reflection: Reflection on learning in Agile software development. Change: Transition to an Agile software development environment – Organizational changes. Leadership: Styles – The Agile changeleader. Delivery and cyclicality: Reflective session between releases.

Total: 45

TEXT BOOK

   1. Craig Larman, Agile and Iterative Development, Pearson Education, Third Edition,2016

REFERENCE BOOKS

   1. Orit Hazzan Yael Dubinsky, Agile Software Engineering, Springer International, SecondEdition,2014
   2. James Shore and Shane Warden, The Art of Agile Development, O`REILLY, FirstEdition,2013

WEBSITES

   1. www.agilesoftwareproject– management– podcast.com
   2. www.codebetter.com/darrellnorton/2005/02/02/lean– Agile software–development–overview
   3. www.sei.cmu.edu/productlines/frame_report/agile_req_eng.htm
   4. www.careervarsity.com/careertools/agilesoftwareengineering.ppt
   5. www.scribd.com/doc/16103271/Software-Agile.ppt

SEMESTER-VI

22BECY6E03   **ADVANCED JAVA PROGRAMMING**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Translate vast data into abstract concepts and to understand JAVA concepts
- Have a clear understanding of subject related concepts
- Develop computational ability in Java programming language.
- Know about multithreading concepts and applications.
- Solve problem in real time scenario.

COURSE OUTCOMES

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

- Infer the importance of class relationships in object-oriented programming..
- Outline the need for packages in organizing and managing classes and resources in large-scale projects.
- Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
- Solve programming questions that involve manipulating and accessing data in collections.
- Discuss event driven GUI and web related applications which mimic the real word scenarios.

UNIT I ASSOCIATIONS, MODIFIERS   9

Uses A - Association-Diagrammatic representation-Demo on association-Assignment on relationships-Solving MCQs based on relationships between classes-Types of access specifiers-Demo on access specifiers-Assignment on access modifiers-Instance Members-Solving MCQs based on modifiers.

UNIT II INTERFACE & ABSTRACT CLASSES   9
Abstract Classes-Need-Abstract Classes-Abstract Methods-Interfaces-Assignment on abstract classes and interface-Need for packages-Access specifiers & packages-Import classes from other packages.

UNIT III EXCEPTIONS   9
Need for exception handling-try-catch-throw-throws-Creating own exception (Java, Python)-Handling own exceptions.

UNIT IV COLLECTIONS 9

ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set-Programming questions based on collections-Real world problems based on data structure.

UNIT V LINKED LIST ARRAYS 9

Solving programming questions based on linked list and arrays.

Total: 45

TEXT BOOKS

 1. Herbert Schildt , Java The Complete Reference, McGraw-Hill, 9th Edition , 2014

REFERENCE BOOKS

 1. John Dean, Introduction to Programming with Java: A Problem-Solving Approach ,2008

WEBSITES

 1.   https://www.javatpoint.com/java-oops-concepts

SEMESTER-VI

22BECY6E04   BIOMETRIC SECURITY **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Network Security/ Information Security

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the fundamental approaches for biometric systems.
- Gain knowledge about biometric face recognition.
- Analyze the process of iris recognition.
- Learn about various biometric security systems.
- Illustrate various attacks on biometric systems.

COURSE OUTCOMES

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

- Analyze the biometric systems, their functionalities, and the underlying principles and their practical applications in real-world scenarios.
- Demonstrate the face recognition and face detection methods.
- Demonstrate encoding and matching algorithms used to extract distinctive features from the iris for verification purposes.
- Illustrate the architecture and components involved in capturing data from multiple biometric sources.
- Discuss types of attacks that can occur at the user interface level

UNIT I INTRODUCTION TO BIOMETRICS **9**

Biometric functionalities – Biometric system errors – The design cycle of biometric systems – Applications of biometric systems – Security and privacy issues – Fingerprint recognition – Fingerprint acquisition – Feature extraction – Fingerprint indexing – Palmprint.

UNIT II FACE RECOGNITION **9**

Introduction to face recognition – Image acquisition – Face detection – Feature extraction and matching.

UNIT III IRIS RECOGNITION 9

Introduction to iris recognition – Design of an iris recognition system – Iris segmentation – Iris normalization - Iris encoding and matching – Iris quality – Biometric traits – Hand geometry – Soft biometrics.

UNIT IV MULTI-BIOMETRICS 9

Multi-biometrics – Sources of multiple evidence – Acquisition and processing architecture – Fusion levels.

UNIT V SECURITY OF BIOMETRIC SYSTEMS 9

Adversary attack – Attacks at the user interface – Attacks on the biometric processing – Attacks on the template database.

Total: 45

TEXT BOOKS

1. Anil K Jain,Arun A Ross and Karthik Nandakumar,I ntroduction to Biometrics, Springer, First Edition,2011.
2. Rachid Guerraoui and Franck Petit, Stabilization, Safety, and Security of Distributed Systems, Springer,First Edition,2010.

REFERENCES

1. Marcus Smith,Monique Mann andGregor Urbas, Biometrics, Crime and Security, Taylor and Francis, First Edition,2018.
2. Ravindra Das, The Science of Biometrics Security Technology for Identity Verification, Taylor and Francis,First Edition,2018

WEBSITES

1. www.m2sys.com/blog/education
2. www.javatpoint.com/biometrics-advantage-and-disadvantage
3. www.idexbiometrics.com/what-does-the-future-hold-for-biometric-security-technology/
4. www.link.springer.com/chapter/10.1007/978-1-4471-0997-6_13
5. www.users.ece.cmu.edu/~jzhu/class/18200/F06/L10A_Savvides_Biometrics.pdf

SEMESTER-VI

22BECY6E05   **VULNERABILITY ASSESSMENT AND PENETRATION TESTING**   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the tools that can be used to perform information gathering.
- Identify operating systems, server applications to widen the attack surface and perform vulnerability assessment activity and exploitation phase.
- Understand the vulnerability assessment is carried out by means of automatic tools or manual investigation.
- Learn the web application attacks starting from information gathering to exploitation phases.
- Familiarize with metasploit attacks and the techniques used in penetration testing.

COURSE OUTCOMES

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

- Explain the different phases involved in the penetration testing process.
- Identify different approaches and tools used in information gathering during penetration testing
- Discuss the function of vulnerability scanners and their role in identifying and assessing security vulnerabilities.
- Identify key challenges associated with securing mobile devices and its applications.
- Summarize wireless network vulnerability analysis process.

UNIT I TESTING PROCESS   **9**

Introduction – Terminologies – Categories of penetration testing – Phases of penetration test /Testing process– Types and techniques– Penetration testing reports Blue/Red teaming – Strategies of testing – Non-disclosure agreement checklist – Phases of hacking – Open-source/proprietary pentest methodologies.

UNIT II INFORMATION GATHERING   **9**

Information gathering techniques – Active, passive and sources of information gathering – Approaches and tools – Traceroutes, neotrace, whatweb, netcraft,Xcode exploit scanner and NSlookup. Host discovery – Scanning for open ports and services – Types of port.

UNIT III HOST DISCOVERY AND EVADING TECHNIQUES 9

Vulnerability scanner function – Pros and cons – Vulnerability assessment with NMAP – Testing SCADA environment with NMAP – Nessus vulnerability scanner – Safe check – Silent dependencies – Port range vulnerability data resources. Vulnerability scanner: SDN data plane – Control plane – Application plane. SDN security attack vectors and SDN hardening – Overlay model and network model for cloud computing

UNIT IV MOBILE APPLICATION SECURITY 9

Types – Key challenges – Methodology android and ios vulnerabilities – OWASP mobile security risk – Exploiting WM – Blackberry vulnerabilities – Vulnerability landscape for Symbian – Exploit prevention – Handheld exploitation.

UNIT V VULNERABILITY ANALYSIS 9

Testing for vulnerability web application and resources – Authentication bypass with insecure cookie handling – XSS vulnerability – File inclusion vulnerability – Remote file inclusion – Patching file inclusions – Testing a website for SSI injection. Wireless network vulnerability analysis – Exploits.

Total: 45

TEXT BOOKS

1. VivekRamachandran and Cameron Buchanan, Kali Linux Wireless Penetration Testing Beginner's Guide, Packt Publishing, First Edition,2015.
2. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, First Edition,2015
3. Patrick Engebretson and David Kennedy, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing made easy, Elsevier Science, First Edition,2013.

REFERENCE BOOKS

1. Prakhar Prasad, Mastering Modern Web Penetration Testing, Packt Publishing,First Edition,2016.
2. Abhinav Singh, Metasploit Penetration Testing Cookbook, W.Satllings, Prentice Hall, 2010. Packt Publishing,First Edition,2012.

WEBSITES

1. www.nptel.ac.in/courses/106/106/106106178/
2. www.coursera.org/lecture/proactive-computer-security/penetration-testing-ENTiH

3. www.softwaretestinghelp.com/vulnerability-assessment-tools/

4. www.veracode.com/security/vulnerability-assessment-and-penetration-testing

5. www.hackingarticles.in/penetration-testing/

22BECY6E06   **INTERNET OF THINGS**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the basics of Internet of Things.
- Get an idea of application Internet of Things
- Infer the middleware used for Internet of Things
- Know about Arduino board and its uses.
- Understand the IOT protocols and its applications.

COURSE OUTCOMES

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

- Infer IoT architecture and various and the components involved in building IoT systems.
- Outline the importance of communications criteria in IoT systems and the factors to consider when selecting communication technologies.
- Illustrate the basic blocks of an IoT device, including sensors, actuators,.
- Discuss the importance of data analytics in the context of IoT and decision-making based on the data generated by IoT devices..
- Explain the architecture of IoT systems in transportation, and their role in improving safety in transportation networks.

