KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established under Section 3 of UGC Act 1956)

Eachanari, Coimbatore-641 021. INDIA

FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

REGULAR PROGRAMME

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

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

1. ADMISSION

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

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

OR

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

OR

Passed D.Voc. Stream in the same or allied sector.
(The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

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

S. No.	Programme	Eligibility criteria
1.	B.E Bio Medical Engineering	Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks incase of candidates belonging to reserved category) in ANY branch of Engineering and Technology. **OR** Passed B.Sc. Degree from a 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. **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)
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	

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 shallbe provided by the “Students’ Affairs Committee” of Karpagam Academy of Higher Education

.Students' Affairs Committee comprises all the Heads of the Departments and Dean of the Faculty of Engineering and a nominee of the Registrar.

2 . PROGRAMMES OFFERED

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

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

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

3.MODE OF STUDY

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, projectwork, industrial visits, camps, etc.

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

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

(v) Choice Based Credit System

CBCS is introduced for students admitted in the academic year 2017-18. As per AICTE guidelines, CBCS is an approach in which students opt for courses of their choice. CBCS provides greater flexibility with multiple courses and enable students to undergo additional courses. CBCS is applicable to Full Time Undergraduate & Post Graduate Programmes of study. It provides a choice for students to select from the prescribed courses(Professional soft core, Professional Hard core, Professional Electives, Open Electives, Value added courses, Humanity Sciences, Basic sciences & Engineering sciences). A course designated as hard core for a particular programme of study must invariably be completed by the student to receive the degree in the programme. The Hardcore courses cannot be substituted by another courses. Students can exercise their choice among a set of Soft core courses from the list of Soft core courses specified for each Programme of study. The student should meet the criteria for prerequisites to become eligible to register for that course. The student should request for the course for every semester within the first week of semester. Maximum no of students to be registered in each course shall depend on 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 exceeding6and 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 shallbe 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 classesand 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 programmeswith prior permission from the Registrar shall be given exemption from prescribed attendance requirements and shall be permitted to appear for the Examination on the recommendation of the Head of the Department concerned and Dean to condone the lack ofattendance. 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 theacademic 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 beginningof 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-learningprocess. The functions of the class committee include

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

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 =18Marks)**.
Part- B	Question 10 to 12 will be of either or type, covering two units of the syllabus. Each Question may have subdivision. (**3 x 14 =42 Marks)**.

PATTERN OF TEST QUESTION PAPER(Test III)

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

PRACTICAL COURSES:

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

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

INTEGRATED THEORY AND PRACTICAL COURSES

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

The external evaluation of integrated practical component from End semester Examinatiion by internal mode is awarded for 50 Marks and later scaled down to 15 Marks and similarly the external evaluation for integrated theory from End semester Examinatiion is awarded for 100 Marksand 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 inIndustry 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 arrearExaminations 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. Therewill 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, itis mandatory that candidate shall register and reappear for the Examination in that course during the subsequent semester when Examination is conducted in that course. Further the candidate should continue to register and reappear for the Examination till a pass is secured in such supplementary Examination within the stipulated maximum duration of the programme (Clause 5.1).

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

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

13.3.1 If a candidate fails to secure a pass in value added course, he/she has to appear for the testswhen 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 befiorethe 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 University.

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 butmaintains CGPA of 7.5 and above is not eligible for Honors degree but eligible for First class with Distinction.

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

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

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

17.1 A candidate may for valid reasons and on prior application, be granted permission to

Withdraw from appearing for the examination of any one course or consecutive examinations

of more than one course in a semester examination. .

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

.**17.3** Withdrawal application is valid only if it is made within 10 days prior to the commencementof 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 daysnotice,applications forwithdrawal for special cases under extraordinary conditions may be considered on the merit of the case.

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

17.5 Withdrawal from the ESE is NOTapplicable to arrearExaminations.

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 programmein 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 specifiedin 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 period spent in that semester shall not be considered as permitted 'Withdrawal' or 'Break of Study' (Clause18 and 18 respectively).

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

20. INDUSTRIAL VISIT

Every student is required to undergo one industrial visit for every semester, starting from thethird 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)
FACULTY OF ENGINEERING
Department of Computer Science and Engineering

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 Computer Science and Engineering.

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, andengineering 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 researchmethods 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 ofthe 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 anddesign documentation, make effective presentations, and give and receive clear instructions.

k) **Project Management and Finance:** Demonstrate knowledge and understanding of the engineeringand 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 inindependent 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 needsof 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
PEO1	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
PEO2	✓	✓	✓	✓	✓			✓	✓	✓				✓
PEO3	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓

Credit Distribution:

S.No.	Course Category	Credit Distribution	Percentage
1	Basic Science	25	15.15%
2	Engineering Science	14	8.48%
3	Humanities and Science	12	7.27%
4	Professional Core	92	55.75%
5	Professional Elective	9	5.45%
6	Open Elective	3	1.81%
7	Project Work	10	6.06%
	Total	165	100%

FACULTY OF ENGINEERING (FOE)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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

(2021-2022 Batch and Onwards)