UNIT I ARCHITECTURES AND MODELS   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 CONNECTIVITY   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 SYSTEM DEVELOPMENT   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, 2012
2. Dieter Uckelmann; Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer, 2011
3. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press - 2010

REFERENCES

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

WEBSITES

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lec1.pd f
2. https://nptel.ac.in/courses/106105166/
3. https://nptel.ac.in/courses/108108098/

22BECY6E07 **HUMAN COMPUTER INTERACTION** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the foundations of Human Computer Interaction.
- Become familiar with the design technologies for individuals and persons with disabilities.
- Illustrate the components mobile HCI.
- Learn the guidelines for user interface.
- Understand about Designing Web Interfaces.

COURSE OUTCOMES

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

- Infer input and output channels through which humans interact with computers as well as emerging technologies.
- Outline the role of human-computer interaction in the software development life cycle .
- Illustrate communication and collaboration models and their relevance to the design of interactive systems..
- Discuss the type of mobile application and Mobile Information Architecture
- Apply interaction techniques in web interfaces effectively**.**

UNIT I FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT II DESIGN & SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT III   MODELS AND THEORIES   9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI   9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V WEB INTERFACE DESIGN   9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Total: 45

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.
2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009

REFERENCE BOOKS

1. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.

WEBSITES

1. www.core.ac.uk/download/pdf/144527187.pdf
2. www.nptel.ac.in/courses/110/105/110105139/
3. www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
4. www.lawshelf.com/videocoursesmoduleview/
5. www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

B.E COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

2022-2023
SEMESTER-VI

22BECY6E08   **STORAGE MANAGEMENT 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

PRE-REQUISITES: Computer Networks
COURSE OBJECTIVES

The goal of this course for the students is to

- Study the basic concepts of data storage systems.
- Examine emerging technologies including IP-SAN.
- Describe the different backup and recovery topologies
- Illustrate storage aspects in providing disaster recovery and business continuity capabilities.
- Obtain the knowledge in data storage infrastructure.

COURSE OUTCOMES

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

- Analyze basic information storage and retrieval concepts in a storage system.
- Compare different storage networking technologies and virtualization.
- Make use of replication tools for back and recovery.
- Apply security infrastructure to overcome risk traits.
- Experiment with storage architectures, including storage subsystems SAN, NAS and CAS.

UNIT I INTRODUCTION   **9**
Introduction to Storage Systems: Storage System – Introduction to Information Storage and Management – Storage System Environment – Data Protection Raid – Intelligent Storage System.

UNIT II STORAGE AREA NETWORKING   **9**
Storage Area Networking: Storage Networking Technologies and Virtualization – Storage Networks – Network Attached Storage – IP SAN – Content Addressed Storage – Storage Virtualization.

UNIT III BACKUP AND RECOVERY   **9**
Backup and Recovery Mechanisms: Introduction to Business Continuity – Backup and Recovery – Local Replication – Remote Replication.

UNIT IV STORAGE SECURITY   **9**
Storage Security: Securing the storage Infrastructure – Storage Security Framework – Risk Triad – Storage Security Domains – Security Implementation in Storage Networking.

UNIT V STORAGE INFRASTRUCTURE MANAGEMENT   **9**

Storage Infrastructure Management: Managing the Storage Infrastructure – Monitoring the Storage Infrastructure – Storage Management Activities – Developing an Ideal Solution – Concepts in Practice – Disaster recovery – Cloud storage-Github.

Total :45

TEXT BOOK

1. Somasundaram Gnanasundaram and Alok Shrivastava "Information Storage and Management, Storing, Managing, and Protecting Digital Information" John Wiley, Second Edition ,2012

REFERENCE BOOKS

1. R. Kelly Rainer and Casey G. Cegielski "Introduction to Information Systems: Enabling and Transforming Business" John Wiley, First Edition 2010
2. David Alexander , Amanda French and David Sutton "Information Security Management Principles" The British Computer Society ,Second Edition 2012

WEBSITES

1. www.nptel.ac.in/courses/106/108/106108058/
2. www.enterprisestorageforum.com/storage-management/data-storage-security-guide.html
3. https://www.oreilly.com/library/view/information-storage and/9781118236963/9781118236963c14.xhtml
4. www.mycloudwiki.com/san/storage-infrastructure-management-overview/
5. www.enterprisestorageforum.com/networking/nas-vs-san-differences-and-use-cases/

22BECY6E09   **SECURE CODING**   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Basics of Network Security

COURSE OBJECTIVES

The goal of this course for the students is to

- Study the basic concepts of software security.
- Understand the principles of software security.
- Familiar different protection schemes.
- Obtain the knowledge cryptography.
- Explore the different aspects of authentication.

COURSE OUTCOMES

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

- Illustrate the concepts software security
- Apply different cryptographic techniques to enhance security over data.
- Experiment with network traffic and develop solutions for the same.
- Apply software security fundamentals to a real time applications
- Summarize cross site scripting to overcome information leak.

UNIT I INTRODUCTION   **9**

Introduction to software security – Managing software security risk – Selecting software development technologies – An open source and closed source – Guiding principles for software security – Auditing Software – Buffet overflows

UNIT II CRYPTOGRAPHY   **9**

Access control – Race conditions – Input validation – Password authentication. Anti-Tampering – Protecting against Denial-of-Service attack – Copy protection schemes – Client-side security – Database security

UNIT III SECURITY FUNDAMENTALS   **9**

Applied cryptography – Randomness and determinism - Buffer overrun – Format string problems – Integer overflow and software security fundamentals – SQL injection - Command injection

UNIT IV ERROR HANDLING   **9**

Failure to handle errors and security touchpoints- Cross Site Scripting – Magic URLs – Weak passwords – Failing to protect data – Weak random numbers – Improper use of cryptography

UNIT V CROSS SITE SCRIPTING   9

Information leakage – Race conditions – Poor usability – Failing to protect network traffic – Improper use of PKI – Trusting network name resolution – Case study of cross site scripting – Magic URLs – Weak passwords buffet overflows – Access control – Race conditions.

Total : 45

TEXT BOOKS

1. Robert C. Seacord "Secure Coding in C and C++" Pearson Edition, First Edition, 2013
2. Eduardo Fernandez-Buglioni "Security Patterns in practice" Kindle Edition, First Edition 2013

REFERENCE BOOKS

1. Robert C. Seacord "SEI CERT C Coding Standard: Rules for Developing Safe, Reliable, and Secure Systems" Addison-Wesley, First Edition 2016
2. Robert C. Seacord "Java Coding Guidelines: 75 Recommendations for Reliable and Secure Programs" Addison-Wesley, First Edition 2013

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1. www.perforce.com/blog/sca/what-secure-coding
2. www.geeksforgeeks.org/secure-coding-what-is-it-all-about/
3. www.resources.whitesourcesoftware.com/blog-whitesource/secure-coding
4. www.owasp.org/www-project-secure-coding-practices-quick-reference-guide/
5. www.seedsecuritylabs.org/labsetup.html

22BECY6E10   **3D PRINTING AND DESIGN**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Create awareness on rapidly evolving and widely used fabrication technology.
- Make aware of the technology for conceptual modelling, prototyping and rapid manufacturing.
- Impart detailed knowledge of wide applications of Additive Manufacturing (AM) in industry and society; and in particular, key applications of AM such as rapid tooling, medical AM and rapid manufacturing.
- Understand 3D printers and its applications.
- Know about liquid based 3D printing.

COURSE OUTCOMES

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

- Explain the principle of fused deposition modeling 3D Printing
- Apply Auto-cad software for designing and drafting
- Illustrate various additive manufacturing techniques
- Outline design technology and innovation
- Model and fabricate their own 3D parts using advanced CAD software and 3D printing

UNIT I INTRODUCTION   9

Introduction to Design, Prototyping fundamentals. Introduction to 3D printing, its historical development, advantages. Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of 3D printing process, Applications to various fields.

UNIT II FDM AND FFM PRINTING   9

Principle of FDM/FFF printing, Basic steps to perform FDM printing, Significant process parameters of FDM printing, layer height, raster angle, raster width, build temperature, Nozzle temperature, orientation, printing speed etc

UNIT III FDM MATERIALS   9

Types of FDM printer Cartesian, Polar, delta, Robotic (SCARA), continuous FDM Materials PLA, ABS, PETG, Nylon, PVA, PC, TPU, Carbon reinforced nylon, ceramics, metals, Dual and multi material etc

UNIT IV LIQUID BASED 3D PRINTING 9

Stereo lithography apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid ground curing (SGC): Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies

UNIT V SOLID BASED 3D PRINTING 9

Laminated object manufacturing(LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies, practical demonstration

Total : 45

TEXT BOOKS

1. Ian Gibson, Ian Gibson. "Additive manufacturing technologies 3D printing, rapid prototyping, and direct digital manufacturing."2014 Springer International Publishing
2. Harshit K. Dave, J. Paulo Davim Fused Deposition Modeling Based 3D Printing, Springer International Publishing

REFERENCE BOOKS

1. Manu Srivastava, Sandeep Rathee, Sachin Maheshwari, TK Kundra Additive Manufacturing Fundamentals and Advancements CRC press

WEBSITES:

1. https://3dprintingindustry.com/3d-printing-basics-free-beginners-guide/
2. https://make.3dexperience.3ds.com/processes/introduction-to-additive-processes
3. https://markforged.com/resources/learn/3d-printing-basics

22BECY7E01   SOCIAL NETWORK 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

The goal of this course for the students is to

- Provide training on the concepts and techniques in social networking.
- Know about social networking for business and professional use;
- Understand social network analysis and social network developer tools;
- Gain knowledge about sector media and privacy issues.
- Use social network concepts for solving real-world issues.

COURSE OUTCOMES

Upon completing this course, students will be able to

- Experiment with multiple application of social networks for business and professional use
- Analyze human behavior in social web and related communities.
- Apply social network developer tools analyze social network
- Illustrate proficiency of public sector media and privacy
- Outline concepts in social networking and utilizing these concepts for solving real-world social network issues.