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and outcomes		Instruction hours/week			Credit(s)	Maximum marks			Page No.
			PEOs	Pos	L	T	P		CIA	ESE	TOTAL	
SEMESTER I												
21BECC101	English	HS	II	(f,g,i)	2	0	2	3	**40**	**60**	**100**	**1**
21BECC102	Mathematics-I	BS	I,III	(a,f,i,j)	3	1	0	4	**40**	**60**	**100**	**3**
21BECC141	Engineering Physics	BS	I,III	(a,d, f)	3	0	4	5	**40**	**60**	**100**	**5**
21BECC142	Engineering Chemistry	BS	I	(a,d, f,h,i j,k)	4	0	2	5	**40**	**60**	**100**	**8**
21BECC143	Python Programming	ES	I	(a,j,k)	2	0	2	3	**40**	**60**	**100**	**11**
21BECS111	Engineering Graphics	ES	I,II	(a,d, f,g)	1	0	4	3	**40**	**60**	**100**	**14**
SEMESTER TOTAL					**15**	**1**	**14**	**23**	**240**	**360**	**600**	
SEMESTER II												
21BECC201	Communicative English	HS	II	(f,g,i)	2	0	2	3	**40**	**60**	**100**	**16**
21BECC202	Mathematics-II	BS	I,III	(a,b, ,c,d)	3	1	0	4	**40**	**60**	**100**	**18**
21BECC203	Semi Conductor Physics	BS	I,III	(a,d, f)	3	0	0	3	**40**	**60**	**100**	**21**
21BECC204	Environmental studies	HS	II	(f,g, h)	3	0	0	3	**40**	**60**	**100**	**23**
21BECS241	Basic Electrical & Electronics Engineering	ES	I,III	(j,l)	3	1	2	5	**40**	**60**	**100**	**26**
21BECS242	C Programming	PC	I,III	(a,b, c,d)	3	0	4	5	**40**	**60**	**100**	**29**
SEMESTER TOTAL					**17**	**2**	**8**	**23**	**240**	**360**	**600**	
SEMESTER III												
21BECS301	Mathematics-III	**PC**	II	(a,b, c,f)	3	1	0	4	**40**	**60**	**100**	**32**

	(Discrete Mathematics)											
21BECS302	Software Engineering	**PC**	I,III	(a,b, ,c,d)	3	0	0	3	**40**	**60**	**100**	**34**
21BECS341	Digital Electronics	**PC**	I	(a,b, c)	3	0	4	5	**40**	**60**	**100**	**36**
21BECS342	Data structures & Algorithms	**PC**	I,III	(a,b, c,d)	3	1	4	5	**40**	**60**	**100**	**39**
21BECS343	Object Oriented Programming with JAVA	**PC**	I	(a,b, c,d,f ,k)	3	1	4	5	**40**	**60**	**100**	**42**
21BECS351	PC hardware Assembly and Troubleshooting	**MC**	I	(a,b, e)	1	1	0	0	**100**	**-**	**100**	**140**
SEMESTER TOTAL					**16**	**4**	**12**	**22**	**300**	**300**	**600**	
SEMESTER –IV												
21BECS401	Mathematics- IV (Probability and Statistics)	**BS**	I,III	(a,b, c,d,f)	3	1	0	4	**40**	**60**	**100**	**45**
21BECS402	Formal Language and Automata Theory	**PC**	I	(a,b, c,d,f)	3	0	0	3	**40**	**60**	**100**	**47**
21BECS403	Microprocessor and Micro Controller	ES	I	(a,b, c)	3	0	0	3	**40**	**60**	**100**	**49**
21BECS441	Database Management Systems	**PC**	I	(a,b, e)	3	1	4	5	**40**	**60**	**100**	**51**
21BECS442	Computer Networks	**PC**	I,III	(a,b, c,d,e)	3	0	4	5	**40**	**60**	**100**	**54**
21BECS451	Mobile Application development	**MC**	I	(a,b, c,d,e ,f)	0	1	1	0	**100**	**-**	**100**	**142**
SEMESTER TOTAL					**15**	**3**	**9**	**20**	**300**	**300**	**600**	
SEMESTER –V												
21BECS501	Servlets and JSP	**PC**	I	(a,b, c,d,e)	3	0	0	3	**40**	**60**	**100**	**57**
21BECS502	Artificial Intelligence	**PC**	I	(a,b, c,d,f)	3	0	0	3	**40**	**60**	**100**	**59**
21BECS503	Design and Analysis of Algorithms	**PC**	I,III	(a,b, c,d,f)	3	0	0	3	**40**	**60**	**100**	**61**
21BECS541	Computer Organization & Architecture	**PC**	I	(a,b, c)	3	0	4	5	**40**	**60**	**100**	**63**

21BECS542	Operating Systems	**PC**	I,III	(a,b,c,d,e,f,l)	3	0	4	5	**40**	**60**	**100**	**66**
21BECS551	In plant Training	**MC**	I,III	(a,b,c,d,e,f,g,h,I,j,k,l)	-	-	-	0	**100**	-	**100**	-
SEMESTER TOTAL					**15**	**0**	**8**	**19**	**300**	**300**	**600**	
SEMESTER –VI												
21BECS601	Cloud Computing	**PC**	I	(a,b,c)	3	0	0	3	**40**	**60**	**100**	**71**
21BECS602	Data Warehousing and Data Mining	**PC**	I,II,III	(a,b,c,d)	3	0	0	3	**40**	**60**	**100**	**73**
21BECS641	Compiler Design	**PC**	I	(a,b,c,d)	3	1	4	5	**40**	**60**	**100**	**75**
21BECS642	Object Oriented Analysis and Design	**PC**	I,II	(a,b,c,d)	3	0	4	5	**40**	**60**	**100**	**78**
21BECS6Exx	Elective-I	**PE**	I,II	(a,b,c,d)	3	0	0	3	**40**	**60**	**100**	**95-104**
21BECS651	CCNA-Introduction to Networks	**MC**	I,III	(a,b,c,e)	0	0	1	0	**100**	**-**	**100**	**143**
SEMESTER TOTAL					**15**	**1**	**9**	**19**		**300**	**600**	
SEMESTER –VII												
21BECS701	Machine Learning	**PC**	I,II	(a,b,c,e)	3	0	0	3	**40**	**60**	**100**	**81**
21BECS702	Professional Ethics and Entrepreneurship Development	**HS**	II,III	(a,f,g,h,i,j,k,l)	3	0	0	3	**40**	**60**	**100**	**83**
21BECS741	Internet of Things	PC	I	(a,b,c,e)	3	0	4	5	**40**	**60**	**100**	**85**
21BECS703	Big Data and Its Applications	**PC**	I,II	(a,b,c,e)	3	0	0	3	**40**	**60**	**100**	**88**
21BECSOExx	Open Elective	**OE**			3	0	0	3	**40**	**60**	**100**	**135 - 138**
21BECS7Exx	Elective II	**PE**			3	0	0	3	**40**	**60**	**100**	**105-114**