UNIT I   INTRODUCTION   9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II   MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION   9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES   9

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS   9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

Total : 45

TEXT BOOKS

1. Peter Mika, ―Social Networks and the Semantic Web‖, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition, Springer, 2010.

REFERENCES

1. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.

WEBSITES

1. https://www.academia.edu/9601905/Social_Network_Security_A_Brief_Overview
2. https://thesai.org/Downloads/Volume7No2/Paper_2 Role_of_Security_in_Social_Networking.pdf
3. https://www.researchgate.net/publication/284367906

22BECY7E02   SECURE SOFTWARE ENGINEERING AND RISK MANAGEMENT   3H-3C

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

PRE-REQUISITES: Database Security, Cryptography and Network Security
COURSE OBJECTIVES

The goal of this course for the students is to

- Learn different frameworks considered while modelling a secure system.
- Aware different access controls used in the secure system architecture.
- Know multilevel and multilateral security framework.
- Explore system evaluation and assurance techniques.
- Analyze vulnerabilities and shortcoming in user authentication techniques.

COURSE OUTCOMES

Upon completing this course, students will be able to

- Identify threats to software security and exploitation techniques.
- Apply the different types of security mechanisms to provide the services.
- Summarize the software requirement specifications and the SRS documents.
- Outline the security threats, attacks and manage the risks involved in the attacks using various risk assessment techniques
- Identify the risks associated with software engineering and use relevant models to mitigate the risks.

UNIT I INTRODUCTION   9

Introduction – Software assurance and software security – Threats to software security – Sources of software insecurity – Benefits of detecting software security.

UNIT II SOFTWARE SECURE   9

Software secure: Properties of secure software – Influencing the security properties of software – Asserting and specifying the desired security properties.

UNIT III REQUIREMENTS   9

Requirements engineering for secure software: Introduction - The SQUARE process model – Requirements elicitation and prioritization. Secure software architecture and design – Software security practices for architecture and design –

UNIT IV SECURITY PRINCIPLES   9

Architectural risk analysis – software security knowledge for architecture and design – Security principles – Security guidelines and attack patterns – Secure coding and testing – Code analysis – Software security testing.

UNIT V RISK MANAGEMENT   9

Risk management and security planning – Risk management process overview – Cost benefit analysis – Risk analysis – Laws and customs – Human issues – Organizational issues – Information system risk analysis – System approach to risk management – Threat assessment – Assets and safeguards – Modes of risk analysis – Effective risk analysis – Qualitative risk analysis – Value analysis.

Total: 45

TEXT BOOKS

1. Douglas Landoll "The Security Risk Assessment Handbook" CRC Press, Second Edition 2016
2. Michael Howard "The Security Development Lifecycle: SDL: A Process for Developing Demonstrably More Secure Software" Microsoft Press, First Edition 2017

REFERENCE BOOKS

1. Theodor Richardson and Charles N. Thies "Secure Software Design Jones and Bartlett Learning, First Edition 2013
2. John McManus "Risk Management in Software Development Projects" Taylor and Francis, First Edition 2012

WEBSITES

1. www.slideshare.net/aizazhussain234/software-security-engineering-56204635
2. www.slideserve.com/bart/security-engineering-for-software
3. www.cl.cam.ac.uk/teaching/0910/Security/security-part2-1.ppt
4. www.slideshare.net/AbhinyaKalyan/risk-management-16546063
5. www.irmi.com/term/insurance-definitions/risk-management-techniques

SEMESTER-VII

22BECY7E03	UI/UX DESIGN	3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Provide a sound knowledge in UI & UX
- Understand the need for UI and UX
- Understand the various Research Methods used in Design
- Explore the various Tools used in UI & UX
- Create a wireframe and prototype

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Build UI for user Applications
- Develop UX design of any product or application
- Model UX Skills in product development
- Apply Sketching principles to wireframing, prototyping and testing
- Build Wireframe and Prototype

UNIT I FOUNDATIONS OF DESIGN   9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN   9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN   9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

Total : 45

TEXT BOOKS
1. Joel Marsh, "UX for Beginners", O'Reilly , 2022 2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

REFERENCE BOOKS
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface"
   3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015

WEBSITES
1. https://www.nngroup.com/articles/
2. https://www.interaction-design.org/literature.

SEMESTER-VII

22BECY7E04   WEB APPLICATION 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

The goal of this course for the students is to

- Understand the fundamentals of web application security
- Focus on wide aspects of secure development and deployment of web applications
- Learn how to build secure APIs
- Learn the basics of vulnerability assessment and penetration testing
- Get an insight about Hacking techniques and Tools

COURSE OUTCOMES

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

- Outline the basic concepts of web application security and the need for it
- Experiment with the process for secure development and deployment of web applications
- Identify the skill to design and develop Secure Web Applications that use Secure APIs
- Summarize the importance of carrying out vulnerability assessment and penetration testing
- Apply the hacker skills to use hacking tool sets

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY   9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT   9

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API   9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING   9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Databasebased vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS   9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

Total : 45

TEXT BOOKS

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCE BOOKS

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc. 2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
2. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
3. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
4. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

SEMESTER-VII

22BECY7E05	GAME DEVELOPMENT	3H-3C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Fundamentals of Computer

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the concepts of Game design and development.
- Familiarize the processes, mechanics and issues in Game Design.
- Acquire knowledge of Core architectures of Game Programming.
- Introduce Game programming platforms, frame works and engines.
- Apply computer graphics concepts to develop games.

COURSE OUTCOMES

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

- Outline the concepts of Game design and development.
- Apply principles of game design and solve the issues of game creation.
- Make use of software development tools and methods for game development
- Apply game programming theories to Design and create prototypes of computer games for a variety of audiences
- Apply basic artificial intelligence to developing computer games.

UNIT I ANIMATION   **9**

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.

UNIT II GAME LOGIC   **9**

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

UNIT III EVENT MANAGEMENT   **9**

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management

UNIT IV GAME STUDIO   **9**

2D and 3D Game development using Flash, DirectX, Java, Python – Introduction to python-pygame libraries- Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, UnityDX Studio.

UNIT V GAME DESIGN   **9**

Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multiplayer games. Game project management, Game design documentation, Rapid prototyping and game testing.

Total: 45

TEXT BOOKS

1. Mike Mc Shaffrfy and David Graham "Game Coding Complete Delmar Cengage Learning" Fourth Edition 2012
2. Jason Gregory "Game Engine Architecture" Wiley Publications, Third Edition 2018

REFERENCE BOOKS

1. Josh Glazer, Sanjay Madhav "Multiplayer Game Programming Architecting Networked Games" Pearson Education Second Edition 2015
2. Eric Lengyel "Mathematics for 3D Game Programming and Computer Graphics Course Technology" Third Edition 2011

WEBSITES

1. www.coursera.org/specializations/game-design-and-developmen
2. www.coursera.org/specializations/programming-unity-game-development
3. www.github.com/games50
4. https://logicsimplified.com/newgames/best-game-development-platform-for-cross-game-development/
5. https://www.cs.umd.edu/class/spring2016/cmsc425/Lects/cmsc425-spring16-lects.pdf

OPEN ELECTIVES

OFFERED

FROM

COMPUTER SCIENCE AND

ENGINEERING(CYBER SECURITY)

22BECYOE01 **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:

The goal of this course for the students is to
- 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:

Upon completion 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.

UNIT I INTRODUCTION **9**

Introduction to Cyber Crime: Cyber Crime and Information Security – Classifications of Cyber Criminals – Cyber Cri\me 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 – Stegnography – 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

WEBSITES:

1. www.lexology.com/library/
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.itu.int/en/ITU-D/Cybersecurity

22BECYOE02   **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:

The goal of this course is for the students

- 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:

Upon completion of the 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.

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 ForensicInvestigations, Apress, First Edition, 2019

REFERENCE BOOKS:

1. Marjie Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, ThirdEdition, 2013
2. Albert Marcella J and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence,Wiley Publisher, .First Edition, 2012

WEBSITES:

1.
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.cs.nmt.edu/~df/lectures.html

22BECYOE03   **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:

The goal of this course is for the students:
- To understand the need for cyber laws and intellectual property rights.
- To acquire knowledge about the protective measures of Intellectual property such ascopyright, 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:

Upon completion of the course, the students will be able to:
- Outline the fundamental concepts of cyber laws and the various intellectual property rightsfor 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

UNIT 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

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UNIT III IP IINTELLECTUAL 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 andPractice- Cyber Laws and Laws Relating to E-Commerce, Universal Law,Third Edition,2011

WEBSITES:
1.www.core.ac.uk/download/pdf/144527187.pdf
2.www.nptel.ac.in/courses/110/105/110105139/
3.www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
4.www.lawshelf.com/videocoursesmoduleview/
5.www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

22BECYOE04   **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

PRE-REQUISITES: Network Security

COURSE OBJECTIVES:

The goal of this course is for the students :
- 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:

Upon completion of the 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.

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.

WEB SITES:

1. www.nptel.ac.in/courses/106/104/106104220/

2. www.icaew.com/technical/technology/blockchain/blockchain-articles/what-

isblockchain/history

3. 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

LIST OF OPEN ELECTIVES

SCIENCE AND HUMANITIES

22BESHOE01/22BTSHOE01   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

The goal of this course for the students is to
- Understand the basic concepts of communication and its types.
- Familiar with various models of communication and their relevance.
- Apply the concept of media theory with real time experience of media consumption.
- Understand the pioneering role of communication in the development of societies.
- Create research proposals in the field of communication and allied areas.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Identify the difference between various types of communication.
- Remember the theories of communication.
- Restate the concepts of communication models with real life situation.
- Analyze the psychological impact of media theory among people.
- Evaluate the impact of issues of media monopoly.

UNIT I: BASIC CONCEPTS OF COMMUNICATION   9

Types of Communication; Functions of Mass Communication; Barriers, Intertextuality.

UNIT II: MODELS AND THEORIES OF COMMUNICATION   9

Various models and theories of communication.

UNIT III: MEDIA THEORY   9

Paradigm Shifts in Mass Communication Theories

UNIT IV: FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY   9

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

TEXT/REFERENCE 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.
3. Introduction to Communication Studies – By John Fiske, 2010.
4. Mcquail's Mass Communication Theory – By Denis Mcquail, 2010.

22BESHOE02/22BTSHOE02   FUZZY MATHEMATICS   3H-3C

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

COURSE OBJECTIVES

The goal of this course for students is to
- Understand basic knowledge of fuzzy sets and fuzzy logic
- Apply basic knowledge of fuzzy operations.
- Know the basic definitions of fuzzy relations
- Apply basic fuzzy inference and approximate reasoning
- Know the applications of fuzzy Technology.
- Provide a firm basis for further reading and study in the subject**.**

COURSE OUTCOMES

Upon completion of this course, the student will be able to
- To gain the main subject of fuzzy sets.
- To understand the concept of fuzziness involved in various systems and fuzzy set theory.
- To gain the methods of fuzzy logic.
- To comprehend the concepts of fuzzy relations.
- The Engineers will have an exposure on various topics such as fuzzy algebra, fuzzy theory and fuzzy technology.
- Apply the basic knowledge of Mathematics in Engineering fields.

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

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

Total: 45

SUGGESTED READINGS

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.
3. Michal Baczynski and BalasubramaniamJayaram,(2008) Fuzzy Implications, Springer-Verlag publishers, Heidelberg.
4. Kevin M Passino and Stephen Yurkovich,(1998) Fuzzy Control, Addison Wesley Longman publishers,USA.

22BESHOE03/22BESHOE03   **MATERIAL SCIENCES**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Inculcate the fundamental principles and concepts of magnetic materials for different engineering applications.
- Impart basic knowledge of superconductivity and associated applications.
- To serve the fundamental concepts of dielectric materials for diverse applications in energy engineering.
- Divulge the basics of crystals, their structures and different crystal growth techniques.
- Make the students familiar in the fundamentals of ceramics, composites and nonmaterial's.

COURSE OUTCOMES

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

- Students accumulate the knowledge on the basics of magnetic materials and its applications.
- Gain knowledge on the concepts of superconductivity, devices and their applications.
- Clarity on the concepts of dielectric properties of materials and their applications in engineering field
- Understand the basics of crystals, their structures and different crystal growth techniques.
- Clear idea of ceramics, composites and nanomaterials.

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 Tc 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
3. William D CallisterJr, "Materials Science and Engineering – An Introduction", John Wiley and Sons Inc.,7th edition, New York, 2006
4. S.O. Pillai, Solid State Physics. New Age International(P) Ltd., publishers, 2009
5. M.A. Wahab, Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
6. 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

WEBSITES
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

22BTSHOE04/22BTSHOE04   GREEN 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

The goal of this course for students is to
- Make the students conversant about the green chemistry
- Make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- Acquaint the student with concepts of green technology.
- Develop an understanding of the basic concepts of renewable energy resources.
- Acquaint the students with the basics information on catalysis.
- Apply the concepts of green catalysts in the synthesis.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Outline the basic principles of green chemistry.
- Examine the different atom efficient process and synthesis elaborately.
- Apply the concepts combustion of green technology.
- Identify and apply the concepts of renewable energy.
- Apply the concepts of green catalysts in the synthesis.
- Integrate the chemical principles in the projects undertaken in field of engineering and technology.

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 fluorous solvents, 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.

UNITIII-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

SUGGESTED READINGS

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.
3. Ahluwalia V. K. (2018) Green Chemistry A Textbook 4th Reprint Narosa Publishing House Pvt. Ltd, New Delhi.
4. Ahluwalia V. K. and M.Kidwai (2007) New Trends in Green Chemistry 2nd edition Anamaya publishers., New Delhi.
5. Dr. Sunita Ratan (2012) A Textbook of Engineering Chemistry S.K. Kataria and Sons., New Delhi
6. Mukesh Doble. Ken Rollins, Anil Kumar (2007) Green Chemistry and Engineering, 1st edition Academic Press, Eleesevier., New Delhi.
7. Desai K. R. (2005) Green Chemistry Himalaya Publishing House, Mumbai.

WEBSITES

1. http://www.organic-chemistry.org/topics/green-chemistry.shtml
2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
3. 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

LIST OF OPEN ELECTIVES

ELECTRICAL

AND

ELECTRONICS ENGINEERING

22BEEEOE01 **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

The goal of this course is for the students is to

- Gain the knowledge about environmental aspects of energy utilization.
- Understand the basic principles of solar cells, photovoltaic conversion.
- Understand the basic principles of wind energy conversion.
- Gain the knowledge about hydro and ocean energy.
- Understand the basic principles of Biomass, fuel cell, Geo thermal power plants and MHD.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Discuss remedies/potential solutions to the supply and environmental issues associated with fossil fuels and other energy resources.
- Selection, Operation and Operation of Solar PV System for different types of applications
- Selection and Operation of Wind Turbine system
- Selection and Operation of Hydroelectric Plant and Ocean Energy
- Biomass Power Generation Types, Applicability and Limitations, Selection and Operation of Fuel Cell, Geo thermal plants and MHD

UNIT I INTRODUCTION 9

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization-Energy Conservation and Energy Efficiency-Need sand 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 collector sand storage.

UNIT III   WINDENERGY 9

Introduction– Basic principles of wind energy conversion-components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Interconnected systems.

UNIT IV   HYDROENERGY   **9**

Hydropower, classification of hydropower, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean waveen 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

SUGGESTED READINGS

1. Rai.G.D,Non-conventionalsourcesofenergyKhannapublishers,2011
2. Khan.B.H,Non-Conventional EnergyResources ,TheMcGraw Hills, Secondedition,2012
3. John W Twidell and Anthony D Weir , Renewable Energy Resources , Taylor and Francis – 3rdedition ,2015

22BEEEOE02   **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

The goal of this course for the students is to

- 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

Upon completion of this course the 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.
- Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology
- Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration.
- Analysis the performance of Energy Management strategies in HEVs.

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 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.

Total:45

SUGGESTED READINGS

1. C.Mi,M.A.Masrurand 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.Gayand A.Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press,2004.
4. T.Denton,"Electric and HybridVehicles",Routledge,2016.

WEBSITES

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

LIST OF OPEN ELECTIVES

ELECTRONICS AND COMMUNICATION

ENGINEERING

22BEECOE01   REAL TIME 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

The goal of this course for students is to :
- Introduce students to the embedded systems, its hardware and software.
- Introduce devices and buses used for embedded networking.
- Study about task management.
- Learn about semaphore management and message passing.
- Study about memory management.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Explain the Embedded systems and its hardware and software.
- Illustrate the devices and buses used for embedded networking.
- Construct about task management.
- Summarize semaphore management and message passing.
- Demonstrate the memory management system.

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 - RealTime Kernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy- ReentrantFunctions–Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion–Deadlock– Inter task Communication–Message Mailboxes–Message Queues- Interrupts- TaskManagement–Memory Management-Time Management–Clock Ticks.

UNIT-III TASK MANAGEMENT   9

Introduction-μ C/OS-II Features-Goals ofμ C/OS-II-Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Underμ C/OS-II–Clock Tick-μ   C/OS- II Initialization. Task Management: Creating Tasks–Task Stacks– Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: 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-VMEMORY MANAGEMENT   9

Memory Management: Memory Control Blocks–Creating Partition-Obtaining a Memory Block– Returning a Memory Block. Getting Started withµ C/OS-II–Installingµ   C/OS-II–Portingµ C/OS-II:Development Tools–Directories and Files– Testing a Port -IAR Workbench withµ   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 ofµ C/OS-II.

Total :45

SUGGESTED READINGS

1. JeanJ. Labrosse, Micro C/OS–II The Real Time Kernel, CMPBOOKS, 2009.
2. David Seal, ARM Architecture, Reference Manual, Addison-Wesley, 2008.
3. Steve Furbe, ARM System-on-Chip, Architecture,Addison-Wesley Professional, California, 2000.
4. K.C. Wang, Embedded and Real-Time Operating Systems, Springer, 2017.
5. JanezPuhan, Operating systems, Embedded systems and Real-time systems, CIP - Cataloging In Publication, 2015.

WEBSITES

1. https://nptel.ac.in/courses/10810505.
2. 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/

22BEECOE02 **CONSUMER ELECTRONICS** **3H-3C**

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

COURSE OBJECTIVES

The goal of this course for students is to:
- Study about various speakers and microphone.
- Learn the fundamental of television systems and standards.
- Learn the process of audio recording and reproduction.
- Study various telephone networks.
- Discuss about the working of home appliances.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Explain working of various type of loud speakers.
- Illustrate knowledge on various types of picture tubes.
- Demonstrate the working of various optical recording systems.
- Summarize various telecommunication networks.
- Describe the working of various home appliances.

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 TVFundamentals - 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

SUGGESTED READINGS

1. S.P. Bali," Consumer Electronics Pearson Education",2007
2. J.S.Chitode, "Consumer Electronics", Technical Publications,2007
3. Philip Hoff, Philip Herbert Hoff, "Consumer Electronics for Engineers", Cambridge University Press,1998
4. R.G.Gupta ,"Audio & Video Systems", Tata Mc Graw hill Publishing Company Ltd, 2004

WEBSITES

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

LIST OF OPEN ELECTIVES

FOOD TECHNOLOGY

22BTFTOE01   PROCESSING OF FOOD MATERIALS   3H-3C

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

COURSE OBJECTIVES

The goal of this course for students is to

- Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oilseeds.
- Summarize the production and processing methods of fruits and vegetables.
- Discuss the chemical composition, processing, production, spoilage and quality of milk and milk products.
- Outline the overall processes involved in the production of meat, poultry and fish products.
- Review the production and processing methods of plantation and spice products.