21BECS791	ProjectWork Phase– I	**PW**	I,III	(a,b, c,d, e,f,g ,h,I, j,k,l)	0	0	6	4	**40**	**60**	**100**	**-**
21BECS751	CCNA – Routing and Switching Essentials	**MC**	I,III	(a,b, c,e)	0	0	1	0	**100**	**0**	**100**	**145**
SEMESTER TOTAL					**18**	**0**	**11**	**24**	**380**	**420**	**800**	
SEMESTER –VIII												
21BECS801	Cyber Security	**PC**	I	(a,b,c)	3	0	0	3	**40**	**60**	**100**	**90**
21BECS802	Block Chain Technologies	**PC**	I,III	(a,b, c,e)	3	0	0	3	**40**	**60**	**100**	**92**
21BECS8Exx	Elective- III	**PE**			3	0	0	3	**40**	**60**	**100**	**115-128**
21BECS891	Project Work Phase –II & Viva Voce	**PW**	I,III	(a,b, c,d, e,f,g ,h,I, j,k,l)	0	0	12	6	**80**	**120**	**200**	**-**
SEMESTER TOTAL					**9**	**0**	**12**	**15**	**200**	**300**	**500**	
PROGRAM TOTAL								**165**				

Total Marks = 4900

Total Cretits = 165

LIST OF PROFESSIONAL ELECTIVES

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			Credit(s)	Maximum Marks			Page No.
			PEOs	Pos	L	T	P		CIA	ESE	TOTAL	
Professional Electives for semester-VI Elective I												
21BECS6E01	Advanced Data Structures	**PE**	I	(a,b, c,d)	3	0	0	3	**40**	**60**	**100**	**95**
21BECS6E02	C# and.NET	**PE**	I	(a,b, c,d,e)	3	0	0	3	**40**	**60**	**100**	**97**
21BECS6E03	Software Testing	**PE**	I,III	(a,b, c,d,e)	3	0	0	3	**40**	**60**	**100**	**99**
21BECS6E04	Advanced Databases	**PE**	I,III	(a,b,e)	3	0	0	3	**40**	**60**	**100**	**101**
21BECS6E05	TCP/IP Design and Implementation	**PE**	I	(a,b,c)	3	0	0	3	**40**	**60**	**100**	**103**
Professional Electives for semester-VII Elective II												
21BECS7E01	Network Routing Algorithms	**PE**	I	(a,b,c)	3	0	0	3	**40**	**60**	**100**	**105**
21BECS7E02	Devops	**PE**	I,III	(a,b, c,d,e)	3	0	0	3	**40**	**60**	**100**	**107**
21BECS7E03	Design Patterns	**PE**	I	(a,b,c)	3	0	0	3	**40**	**60**	**100**	**109**
21BECS7E04	Service Oriented Architecture	**PE**	I	(a,b, c,d)	3	0	0	3	**40**	**60**	**100**	**111**
21BECS7E05	Semantic Web	**PE**	I	(a,b, c,d)	3	0	0	3	**40**	**60**	**100**	**113**
Professional Electives for semester-VIII Elective III												
21BECS8E01	Software Project Management	**PE**	I,III	(a,b, c,d,j, k)	3	0	0	3	**40**	**60**	**100**	**115**
21BECS8E02	E-Commerce	**PE**	I	(e,f, g)	3	0	0	3	**40**	**60**	**100**	**117**
21BECS8E03	Human Computer Interaction	**PE**	I,III	(a,b, c,d,e)	3	0	0	3	**40**	**60**	**100**	**119**
21BECS8E04	Natural Language Processing	**PE**	I	(a,b, c,d)	3	0	0	3	**40**	**60**	**100**	**121**
21BECS8E05	Ad-Hoc Networks	**PE**	I	(a,b, c,d,e)	3	0	0	3	**40**	**60**	**100**	**123**

21BECS8E06	Digital Marketing	**PE**	I	(a,b, c,d)	3	0	0	3	**40**	**60**	**100**	**125**
21BECS8E07	Robotics and its Applications	**PE**	I	(a,b, c,d)	3	0	0	3	**40**	**60**	**100**	**127**

LIST OF OPEN ELECTIVES OFFERED BY OTHER DEPARTMENTS

COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**Credit(s)**	**Maximum Marks**			**Page No.**
			PEOs	**Pos**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
Electrical & Electronics Engineering												
21BEEEOE01	Electric Hybrid Vehicles	**OE**	I	(a,b, c)	**3**	**0**	**0**	**3**	**40**	**60**	**100**	**130**
Electronics & Communication Engineering												
21BEECOE01	Principles of Modern Communication System	**OE**	I,II	(a,d, g,h,j)	**3**	**0**	**0**	**3**	**40**	**60**	**100**	**132**
Open Elective Courses Offered to other Departments												
21BECSOE01	Internet Programming	**OE**	I,III	(a,b, c,g,h)	**3**	**0**	**0**	**3**	**40**	**60**	**100**	**135**
21BECSOE02	Machine Learning	**OE**	I,II	(a,b, g,h)	**3**	**0**	**0**	**3**	**40**	**60**	**100**	**137**

i) CATEGORY

a. BS-Basic Sciences
b. ES-Engineering Sciences
c. HS-Humanities and Sciences
d. PC-Professional Course
e. PE- Professional Elective
f. OE- Open Elective
g. PW-Project Work
h. MC-Mandatory Course

ii) PEOs -Programme Educational Objectives.
iii) PO-Programme Outcomes.

SEMESTER-I

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

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

End Semester Exam:3 Hours

Course Objectives

The goal of this course is for the students

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

Course Outcomes

Students undergoing this course will be able to

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

UNIT: I - **BASIC WRITING SKILLS** **9**

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

UNIT: 1I - VOCABULARY BUILDING **9**

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

UNIT: III – GRAMMAR AND USAGE **9**

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

UNIT: IV – LISTENING AND READING SKILLS **9**

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

UNIT: V.-**WRITING PRACTICES** **9**

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

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

Total Hours: 45

TEXT BOOKS :

1. Sangeeta Sharma , Meenakshi Raman, .(2015),Technical Communication: Principles And Practice, 2nd Edition, OUP, New Delhi.
2. Sanjay Kumar and PushpLata, (2011), Communication Skills ,Oxford University Press.
3. Liz Hamp - Lyons and Ben Heasly, (2006), Study Writing, Cambridge University Press.

REFERENCES:

1. F.T. Wood., (2007), Remedial English Grammar, Macmillan.
2. Michael Swan, (1995). Practical English Usage, OUP.

WEBSITES:

1) https://nptel.ac.in/courses/109106067/
2) https://www.edx.org/learn/english
3) https://www.coursera.org/browse/language-learning/learning-english

SEMESTER-I

21BECC102 **MATHEMATICS -I** **4H-4C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To explain the use of matrix algebra techniques that is needed by engineers for practical applications.
- To teach the geometrical aspects of curvature and elegant application of differential calculus which are needed in Engineering applications.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model Engineering problems.
- To familiarize the student with functions of several variables which is the foundation for many branches of Engineering.
- To impart knowledge on sequences and series.
- To assist students to develop various engineering problems using mathematics.

COURSE OUTCOMES:

Upon completion of this course the students will be able

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

UNIT I - Matrices **9**

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

UNIT II – Differential Calculus **9**

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

UNIT III - Differential Equations **9**

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

UNIT IV –Functions of Several Variables **9**

Partial derivatives- Homogeneous functions and Euler's theorem - Total derivative - Differentiation of implicit functions - Jacobians -Partial differentiation of implicit functions-

Taylor's series for functions of two variables- Errors and approximations - Maxima and minima of functions of two variables- Lagrange's method of undetermined multipliers.

UNIT V - Sequences and series **9**

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

Total Hours: 45

TEXT BOOKS :

1. Grewal B.S., (2014), Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Delhi.
2. Erwin Kreyszig, (2016), Advanced Engineering Mathematics, 10th Edition, John Wiley, India.
3. BaliN.P. and Manish Goyal, (2014), A text book of Engineering Mathematics, Laxmi Publications, New Delhi, India.
4. Veerarajan T**,** (2008), Engineering Mathematics for first year,Tata McGraw-Hill, New Delhi,.
5. Ramana B.V**,** (2010), Higher Engineering Mathematics, 11th Reprint, Tata McGraw Hill New Delhi.
6. Hemamalini. P.T**,** (2014), Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.

REFERENCES:

1. ThomasG.B and. FinneyR.L**,** (2002), Calculus and Analytic geometry, 9th Edition,Pearson**,**.
2. Michale D. Greenberg, (2011),Advanced Engineering Mathematics, 2nd Edition, Books Pearson Education, First Indian reprint.
3. Peter V. O'Neil,(2012), Advanced Engineering Mathematics, 7th Edition, Cengage learning.
4. Gilbert Strang, (2009), Introduction to Linear Algebra, 4th Edition, Wellesley-Cambridge Press.

WEBSITES :

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

SEMESTER-I

21BECC141 **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 is for students to

- Inculcate the basics of properties of matter, sound and its applications.
- 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.
- Explain various applications for engineering based on atomic arrangements of crystals.

COURSE OUTCOMES

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

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

UNIT I – PROPERTIES OF MATTER AND SOUND **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 Hours : 45

TEXT BOOKS:

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

JOURNALS :

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

WEBLINKS:

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

(ii) Laboratory

Course Objectives

The Goal of this course is for students to

- Inculcate the basics of properties of matter, sound and its applications.
- 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.
- Explain various applications for engineering based on atomic arrangements of crystals.

Course Outcomes

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

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

LIST OF EXPERIMENTS – PHYSICS (Any 10 Experiments)

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

Total Hours: 30

SEMESTER-I

21BECC142 **ENGINEERING CHEMISTRY** **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 OBJECTIVE

The goal of this course is for students to

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

COURSE OUTCOMES

Upon completion of the course the students will be able to

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

UNIT I - Periodic properties, Intermolecular forces **9**

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

UNIT II – Electrochemistry and Storage Devices **9**

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

UNIT III – Corrosion and its control **9**

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion - Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings – Organic coatings-Paints - Constituents and functions –Inorganic

coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hot dipping

UNIT IV – Water Technology **9**

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

UNIT V - Spectroscopic techniques and applications **9**

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

.

TEXT BOOKS:

1. B. H. Mahan, (2010).University chemistry, Pearson Education,
2. M. J. Sienko and R. A. Plane, Chemistry: Principles and Applications.
3. C. N. Banwell, (2001)Fundamentals of Molecular Spectroscopy, McGraw-Hill,.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)
5. P. W. Atkins, (2009).Physical Chemistry, Oxford University Press,

REFERENCES:

1. K. P. C. Volhardt and N. E. Schore, (2014).5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman,
2. P C Jain & Monica Jain, (2015).Engineering Chemistry, DhanpatRai Publishing Company,

WEBSITES:

1. https://nptel.ac.in/courses/122/106/122106028/
2. http://ecoursesonline.iasri.res.in/course/view.php?id=534

(ii) Laboratory

COURSE OBJECTIVE

The goal of this course is for students to

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

COURSE OUTCOMES

Upon completion of the course the students will be able to

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

Choice of 10 experiments from the following:

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

Total Hours: 30

SEMESTER-I

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

(Theory & Lab.)

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

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for the students

- Introduces core programming basics including datatypes and operators
- Discuss control structures and string handling
- Course discusses the fundamental principles of Object-Oriented Programming, as well as in-depth data and information processing techniques
- Algorithm development, and program design with functions
- Elaborate the functions of networking in python
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

COURSE OUTCOMES:

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

- Explain various operators used in python.
- Apply the string handling functions to solve the given problem
- Describes various Object-oriented concepts python
- Use image processing techniques in python programming to solve a given problem
- Discuss the functions of networking in python
- Develop various real-time applications using python

UNIT I INTRODUCTION **9**

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

UNIT II CONDITIONAL STATEMENT & STRING HANDLING **9**

Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation – Manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers.