COURSE OUTCOMES

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

- Discuss 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.

UNIT I CEREAL, PULSES AND OILSEEDS TECHNOLOGY   9

Rice milling, Pulse milling, Wheat milling – Recent trends in milling process- Oilextraction – different methods in oil extraction - Methods of manufacture of Bread -differentprocessesofmanufacture-typesofbreads-buns,biscuits,cakesandcookies-Pastaproducts- Tortilla-Method of manufacture.

UNIT II FRUITS AND VEGETABLE PROCESSING   9

ProductionofFruitsandvegetablesinIndia,Maturitystandards,Causeforheavylosses,preservationtreatments -BasicsofCanning,MinimalprocessingandHurdletechnologyas 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 microorganismsinvolvedinspoilageofmilk– Majorpathogens,Plantconstruction,Sanitationmanagement,Cleaning equipment.

UNIT IV-MEAT, POULTRYAND FISH PROCESSING   9

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Common path ogens, Sanitation management, Sanitizers for meat & poultry plants, Fish and other Marine Products Processing, Sources of sea food contamination.

UNIT V-PLANTATIONPRODUCT TECHNOLOGY   9

Processing of Tea, Coffee and Cocoa – Outline of the methods of manufacture of-greentea, 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

SUGGESTED READINGS

1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International BookDistributingCo.Lucknow.3rdEdition.2010.
2. ChakravertyA.,MujumdarA.S.,RaghavanG.S.VandRamaswamyH.S.Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition.2003.
3. SukumarDe. Outlines of Dairy Technology. Oxford University Press. NewDelhi. 23rd impression. 2016.
4. JamesG.Brennan.2006.FoodProcessingHandbook.Wiley-VCHVerlagGmbH&Co. KGaA, Weinheim,Germany

22BTFTOE02   **NUTRITION AND DIETETICS**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Explain the basic concepts of food and nutrition.
- Define the overall classification, function, and source of carbohydrates, lipids and proteins.
- Summarize the availability, source, deficiency and physiological role of fat and water- soluble vitamins.
- Outlinetheroleofhealthandnutritionalimportanceofmicroandmacrominerals.
- Discuss there cent trend sand developments in nutrition.

COURSE OUTCOMES

Upon completion of this course, students will be able to

- Explain the basics in the area of nutritional assessment in health and disease.
- Outline the biological functions of various macro molecules in terms of food and health.
- Discuss 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.

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 FatSolubleVitamins:VitaminA,VitaminD,E&K.ƒWatersolublevitamins:VitaminC,Thiamine,Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.Stabilityunderdifferent food processing conditions.

UNIT IV MINERALS AND WATER 9

Physiological role, bio-availability, requirements, sources and deficiency of Macrominerals : Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Microminerals: 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 managementing out, rheumatism, AIDS/HIV – Cancer – risk factors, symptoms, dietary management, and 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, nutraceuticalsetc.

Total : 45

SUGGESTED READINGS

1. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rdedition 2018. (ISBN-13:9780199489084).
2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1st edition, 2017. (ISBN:9780128052570).
3. Ashley Martin. Nutrition and Dietetics.Syrawood Publishing House.1stEdition,2016. (ISBN:9781682860588).
4. RobertE.C.Wildman.Handbook of Nutraceuticals and Functional Foods.CRCPress,2nd Edition, 2016.(ISBN-10: 9781498770637).
5. Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6thEdition.2017.(ISBN-13:9789386418883).

22BTFTOE03   **READY TO EAT FOOD**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Outline the current status of snack food Industry.
- Describe the production, processing and marketing trends of potato and tortilla chips.
- Outline the overall processing of popcorn.
- Explain the production and processing of fruits involved in snack food preparation.
- Summarize the sensory analysis methods and packaging techniques of snack foods

COURSE OUTCOMES

Upon completion 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 equipments involved in the snack production processes.

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 FRUITBASED 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

SUGGESTED READINGS

1. Lusas,E.W and Rooney,L.W.Snack Foods Processing.CRCPress,1stEdition2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2ndEdition 2013.
3. SergioO Serna-Saldivar, Industrial Manufacture of Snack Foods ,Kennedys Books Ltd. 2008.
4. Lusas,E.WandRooney,L.W.SnackFoodsProcessing.CRCPress,1stEdition 2001.
5. SergioOSerna-Saldivar,Industrial Manufacture of Snack Foods,Kennedys BooksLtd. 2008.

22BTFTOE04   AGRICULTURAL WASTE AND BYPRODUCTS UTILIZATION   3H-3C

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

COURSE OBJECTIVES

The goal of this course for students is to

- Categorize the types of agricultural wastes
- Outline the production and utilization of biomass
- Explain the various parameters considered to be important in the designing of biogas units
- Discuss the methods employed in the production of alcohol from agricultural wastes/ byproducts
- Summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes

COURSE OUTCOMES

Upon successful completion of this, students will be able to

- List and classify the types of agricultural wastes
- Collect and generate number of value added products from agricultural wastes
- Recall the techniques involved in the production and utilization of biomass
- Assess 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 by products of agricultural wastes
- Choose the appropriate materials to produce paperboards and particleboards from agricultural wastes

UNIT I TYPES OF AGRICULTURAL WASTES   9

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, properties of agricultural waste- storage and handling - rice by-products utilization- rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II BIOMASS PRODUCTION AND UTILIZATION   9

Biomass – types – production and utilization Technology used for the utilization of agricultural wastes:Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat andSteam from Sugarcane Leaf andBagasse.

UNIT III BIOGAS DESIGN AND PRODUCTION   9

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogasplant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogasplant.

UNIT IV PRODUCTION OF ALCOHOL FROM WASTE MATERIALS   9

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT V PRODUCTION OF PAPER BOARD AND PARTICLE BOARDS FROM

AGRICULTURAL WASTE   9

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.

REFERENCE BOOKS

1. Efthymia Alexopoulou. Bio energy and Biomass from Industrial Crops on Marginal Lands. Elsevier, 1st Edition, 2020. (ISBN:9780128188644)
2. Navanietha Krishnaraj Rathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1st Edition, 2019. (ISBN:9780128179529)
3. SimonaCiuta,DemetraTsiamis,MarcoJ.Castaldi.GasificationofWasteMaterials.Academic Press, 1st Edition, 2017. (ISBN:9780128127162)
4. Nicholas E. Korres, Padraig O'Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1st Edition, 2013. (ISBN-13:9780415698405)
5. Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1st Edition, 2011. (ISBN-13:9781849025

22BTFTOE05   DESIGN OF FOOD PROCESS EQUIPMENT   3H-3C

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

COURSE OBJECTIVES

The goal of this course for students is to

- Illustrate the types of materials used in the food processing equipments.
- Discuss the materials and designing of differents to ragevessel.
- Explain the importance of reaction vessel and their destining techniques.
- Explain the materials and designing of heat exchanger and evaporators.
- Discuss the importance of dryersin food processing industries.

COURSE OUTCOMES

Upon successful completion of this, 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.
- Discuss the importance of heat exchanger in the designing of food processing equipment's.
- Infer the significance of dryersin food processing.

UNIT I MATERIALS   9

Metals and non-metals, design of pressure vessels – cylindrical shell –internal and external pressure - under continued loadings. Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes Numerical problem and design of pressure vessel.

UNIT II STORAGE VESSELS   9

Design of storage vessels – Rectangular Tank without stiffeners –with stiffeners – shell design – Numerical problem and design. Design of agitators and baffles. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;

UNIT III REACTION VESSELS   9

Design of Reaction vessels – materials -classification – jackets-Design of vessel shell with half coil – Design of vessel shell with jacket – Numerical problem and design. Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

UNIT IV HEAT EXCHANGERS   9

Design of Heat exchangers – types – materials – Design pressure and temperature- shell design – tubes - Numerical problem. -Design of Equipment. Evaporator: Materials of concentration – types – design- consideration – Design of agitators – power requirements – Design based on Torque – criticalspeed.

UNIT V DRYERS   9

Types - General considerations – Design of Tray dryer, Rotary Dryer, fluidized bed dryer, spray dryer, vacuum dryer, microwave dryer – Material Balance, Thermal energy Requirements , electrical energy Requirements, Performance Indices

Total :45

REFERENCE 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 IndiaLtd.,1985
3. Coulson ,J.M. and Richardson, J. F,"Chemical Engineering " Butterworth-Heinemnn Elsevier, ISBN-0750644451,2002

LIST OF OPEN ELECTIVES

MECHANICAL ENGINEERING

22BEMEOE01   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

The goal of this course for students is to

- Learn various energy storage systems used for Hybrid Electric Vehicle(HEV) and Electric Vehicle(EV).
- Learn about design and operation of solid-state Li-ion battery.
- Gain knowledge on the high temperature application of battery.
- Learn various technologies for recycling used batteries.
- Understandthebatteryelectricalandthermalmanagementsystemsusingactiveandpassivecoolingsystem.
- Analysis battery performance.

COURSE OUTCOMES

Upon successful completion of this, students will be able to

- Understand the performance and driving cycles of EVs.
- Can apply their knowledge to manufacture various types of Li-ion batteries.
- Can apply knowledge on use of Li-ion battery in large scale grid and spacecrafts.
- UnderstandTechno-economicaspectsofbatteryrecyclingandenvironmentalsafety.
- Understand battery cooling system and safety precautions for high voltage battery.
- Analysis battery performance.

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-H2cells 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 oxidefuel cells, Technology and economic aspects of battery recycling, Environmental effect and controlling ofpoisonouschemicals contamination.