UNIT III OBJECT ORIENTED PROGRAMMING WITH PYTHON **9**

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

UNIT IV IMAGE PROCESSINGWITH PYTHON 9

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

UNIT V NETWORKING WITH PYTHON 9

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES :

1. "Python Essential Reference". Addison-Wesley Professional; 4 edition (July 20, 2009) by David M.Baezly
2. "Python Cookbook" O'Reilly Media; 3rd edition (June 1, 2013) by David M. Baezly.
3. Guido Van Rossum, Fred . L. Drake 'Introduction to Python' – Network Theory Limited – March 2011
4. Alex Martelli 'Python in a Nutshell' - O'Reilly - 2nd Edition, 2006

WEBSITES:

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

(ii) Laboratory

COURSE OBJECTIVES:

The goal of this course is for the students

- Introduces core programming basics including datatypes and operators
- Discuss control structures and string handling
- Course discusses the fundamental principles of Object-Oriented Programming, as well as in-depth data and information processing techniques
- Algorithm development, and program design with functions
- Elaborate the functions of networking in python
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

COURSE OUTCOMES:

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

- Explain various operators used in python.
- Apply the string handling functions to solve the given problem
- Describes various Object-oriented concepts python
- Use image processing techniques in python programming to solve a given problem
- Discuss the functions of networking in python
- Develop various real-time applications using python

LIST OF EXPERIMENTS:

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

Total Hours:30

SEMESTER-I

21BECS111 ENGINEERING GRAPHICS 5H-3C

Instruction Hours/week: L:1 T:0 P:4 **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 importance graphics in engineering
- To learn basic engineering drawing formats
- To develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings.
- To learn to take data and transform it into graphic drawings.
- To elaborate about isometric projections
- To prepare the students to communicate effectively and to use the techniques, skills, and modern engineering tools necessary for engineering practice

COURSE OUTCOMES:

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

- Know and understand the conventions and the method of engineering drawing.
- Interpret engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.
- Improve their visualization skills so that they can apply this skill in developing new products.
- Improve their technical communication skill in the form of communicative drawings.
- Comprehend the theory of projection.

UNIT I INTRODUCTION 9

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

UNIT II FREE HANDSKETCHING 9

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

UNIT III INTRODUCTION TO COMPUTER GRAPHICS – 2D 9

Overview of Computer Graphics, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars, Drawing Area, Dialog boxes and windows, Shortcut menus ,The Command

Line (where applicable), Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Annotations, layering & other functions.

UNIT IV PROJECTION OF POINTS, LINES ANDPLANESURFACES 9

Projection of points and straight lines located in the first quadrant inclined to both planes– Determination of true lengths and true inclinations.Projection of polygonal surface and circular lamina inclined to both reference planes

UNIT V ISOMETRIC PROJECTIONS 9

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple solids, truncated prisms, pyramids, cylinders and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa

Total Hours: 45

TEXT BOOKS:

1. Venugopal K and Prabhu Raja V, (2015), Engineering Graphics, New Age InternationalPublishers.
2. C M Agrawal and Basant Agrawal, (2012), Engineering Graphics, Tata McGraw Hill, NewDelhi.
3. James D. Bethune, (2019), Engineering Graphics with AutoCAD, Macromedia Press.
4. Narayana, K.L. & P Kannaiah, (2010), Text book on Engineering Drawing, ScitechPublishers.

REFERENCES:

1. Shah, M.B. & Rana B.C., (2010), Engineering Drawing and Computer Graphics, PearsonEducation.
2. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar PublishingHouse.

WEBSITE:

1. http://engineeringgraphics.org/

Semester-II

21BECC201 COMMUNICATIVE ENGLISH 4H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES :

The goal of this course is for students

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

COURSE OUTCOMES :

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

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

UNIT: I - COMMUNICATION SKILLS: 9

Communication Skills: Introduction, Definition, The Importance of Communication. The Communication Process – Source, Message, Encoding, Channel, Decoding Receiver, Feedback, Context Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional Barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective-Past Experiences, Prejudices, Feelings, Environment

UNIT:II - ELEMENTS OF COMMUNICATION 9

Introduction, Face to Face Communication- Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication. Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

UNIT: III - BASIC LISTENING SKILLS 9

Introduction, Self-Awareness, Active Listening, Becoming anActive Listener, Listening in Difficult Situations. Effective Written Communication: Introduction, When and When Not to Use Written Communication-Complexity of the Topic, Amount of Discussion's Required,

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

UNIT: IV - INTERVIEW SKILLS AND GIVING PRESENTATIONS 9

Purpose of an interview, Do's and Don'ts of an interview- Interview Handling Skills-Preparation for interviews -Performance during and after interviews -Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.

UNIT: V.-GROUP DISCUSSION 9

Group Discussion: Introduction,Personality traits of Group Discussion-Company's Perspective Communication skills in group discussion, Do's and Don'ts of group discussion-E-MailEtiquette-Memos- Letters

Total Hours : 45

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

TEXT BOOKS:

1. SanjayKumar,Pushpalata, (2011),Communicationskills,1st EditionOxfordPress.
2. Konarnira, (2011), Communication Skills forprofessionals,2nd EditionNew arrivals.
3. JohnAdair,4th Edition, (2009), . Effectivecommunication, 1stEdition CengageLearning Indiapvt.ltd

REFERENCES:

1. ButterField, (2011), Softskillforeveryone, Macmillan.
2. Stephen.P.Robbins, (2013).Communicationskills, OxfordPress

WEBSITES:

1. https://nptel.ac.in/courses/109/106/109106067/
2. https://onlinecourses.nptel.ac.in/noc20_hs14/preview

SEMESTER-II

21BECC202 MATHEMATICS -II 4H-4C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

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

COURSE OUTCOMES:

Upon completion of this course the students will be able

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

UNIT:I - MULTIPLE INTEGRALS 9

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

UNIT:II- VECTOR CALCULUS **9**

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

UNIT:III-ANALYTIC FUNCTIONS **9**

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

UNIT:IV-COMPLEX INTEGRATION **9**

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

UNIT:V-LAPLACE TRANSFORM **9**

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

Total Hours: 45

TEXTBOOKS:

1. Grewal, B.S., (2014), Higher Engineering Mathematics Khanna Publishers, New Delhi, 43rd Edition.
2. Kreyszig Erwin, (2016), Advanced Engineering Mathematics , John Wiley and Sons, 10th Edition, New Delhi.
3. Bali N. P and Manish Goyal, (2011), A Text book of Engineering Mathematics, Eighth Edition, Laxmi Publications Pvt Ltd.
4. Ramana B.V, (2008), Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi.
5. Kandasamy. P, Thilagavathy. K, Gunavathy. K.,(2008), Engineering Mathematics, S Chand & Co. Ltd, New Delhi.
6. Hemamalini. P.T**,** (2014), Engineering Mathematics**,** McGraw Hill Education (India) Private Limited, New Delhi.
7. Venkataraman, M. K.,(2005), Engineering Mathematics, The National Publishing Company, Chennai.
8. Dass, H.K., and Er. Rajnish Verma,(2011), Higher Engineering Mathematics, S. Chand Private Ltd.
9. Glyn James,(2012), Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education.

REFERENCES:

1. Peter V. O'Neil,(2012), Advanced Engineering Mathematics, 7th Edition, Cengage learning.
2. Sastry.S.S,(2014), Engineering Mathematics''. Vol.I&II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi.

3. Wylie, R.C. and Barrett. L.C., (2012), Advanced Engineering Mathematics, Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi.
4. Narayanan. S, Manicavachagampillay.T.K and Ramaniah, (2002),Advanced Mathematics for Engineering Students, Viswanathan S.(Printers and Publishers) Pvt. Ltd. Chennai.

WEBSITES:

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

SEMESTER-II

21BECC203 SEMI- CONDUCTOR PHYSICS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The Goal of this course is for students to

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

COURSE OUTCOMES

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

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

UNIT 1 - ELECTRONIC MATERIALS 9

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

UNIT 2 - SEMICONDUCTORS 9

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

UNIT 3- MAGNETIC, DIELECTRIC, SUPERCONDUCTING PROPERTIES OF MATERIALS 9

Magnetism in materials - magnetic field and induction - magnetization, magnetic permeability and susceptibility, types of magnetic materials - Ferromagnetism: origin and exchange interaction, Domain Theory, soft and Hard magnetic materials - Dielectric materials:

Polarization, Types - dielectric loss, internal field, Clausius - Mosotti relation, dielectric breakdown - Superconductors – properties – Applications.

UNIT 4 - LIGHT-SEMICONDUCTOR INTERACTION **9**

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

UNIT 5 - ENGINEERED SEMICONDUCTOR MATERIALS **9**

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

Total Hours: 45

TEXT BOOKS:

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, (2018).
2. J Donald Neamen, Dhrubes Biswas Semiconductor Physics And Devices, McGraw Hill Education; 4 edition, (2017).
3. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, wiley Publishers, (2006).
4. Leszek Malkinski, Advanced Magnetic Materials , Published by InTech, (2012).
5. Michael Shur, Physics of Semiconductor Devices, Published by Pearson Education; First edition, (2019).
6. Kulkarni, Sulabha K , Nanotechnology: Principles and Practices, Springer International Publishing, (2018).

JOURNALS:

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

WEB LINKS

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

SEMESTER- II

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

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

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to

- To give a comprehensive insight into natural resources
- Understand ecosystem and biodiversity.
- To educate the ways and means of the environment
- To protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.
- Understand various Social issues and its effect on environment

COURSE OUTCOMES (COS):

Upon completion of the course the students will be able to

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

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

UNIT II - NATURAL RESOURCES - RENEWABLE AND NON-RENEWABLE RESOURCES 9

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

studies.Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III - BIODIVERSITY AND ITS CONSERVATION 9

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

UNIT IV - ENVIRONMENTAL POLLUTION 9

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

UNIT V - SOCIAL ISSUES AND THE ENVIRONMENT 9

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

Total Hours: 45

TEXT BOOKS:

1. Anonymous. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
2. Anubha Kaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
3. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
4. Daniel, B. Botkin., and Edward, A. Keller. 1995. Environmental Science John Wiley and Sons, Inc., New York.
5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S.Chand& CompanyPvt. Ltd., New Delhi.
6. Odum,E.P., Odum, H.T. and Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
7. Rajagopalan, R. 2016.Environmental Studies: From Crisis to Cure, Oxford University Press**.**

REFERENCES:

1. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.

2. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources.Daya Publishing House, New Delhi.
3. Tripathy. S.N., andSunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.
4. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology).S.Chand and Company Ltd, New Delhi.
5. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

WEBSITES:

1. https://nptel.ac.in/courses/120108004/

2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/127105018/lec1.pdf

SEMESTER-II

21BECS241 BASIC ELECTRICAL & ELECTRONICS ENGINEERING 6H-5C

(Theory & Lab)

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

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

- To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- To impart the basic knowledge about the AC and DC Electric circuits.
- To introduce fundamental concepts and analysis techniques in electrical engineering to students across all disciplines.
- To understand the working of Electrical Machines and Transformers.
- To understand the working of Power Converters and components of low-voltage electrical installations.

COURSE OUTCOMES:

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

- Demonstrate an understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- Demonstrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical and electronic devices
- Demonstrate an understanding of selection skill to identify the type of generators or motors required for particular application.
- Demonstrate an understanding of basic concepts of transformers their application in transmission and distribution of electric power.
- Demonstrate an understanding of the effects of electric shock and precautionary measures.
- Apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

UNIT I - DC Circuits **9**

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

UNIT II - AC Circuits **9**

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

UNIT III - Electrical Machines And Transformer **9**

Construction and working of a three-phase and Single-phase induction motor. Construction,

working and speed control of DC motor. Magnetic materials, BH characteristics, Construction and working principle of ideal and practical transformer.