UNIT V BATTERY MANAGEMENT   9

Fundamentals of battery management systems and controls, Battery Thermal Management - Passive cooling, Active cooling-Liquids and air systems. Regulations and Safety Aspects of High Voltage Batteries, Code and Standards, Safe handling of Lithium Batteries, Safety of high voltage battery.

SUGGESTED READINGS

1. Gerardus Blokdyk, "Battery Management System A Complete Guide", Springer, 2019 Edition.
2. Reiner Korthauer,"Lithium-Ion Batteries: Basics and Applications,1stEdition. Springer,2018
3. Alfred Rufer, "Energy Storage: Systems and Components",1st Edition,CRC Press,2017.
4. Arno Kwade and Jan Diekmann, "Recycling of Lithium-Ion Batteries: The Litho Rec Way" (Sustainable Production, Life Cycle Engineering and Management),1st Edition. Springer, 2018.

WEB REFERANCES
    1.https://nptel.ac.in/courses/108/103/108103009/

| 22BEMEOE02 | **INDUSTRIAL SAFETY AND ENVIRONMENT** | **3H-3C** |

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

COURSE OBJECTIVES

The goal of this course for students is to
- Recognize and evaluate occupational safety and heal hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyses the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- Teach student the concept of Industrial Safety & provide useful practical knowledge for work place safety.
- Prevent or mitigate harm or damage to people, property, or the environment.

COURSE OUTCOMES

Upon successful completion of this, students will be able to
- Recognize and evaluate occupational safety and health hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyze the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- Underst and the concept of Industrial Safety & provide useful practical knowledge for work place safety.
- Prevent or mitigate harm or damage to people, property, or the environment.

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, incidentrate, 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

REFERENCE BOOKS

1. Accident Prevention Manual for Industrial Operations,3rdedition,N.S.C.Chicago,2010(digital).
2. Heinrich H.W. "Industrial Accident Prevention", 2ndedition, Tata McGraw-Hill Company, NewYork, 1941.
3. Krishnan N.V, Safety Management in Industry, 1stedition,Jaico Publishing House, Bombay,1997.
4. John R Ridley,Safety at Work, 3rdedition, Elsevier,2014
5. Rol and P.Blake,Industrial Safety,2ndedition, PrenticeHall, Inc.,NewJersey,1973
6. L M Deshmukh,Industrial safety management,1stedition,TATA McGrawHill,2005.

22BEMEOE03   NON-DESTRUCTIVE TESTING   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                               End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is 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.
- Provide in-depth knowledge on various techniques of non-destructive testing.
- Provide an overview of destructive and non-destructive tests and state their applications
- Study the features of NDT techniques for various products and to understand the established NDE techniques and basic familiarity of emerging NDE techniques.
- Expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs.
- Facilitate the understanding of standard application area of NDET

COURSE OUTCOMES

Upon successful completion of this, students will be able to,
- Understand the codes, standards and specifications related to NDT.
- Classify the destructive and non-destructive tests and state their applications.
- Develop NDT techniques for various products.
- Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
- Acquire sound knowledge of established NDE techniques and basic familiarity of emerging NDE techniques.
- Make use of standards application area of NDET

UNIT I INTRODUCTION   9
Properties of Engineering Materials – Types of Defects – Surface and Sub-Surface of a component – Characteristics of Ferrous, Non-ferrous and Alloys. Classification of Destructive testing and Non-Destructive testing – Uses and applications. Codes, Standards and Specifications of NDT (ASME, ASTM, AWS etc.). Importance and Scope of NDT, Non-destructive testing methods

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION   9
Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - Apparatus required for LPT - An Illustration of Penetrant Testing, Application, Advantages and Disadvantages of Penetrants Testing. Introduction to Magnetic Particle Inspection – MPT equipments and devices - An Illustration of Magnetic Particle Inspection, Application, Advantages and Disadvantages of Magnetic Particle Crack Detection.

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION   9

Introduction to Ultrasonic Flaw Detection, UT equipments and devices, An Illustration of Ultrasonic Flaw Detection, Application, Advantages and Disadvantages of Ultrasonic Flaw Detection. Principle of Radiography Inspection, RT equipments and devices Radiation sources, uses of x-rays and gamma rays Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety from Radiation.

UNIT IV EDDY CURRENT TESTING AND VISUAL TESTING METHODS   9

Introduction to Eddy Current Testing. ECT equipments and devices, An Illustration of Eddy Current Testing Equipment, Application, Advantages and Disadvantages of Eddy Current Testing. Introduction to visual testing method, Equipments required for VT - An Illustration of visual testing method, Application, Advantages and Disadvantages of visual testing method.

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS   9

Inspection of Raw Products, Inspection for In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Automobile component Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

Total : 45

REFERENCE BOOKS

1. Sadashiva.M – Non - Destructive Testing Paperback – 15 July 2021.
2. Ramachandran.S and Anderson.A - Non-Destructive Testing – Kindle Edition - 2018
3. J. Prasad and C. G. Krishnadas Nair - Non-Destructive Test and Evaluation of Materials Hardcover – 1 July 2017.
4. Lari and Kumar - Basics of Non - Destructive Testing Paperback – 1 January 2013.
5. Ravi Prakash – Non - Destructive Testing Techniques Hardcover – 1 January 2010.
6. Louis Cartz - Non - destructive Testing - 1st Edition, ASM International, Almere, Netherland, 2007(digital).

22BEMEOE04   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

The goal of this course for the students is to
- Provide knowledge and training in finding optimal solutions under limited resources for the engineering and business problems.
- Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
- Give exposure to inventory in industry.
- Make the student acquire sound knowledge on sequences to perform operation among various alternatives.
- Provide an overview of various tools in various sections of industries like marketing, material handling etc.
- Understand the Engineering and Managerial situations in Transportation.

COURSE OUTCOMES

Upon successful completion of this, students will be able to
- Understand the concepts of Linear programming technique.
- Apply LPP technique of Transportation models.
- Understand the techniques of scheduling and sequencing.
- Acquire knowledge in Inventory control and Queuing theory.
- Perform network analysis for a project.
- Understand the concept to replacement models.

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,unbalanceanddegeneracyintransportationmodel,shortestroutealgorithm– dijkestra 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.

UNITIV   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/1queue, The M/M/mqueue, batch arrival queuing system, queues with breakdowns.

UNITV   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

SUGGESTED READINGS

1. Kanti Swarup,OperationsResearch,12thedition,Sultan ChandandSons,NewDelhi,2010.
2. Viswanathan N and Narahari Y, Performance Modeling of Automated Manufacturing
3. Systems,2nd edition,PrenticeHallof India,New Delhi,2005
4. Prem kumar Gupta and Hira D.S, Operation Research, 1st edition, S Chand and Company Limited, NewDelhi,2017

LIST OF OPEN ELECTIVES

CIVIL ENGINEERING

22BECEOE01 **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

The goal of this course for the students is 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
- Know the Importance of basic housing policies and building bye laws
- Use Housing Programmes and Schemes

COURSE OUTCOMES

Upon ccompletion of 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

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, Bye-laws 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 o f 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,Bombay, 2001.

REFERENCES BOOKS

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 2000.

22BECEOE02   BUILDING SERVICES   **3H-3C**

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

COURSE OBJECTIVES

The goal of this course for the students is to

- Defining and identifying of engineering services systems in buildings.
- Know the role of engineering services systems in providing comfort and facilitating life of users of the building.
- Understand the basic principles of asset management in a building & facilities maintenance environment
- Learn the Importance of Fire safety and its installation techniques.
- Understand Electrical system and its selection criteria
- Use the Principles of illumination & design

COURSE OUTCOMES

Upon completion 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

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 special 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 vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilledwater 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. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

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.

22BECEOE03   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

The goal of this course for the students is to,
- Learn various distress and damages to concrete and masonry structures
- Know the influence of corrosion in durability of structures
- Understand the importance of maintenance of structures
- Study the various types and properties of repair materials
- Learn various techniques involved in demolition of structures
- Assess damage of structures and various repair techniques

COURSE OUTCOMES

After completing the 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 various types and properties of repair materials
- Modern technique and equipment being adopted for the demolition of structures

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, Gunite 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.

TEXT BOOKS

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials,Maintenance andRepair", 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
2. Rehabilitation of Concrete Structures", Allied Publishers, 2004.
3. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013
4. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
5. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
6. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.
7. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011

22BECEOE04   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

The goal of this course for the students is 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.
  • 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

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. Foundationplan. 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 UserManuals.
2. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd NewAsian.
3. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria&Sons.
4. Ajeet Singh (2002), " Workingwith AUTOCAD 2000 with updates on AUTOCAD200I", Tata- Mc Graw-Hill Company Limited, NewDelhi

22BECEOE05   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

The goal of this course for the students is to

- Have developed a more detailed appreciation for construction planning and scheduling
- Apply their learned knowledge as it pertains to upper level construction management skills and procedures.
- 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.

COURSE OUTCOMES

Upon completion of this 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.

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

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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 Kibertet 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.

22BECEOE06   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:

The goal of this course for the students is to

- 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

Upon completion of this course, the students 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.

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 airPollutants 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 MODELLIN   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. Sources 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.

LIST OF OPEN ELECTIVES

BIO MEDICAL ENGINEERING

22BEBMEOE01   **HUMAN ANATOMY AND PHYSIOLOGY**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students
- Discuss all the organelles of an animal cell and their function.
- Perceive structure and functions of the various types of systems of human body.
- Outline about eye, ear and Endocrine glands of human
- Learn organs and structures involving in system formation and functions.
- Understand all systems in the human body.
- Infer basic understanding of the inter connection of various organ systems in human body

COURSE OUTCOMES

Upon completion 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

UNIT I   CELL   9

Structure of Cell– Organelles and description–Function of each component of the cell–Membranepotential–Action Potential–Generation and Conduction –Electrical Stimulation. Blood Cell–Composition –Origin of RBC–Blood Groups–Estimation of RBC, WBC and Platelet-Tissues and its functions-.Homeostasis - Tissue: Types – Specialized tissues– functions.