UNIT IV- Semiconductor Devices And Digital Electronics 9

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

UNIT V- Measuring Instruments And Electrical Installation 9

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

Total Hours: 45

TEXT BOOKS :

1. S.K.Bhattacharya, "Basic Electrical Engineering", Pearson, 2019.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

REFERENCES :

1. VN Mittle and Arvind Mittal,(2006) ,Basic Electrical Engineeering, McGraw Hill.

2. A.Sudhaka and Shyammohan S Palli,(2013), Circuits and Networks, McGraw Hill.

3.R.Muthusubramanian and S.Salivahanan,(2014),Basic Electrical and Electronics Engineering, McGraw Hill.

WEBSITES:

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

(ii) Laboratory

COURSE OBJECTIVES:

- To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- To impart the basic knowledge about the AC and DC Electric circuits.
- To introduce fundamental concepts and analysis techniques in electrical engineering to students across all disciplines.
- To understand the working of Electrical Machines and Transformers.
- To understand the working of Power Converters and components of low-voltage electrical installations.

COURSE OUTCOMES:

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

- Demonstrate an understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- Demonstrate an understanding of basic concepts of analysis of simple DC and AC circuits used in electrical and electronic devices
- Demonstrate an understanding of selection skill to identify the type of generators or motors required for particular application.
- Demonstrate an understanding of basic concepts of transformers their application in transmission and distribution of electric power.
- Demonstrate an understanding of the effects of electric shock and precautionary measures.
- Apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

LIST OF EXPERIMENTS

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

Total Hours: 30

SEMESTER II

21BECS242 **C PROGRAMMING** **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:

Students undergoing this course are exposed to:

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

COURSE OUTCOMES:

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

- Formulate simple algorithms for arithmetic and logical problems
- Translate the algorithms to programs (in C language)
- Test and execute the programs and correct syntax and logical errors
- Implement conditional branching, iteration and recursion
- Decompose a problem into functions and synthesize a complete program using divide and conquer approach
- Use arrays, pointers and structures to formulate algorithms and programs

UNIT I – INTRODUCTION TO PROGRAMMING **9**

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

UNIT II – ARITHMETIC EXPRESSIONS, PRECEDENCE, CONDITIONAL BRANCHING AND LOOPS 9

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

UNIT III - ARRAY AND BASIC ALGORITHMS **9**

One Dimensional Arrays- Array Manipulation; Searching, Insertion, Deletion Of An Element From An Array- Finding The Largest/Smallest Element In An Array- Two Dimensional Arrays, -

Addition / Multiplication Of Two Matrices- Strings As Array Of Characters.Basic Sorting Algorithms-Bubble, Insertion and Selection sorting, Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT IV - FUNCTION AND RECURSION 9

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

UNIT V - STRUCTURE, POINTERS AND FILE HANDLING 9

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

Total Hours: 45

TEXT BOOKS:

1. E. Balagurusamy, Computing Fundamentals and C Programming, TMH Education, 5thEdition,(2017).
2. E.Balaguruswamy, Programming in ANSIC, Tata McGraw-Hill, 7th Edition,(2017).

REFERENCES:

1. Byron Gottfried, Schaum's, Outline of Programming with C, McGraw-Hill, 3rd Edition, (2017).
2. Brian W.Kernighan and Dennis M.Ritchie, The C Programming Language, Prentice Hall of India, 2nd Edition,(2018).

WEBSITES:

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

(ii) Laboratory

COURSE OBJECTIVES:

The goal of this course is for the students

- To develop programs in C using basic constructs.
- To develop applications in C using file processing
- To provide an awareness to Computing and C Programming
- To learn to develop algorithm for simple problem solving
- To write programs to solve mathematical problems.
- To develop applications in C using strings, pointers, functions, structures

COURSE OUTCOMES:

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

- Formulate the algorithms for simple problems
- Translate given algorithms to a working and correct program
- Correct syntax errors as reported by the compilers
- Identify and correct logical errors encountered at run time
- Write iterative as well as recursive programs
- Represent data in arrays, strings and structures and manipulate them through a program

LIST OF EXPERIMENTS:

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Populate an array with height of persons and find how many persons are above the average height.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
9. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
10. Sort the list of numbers using pass by reference.
11. Generate salary slip of employees using structures and pointers.
12. Compute internal marks of students for five different subjects using structures and functions.

Total hours:30

SEMESTER III

21BECS301 Mathematics-III (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 is for the students

- To understand the basic concepts of set theory.
- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and Engineering.
- To familiarize the applications of algebraic structures.
- To understand the basic concepts of graph theory.

COURSE OUTCOMES:

Upon Completion of this course the students will be able

1. 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.
2. To apply a given logic sentence express it in terms of predicates, quantifiers, and logical connectives.
3. To evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
4. To be exposed to concepts and properties of algebraic structures such as groups, rings and fields.
5. To develop the given problem as graph networks and solve with techniques of graph theory.
6. To 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 Hours: 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 to Computer 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, Discrete Mathematics: 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

SEMESTER-III

21BECS302 SOFTWARE ENGINEERING 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Provide the knowledge of software engineering discipline.
- Understand the software life cycle models
- Understand the importance of modeling and modeling languages
- Do apply analysis, design and testing principles to software project development.
- Demonstrate and evaluate real time projects with respect to software engineering principles.
- Design and develop correct and robust software products

COURSE OUTCOMES

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

- Identify the key activities in managing a software project.
- Compare different process models.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance.
- Manage project schedule, estimate project cost and effort required.

UNIT -I **9**

Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation – life cycle process – development process –system engineering hierarchy.

UNIT- II **9**

Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping - S/W document. Analysis and modelling – data, functional and behavioural models – structured analysis and data dictionary.