UNIT II 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-Spinalcord–Reflexaction.

UNIT III RESPIRATORY SYSTEM AND MUSCULOSKELETAL 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 SweatGland–Temperature

regulation, Lymphatic: Parts and Functions of Lymphatic systems– TypesofLymphaticorgansandvessels.

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

TEXTBOOKS

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

WEBSITES

1. https://dth.ac.in/medical/course.php
2. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

22BEBMEOE02   ARTIFICIAL ORGANS AND IMPLANTS   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Have an overview of artificial organs &transplants
- Describe the principles of implant design with a case study
- Explain the implant design parameters and solution
- Study about various blood interfacing implant
- Study about soft tissue replacement and hard tissue replacement

COURSE OUTCOMES

Upon completion 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

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS   9

ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration –
Evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individual organs –
kidney, liver, heart and lung, bone marrow, cornea.

UNIT II   PRINCIPLESOFIMPLANTDESIGN   9

Principles of implant design - body response to implants, Clinical problems requiring implants for
solution, The missing organ and its replacement, Tissue engineering, scaffolds, Biomaterials,
Regenerative medicine & Stem cells.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION   9

Biocompatibility, Local and systemic effects of implants, Design specifications for tissue bonding and
modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear,
Implants for Bone, Devices for nerve regeneration. Limb prosthesis, Externally Powered limb
Prosthesis.

UNIT IV   BLOOD INTERFACING IMPLANTS   9

Neural and neuromuscular implants, Heart valve implants, heart and lung assist devices, artificial heart,
cardiac pacemakers, Prosthetic cardiac valves, Artificial kidney-dialysis membrane and artificial blood.

UNIT V   IMPLANTABLE MEDICAL DEVICES AND ORGANS   9

Gastrointestinal system, Dentistry, Soft tissue replacement & Hard tissue replacement –sutures, surgical tapes, adhesive, percutaneous implants, internal fracture fixation devices, joint replacements. Maxillofacial and craniofacial replacement, Recent advancement and future directions.

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

REFERENCES

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

WEBSITES

1. https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/

LIST OF OPEN ELECTIVES

BIOTECHNOLOGY

22BTBTOE01   **BASIC BIOINFORMATICS**   **3H-3C**

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

COURSE OBJECTIVES

The goal of this course is for students to

- Elaborate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylogenetictrees for evolution.
- Discuss the 3D structure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.
- Illustrate the brief knowledge in Microarray data analysis.

COURSE OUTCOMES

Upon completion this course, the students will be able to

1. Summarize the basic concepts and importance of Bio informatics in various sectors.
2. Demonstrate the sequence alignment tool in bioinformatics.
3. Outline the phylogenetictrees for evolution.
4. Illustrate the protein secondary structure prediction by comparative modeling.
5. Explain the microarray technology and applications of bio informatics in various sectors.

UNIT I   OVERVIEW OF BIOINFORMATICS

Aims and tasks of Bioinformatics-applications of Bioinformatics-challenges and opportunities. The scope of bioinformatics; bioinformatics & the internet; useful bioinformaticssites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene& protein expression data; protein interaction data. Databases–contents, structure & annotation: fileformats; annotated sequence databases; miscellaneous databases.

UNIT II RETRIEVAL OF BIOLOGICAL DATA

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

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 phylogenetictrees; evolution of macro molecular sequences. Sequence annotation: principles of genome annotation annotation tools & resources.

UNIT IV STRUCTURAL BIOINFORMATICS
Protein sequence data-bases-Swiss Prot/TrEMBL,PIR, Sequence motifdatabases-Pfam, PROSITE,Protein structure databases, Protein DataBank-SCOP,CATH,KEGG, Chembank, Sequence, structure and function relationship. Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing& analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; introduction to protein structure prediction; Protein structure prediction, modeling.

UNITV:MICROARRAYDATAANALYSIS
Microarray data, analysis methods; microarray data, tools & resources; sequence sampling &SAGE.Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharmainformatics 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. PearsonEducation.
2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide totheanalysis ofgenesandproteins. Wiley-Interscience.
3. DavidW.Mount.(2004).SequenceandGenomeAnalysis. ColdSpringHarborLaboratory.

REFERENCE BOOKS

1. JonathanPevsner.(2015).Bioinformaticsandfunctionalgenomics.wiley-Liss.
2. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta(2013). Bioinformatics Methods AndApplications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt.Ltd.,

WEBSITES

1. https://www.ncbi.nlm.nih.gov/pmc/
2. https://biology.mit.edu/faculty-and-research/areas-of-research/computational-biology/

22BTBTOE02   FUNDAMENTALS OF NANO BIOTECHNOLOGY   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students to

- Impart the skills in the field of nanobiotechnology and its applications.
- Acquire knowledge in the nanoparticles and its significance in various fields.
- Extend the knowledge in types and application of nanoparticles in sensors.
- Define the concepts of biomaterials through molecular self assembly.
- Equip students with clinical applications of nanodevices.
- Describedeeperunderstandingofthesocio-economicissuesinnanobiotechnology.

COURSE OUTCOMES

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

1. Develop skills in the field of nanobiotechnology and its applications.
2. Summarize the techniques involve in nanoparticlessynthesis and characterization.
3. Demonstrate the nanotechnology application in biomedical and drug delivery system.
4. Outline the clinical applications of nanodevices.
5. Explain the socio-economic issues in nanobiotechnology.

UNIT I INTRODUCTION   9

Introduction to Nanotechnology and nanobiotechnology: Properties at nanoscale, Scope andOverview, Length scales , Importance of Nanoscale and Technology, History of Nanotechnology,FutureofNanotechnology:NanoTechnologyRevolution,;Generalsynthesismethodsofn anoscale 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: Nano biotechnology, Materials, Medicine, Dental care.

UNIT II NANOPARTICLES   9

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications-MEMS/NEMS,Atomic Force Microscopy, Self assemble dmonolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, NanoParticles, Nanowires and Nanotubes.X- ray diffraction technique; Scanning Electron Microscopy with EDX; Transmission Electron Microscopy including high-resolution imaging;

UNIT III MEDICALNANOTECHNOLOGY   9

Nanomedicine,Nanobiosensor and Nanofludics.Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevicesand 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. Artificialneurons. Real-time nanosensors- Applications in cancer biology. Nanomedicine. Syntheticretinyl chips based on bacteriorhodopsins. High throughput DNA sequencing with nanocarbontubules.Nanosurgical devices.

UNIT V   ETHICAL ISSUES IN NANOTECHNOLOGY   9

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: WithEspecialReferencetoNanomedicine, Nanomedicine Applied in Nonmedical Contexts,Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, OtherIssues, Nanotechnology and Future Socio-economic challenges.

TEXT BOOKS

1. Goodsell,D.S. (2004).Bionanotechnology.John Wiley and Sons,Inc.
2. Shoseyov, O. and Levy, I (2008).Nanobiotechnology: Bioinspired Devices and Materialso f the Future. Humana Press.

REFERENCE BOOKS

1. Bhushan,B.(2017).Springer H and book of Nanotechnology.Springer-Verlag BerlinHeidelberg.
2. Freitas JrR.A(2006) Nanomedicine.L and esBiosciences.
3. Kohler,M.andFritzsche,W.(2008).Nanotechnology–AnIntroduction 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

WEBSITES
   1. https://mitnano.mit.edu/
   2. https://nptel.ac.in/courses/118102003

OPEN ELECTIVES

OFFERED

FROM

COMPUTER SCIENCE AND ENGINEERING

22BECSOE01   **INTERNET OF THINGS**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students :

- 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

Upon completion 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.

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

WEBSITES:

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
4. https://www.startertutorials.com/blog/physical-design-of-iot.html
5. https://www.guru99.com/iot-tutorial.html

22BECSOE02   **MACHINE LEARNING**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students:
- To introduce the basic concepts and techniques of Machine Learning.
- To 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

Upon completion 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.

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

REFERENCES

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

WEBSITES

1. 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/

22BECSOE03   **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

The goal of this course is for the students :

- 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

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

- Explain block chain archetectuere 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.

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

WEBSITES

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

22BECSOE04   **CLOUD COMPUTING**   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                        End Semester Exam:3 Hours

COURSE OBJECTIVES:
 The goal of this course is for the students to:
   - 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:
  Upon completion 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 comcept of virtualizaition and load balancing.
   - Demonstrate proficiency in using Google Web Services for cloud management.

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 Hyper visors, 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.

REFERENCES:

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition), 2015.
2. Antohy T Velte , Cloud Computing : "A Practical Approach", McGraw Hill,2018.

WEBSITES:

1. https://nptel.ac.in/courses/106105167/
2. https://www.javatpoint.com/cloud-computing

OPEN ELECTIVES

OFFERED

FROM

ARTIFICIAL INTELLIGENCE

AND DATA SCIENCE

22BTADOE01   **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:

The goal of this course is for the students:

- To study the basic concepts of Data Science and data life cycle
- To understand the theoretical and mathematical aspects of Data Science models
- To learn common random variables and their uses, and with the use of empirical distributions
- To obtain the knowledge in data management tools
- To explore the major techniques for data science

COURSE OUTCOMES:

Upon completion 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.

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.

WEBSITES:

1. https://www.inferentialthinking.com/chapters/intro
2. https://swayam.gov.in/nd1_noc20_cs36/preview
3. 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/

22BTADOE02   FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE   3H-3C

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

End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students**:**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To represent knowledge in solving AI problems.
- To illustrate the different ways of designing software agents
- To know the various applications of AI.

COURSE OUTCOME:

Upon completion of the 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.

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

TEXT BOOKS:

1. "Artificial Intelligence",ElaineRich,Kevin Knight,Mc-GrawHill,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.

WEBSITES:

1. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artificial-intelligence

22BTADOE03   **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:

The goal of this course is for the students:

- 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:

Upon completion 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.

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 ServerDATABASE 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 Puntembekar,"Internet Programming", Technical Publication,2020.
2. John Dean, "Web Programming with HTML5,CSS and JavaScript",Jones & Partleft Learning,2018.
3. Sriram K Vasudevan, Meenakshi Sundaram, and Chandni Suresh"Essential of Internet Programming"DreamTech Press,Willey,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. UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011.

WEBSITES:

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

22BTADOE04   **ROBOTICS 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:

The goal of this course is for the students**:**

- To introduce the functional elements of Robotics.
- To impart knowledge on the forward and inverse kinematics.
- To interpret the manipulator differential motion and control.
- To educate on various path planning techniques.
- To understand about hydraulics system.

COURSE OUTCOMES:

Upon completion 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.

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.

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.

WEBSITES:

1. www.nptel.ac.in/courses/112/101/112101099/
2. www.nptel.ac.in/courses/112/101/112101098/
3. www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial
4. www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots
5. www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

LIST OF
MANDATORY COURSES

22BEMC351   **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

The goal of this course for the students is to

- 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

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

- Understand the basic concepts of quantitative ability
- Understand the basic concepts of logical reasoning Skills
- Acquire satisfactory competency in the use of reasoning
- Solve campus placements aptitude papers covering Quantitative Ability, Logical
- Gaun Reasoning Ability Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

UNIT -I 1. 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 2. 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 3. VERBAL - APTITUDE

1.1 Words

1.2 Idioms

1.3 Phrases in Context

1.4 Reading comprehension techniques

1.5 Narrative sequencing

1.6 Data interpretation

TEXTBOOKS

1. A Modern Approach to Verbal & Non-Verbal Reasoning By R S Agarwal
2. Analytical and Logical Reasoning BySijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical Reasoning for CAT and other management entrance tests By Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by AbhijitGuha 4th edition
6. https://prepinsta.com/
7. https://www.indiabix.com/
8. https://www.javatpoint.com/

SEMESTER-IV

22BEMC451 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

The goal of this course for the students is to

- 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
- Develope personal creativity and entrepreneurial initiative
- Adopt the key steps in the elaboration of business idea

COURSE OUTCOMES

Upon completion 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.
3. Rajeev Roy ,Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
4. Donald F Kuratko,T.VRao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.

22BEMC452   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

The goal of this course for the students is to

- 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

Upon completion of this course the students will be able to
- Understand the cultural diversity
- Infer the need of cultural unty
- Know the Dravidian culture
- Realize the power of 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

TEXT BOOKS
1. Chatterjee, Satishchandra and DhirendramohanDatta. (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

22BEMC551 MOBILE APPLICATION   DEVELOPMENT   **1H-0C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Java Programming

COURSE OBJECTIVES

The goal of this course for the students is to

- Develop knowledge about mobile application development.
- Understand the building blocks of mobile apps.
- Gain knowledge about graphics and animations in mobile apps.
- Know about testing of mobile apps.
- Learn the advantages and limitations of development frameworks.
- Understand more about how to distribute apps on mobile market place.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- define, understand and explain the overview of android with its states and lifecycle.
- apply the mobile applications for e-marketing in Android and iPhone.
- analyze mobile databases and various types of testing.
- develop the simple android applications.
- Evaluate alternative mobile frameworks, and contrast different programming platforms.
- implement the android applications in different field with modern tools.

UNIT I

Mobility landscape – Mobile platforms – Mobile apps development – Overview of android platform – Setting up the mobile app development environment along with an emulator – A case study onmobile app development.

UNIT II

App user interface designing – Mobile UI resources (Layout, UI elements, Draw- able, Menu) – Activity – States and life cycle – Interaction amongst activities – App functionality beyond user interface – Threads, async task, services – States and lifecycle, Notifications, Broadcast receivers.

UNIT III

Telephony and SMS APIs – Native data handling – On-device file I/O – Shared preferences – Mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). Graphics and animation – Custom views – Canvas – Animation APIs – Multimedia – Audio/video playback and record – Location awareness and native hardware access (sensors such as accelerometer and gyroscope).

UNIT IV

Debugging mobile apps – White box testing – Black box testing and test automation of mobile apps – JUnit for android, robotium and monkey talk. Versioning – Signing and packaging mobile apps – Distributing apps on mobile market place. Introduction to objective C – iOS features

UNIT V

UI implementation – Touch frameworks – Location aware applications using core location and map kit – Integrating calendar and address book with social media application – Using WIFI – iPhone market place – Drawbacks on iOS over Android – Various stores available in online market – Configuration ofmobile app – Online ecommerce transaction – E-booking transaction.

TEXT BOOK

1. Anubhav Pradhan and Anil V Deshpande, Composing Mobile Apps Wiley,First Edition 2014

REFERENCE BOOK

1. Barry Burd,Android Application Development All-in-one for Dummies, John Wiley,First Edition 2012

WEB URLs:

1. www.impetus.com/mobility
2. www.cise.ufl.edu/~helal/classes/f10/notes/intro_to_mobile.ppt
3. www.diva– portal.org/smash/get/diva2:626531/FULLTEXT01.pdf
4. www.law.fsu.edu/library/databases/ppt/Androidapps.ppt
5. www.infosys.com/flypp/resources/Documents/mobile-application- testing.pdf

LIST OF
PROJECT WORK

SEMESTER III

22BECY391 FIELD PROJECT / INTERNSHIP   I   **2H-1C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None
COURSE OBJECTIVES

The goal of this course for the students is to
- Be self motivated and diligent professional
- Involve new learning, expanded growth or improvement on the job
- Enable the students to develop their engineering skills

COURSE OUTCOMES

Upon completion , the students will be able to

- Develop written and oral communication skills in both technical and non-technical Environment and use ICT for effective presentation of the study/internship

- Function effectively as an individual to identify the mathematical concepts, science concepts, Engineering concepts and modern engineering tools necessary to communicate the identified Study /internship

- Engage in independent study to research literature and understand engineering trends in the Identified study

- Apply and analyze the knowledge of engineering concepts to effectively communicate the Results from various publications

- Emphasize the need and abide by professional ethics

- Emphasize the role of engineering concepts on environmental, cultural and social concepts

	SEMESTER V
22BECY591 FIELD PROJECT/INTERNSHIP II	**2H-1C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES

The goal of this course for the students is to

- Be self motivated and diligent professional
- Involve new learning, expanded growth or improvement on the job
- Enable the students to develop their engineering skills

COURSE OUTCOMES

Upon completion , the students will be able to

- Develop written and oral communication skills in both technical and non-technical environment and use ICT for effective presentation of the study/internship
- Function effectively as an individual to identify the mathematical concepts, science concepts, engineering concepts and modern engineering tools necessary to communicate the identified study /internship
- Engage in independent study to research literature and understand engineering trends in the identified study
- Apply and analyze the knowledge of engineering concepts to effectively communicate the results from various publications
- Emphasize the need and abide by professional ethics
- Emphasize the role of engineering concepts on environmental, cultural and social concepts

SEMESTER VI

22BECY691   **MINI PROJECT**   **4H-2C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None
COURSE OBJECTIVES

The goal of this course for the students is to
- Provide an opportunity to transform theoretical knowledge acquired into practice.
- Sufficient confidence to carry out final year projects.
- An opportunity to conceptualize an idea into a system or product based on the theoretical knowledge gained in the specific domain.
- Knowledge and practice in writing project report and its presentation to the expert committee.

COURSE OUTCOMES

Upon completion , the students will be able to
- Apply and analyze the engineering concepts to solve the identified research work through literature survey
- Arrive at an exhaustive list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and societal need and validate the results of the identified work leading to publications
- Abide by the norms of professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team and mentor/lead the team
- Communicate effectively through presentation and demonstration of the project and preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project
- Function effectively as an individual to engage in independent learning.

Guidelines

- Maximum of 4 students per group will do the project.
- Each batch will select and carry out their project under the guidance of a teaching faculty.
- The project will be evaluated by the guide and coordinator nominated by the HOD as per the following details:

Category	Marks	Evaluated by
Project Selection and Design	20	Guide
Implementation and Validation	40	Guide and Coordinator
Project Report	20	
Viva-Voce	20	

		SEMESTER VII
22BECY791	**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

PRE- REQUISITES: None
COURSE OBJECTIVES

- Identification of a real life problem in thrust areas
- Proposing different solutions for the problems based on literature survey
- Developing a mathematical model for solving the above problem
- Finalization of system requirements and specification
- Future trends in providing alternate solutions
- Consolidated report preparation of the above

COURSE OUTCOMES

Upon completion , the students will be able to

- Apply and analyze the engineering concepts to solve the identified research work through literature survey
- Arrive at an exhaustive list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and Societal need and validate the results of the identified work leading to publications
- Abide by the norms of professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team and mentor/lead the team
- Communicate effectively through presentation and demonstration of the project and
   Preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project
- Function effectively as an individual to engage in independent learning

	SEMESTER VIII
22BECY891 **PROJECT WORK AND VIVA VOCE PHASE II**	**20H-10C**

Instruction Hours/week: L:0 T:0 P:20   **Marks:** Internal:**80** External:**120** Total:**200**

End Semester Exam:3 Hours

COURSE OBJECTIVES

- The objective of the project work is to enable the students in convenient groups of not more than members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Twenty periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

COURSE OUTCOMES

Upon completion , the students will be able to
- Apply and analyze the engineering concepts to solve the identified research work through Literature survey
- Arrive at an exhaustive list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and Societal need and validate the results of the identified work leading to publications
- Abide by the norms of professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team and mentor/lead the team
- Communicate effectively through presentation and demonstration of the project and Preparation of the report and video
- Apply the principles of project management and finance during the implementation of the Project
- Function effectively as an individual to engage in independent.