UNIT- III **9**

Design process and concepts – modular design – design heuristic – design model and document. Architectural design – software architecture – data design – architectural design – transform and transaction mapping – user interface design – user interface design principles. Real time systems – Real time software design – system design – real time executives – data acquisition system – monitoring and control system.

UNIT- IV **9**

Taxonomy of software testing – levels – test activities – types of s/w test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large. S/W testing strategies – strategic approach and issues - unit testingintegration testing – validation testing – system testing and debugging.

UNIT- V **9**

Measures and measurements – S/W complexity and science measure – size measure – data and logic structure measure – information flow measure. Software cost estimation – function point models – COCOMO model- Delphi method. - Defining Task Network – Scheduling – Earned Value Analysis – Error Tracking - Software changes- program evolution dynamics- software maintenance – Risk management -Architectural evolution.

Total Hours: 45

TEXT BOOKS:

1. Roger S. Pressman, ―Software Engineering – A Practitioner's Approach, Seventh Edition, McGraw-Hill International Edition, 2015.
2. Ian Sommerville, ―Software Engineering, 9th Edition, Pearson Education Asia, 2011.

REFERENCES:

1. Rajib Mall, ―Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited, 2009.
2. PankajJalote, ―Software Engineering, A Precise Approach, Wiley India, 2010.
3. Kelkar S.A., ―Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, ―Software Engineering, Tata McGraw-Hill Publishing Company Limited,2007.

WEBSITES:

1. https://www.edx.org/learn/software-engineering
2. https://www.coursera.org/courses?query=software%20engineering
3. https://swayam.gov.in/nd1_noc20_cs69/preview

SEMESTER III

21BECS341 **DIGITAL ELECTRONICS** **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:

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
- To explain the various semiconductor memories and related technology.
- To introduce the electronic circuits involved in the design of logic gates.

COURSE OUTCOMES:

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

- Understand the characteristics and operations of logic functions and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Understand the functions of semiconductors and memories.
- Use PLDs to implement the given logical problem.
- Describe and compare various memory systems, shift registers and analog to digital and digital to analog conversion circuits

UNIT 1 **9**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT 2 **9**

Standard representation for logic functions, K-map representation, simplification Of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer,De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder,serialadder, ALU, elementary ALU design, popular MSI chips, digital comparator,paritychecker/generator, code converters, priority encoders, decoders/drivers for display devices-M method of function realization.

UNIT 3 **9**

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter,sequence generator,

ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT 4 **9**

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

UNIT 5 **9**

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

Total Hours:45

TEXT BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCES:

1. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. Soumitra Kumar Mandal " Digital Electronics", McGraw Hill Education Private Limited,2016.
3. A.Anand Kumar "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016.
4. Anil K.Maini "Digital Electronics", Wiley, 2014.

WEBSITES:

1. https://www.allaboutcircuits.com/textbook/digital/
2. https://www.allaboutcircuits.com/

ii) Laboratory

COURSE OBJECTIVES:

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits.
- To explain the various semiconductor memories and related technology.
- To introduce the electronic circuits involved in the design of logic gates.

COURSE OUTCOMES:

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

- Understand the characteristics and operations of logic functions and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Understand the functions of semiconductors and memories.
- Use PLDs to implement the given logical problem.
- Describe and compare various memory systems, shift registers and analog to digital and digital to analog conversion circuits

LIST OF EXPERIMENTS :

1. Study of Gates &Flip-flops.
2. HalfAdder and FullAdder.
3. Magnitude Comparator (2-Bit).
4. Encoders and Decoders.
5. Multiplexer and Demultiplexer.
6. Code Converters.
7. Implementation of combinational logic functions using standard ICs
8. Synchronous Counters.
9. Ripple Counter.
10. Implementation of sequential logic functions using standard ICs

Total Hours: 30

SEMESTER III

21BECS342 **DATA STRUCTURES & ALGORITHMS** **7H-5C**

(THEORY & LAB)

Instruction Hours/week: L: 3 T:1 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSEOUTCOMES:

Upon Completion of this course the student will be able:

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

UNIT1: INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS **9**

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

UNIT2: LINEAR DATA STRUCTURES **9**

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

UNIT3: TREES **9**

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

UNIT4: SORTING AND HASHING **9**

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

UNIT 5: GRAPH **9**

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

Total Hours:45

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2nd, Edition,2015.
2. ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2011.
3. Thomas H. Cormen , Charles E. Leiserson, Ronald L. Rivest,Introduction to Algorithms, 3rd Edition by Clifford Stein, 2015.

REFERENCES:

1. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
2. Richard.F, Gilberg A, Behrouz A., Forouzan, "Data Structures- A Pseudocode Approach with C", Thomson Brooks, 2nd, Edition,2008.
3. AhoHopcroft and Ullman, " Data Structures and Algorithms, Pearson Education, 4th Edition,2009.

WEBSITES:

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

(ii) Laboratory

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

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

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

LIST OF EXPERIMENTS

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

Total Hours: 30

SEMESTER-III

21BECS343 OBJECT ORIENTED PROGRAMMING WITH JAVA 7H-5C

(Theory & Lab.)

Instruction Hours/week: L:3 T:1 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory:

COURSE OBJECTIVES:

The goal of this course is for the students to

- To introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.
- To understand Object Oriented Programming concepts and basics of Java.
- To know the principles of packages, inheritance and interfaces.
- To define exceptions and use I/O streams.
- To prepare and execute a professional Program using java.

COURSE OUTCOMES:

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

- Specify simple abstract data types and design implementations, using abstraction functions to document them.
- Develop Java programs using OOP principles
- Develop Java programs with the concepts of inheritance and interfaces
- Build Java applications using exceptions and I/O streams
- Write Programs for handling runtime errors using exception.
- Write Programs to handle various Input / Output Streams.

UNIT I: FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING 10

Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java – Characteristics of Java – The Java Environment – Java Source File Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers – static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages – JavaDoc comments

UNIT II: CLASSES, OBJECTS AND METHODS 9

Defining a Class-Creating Objects-Accessing Class Members-Constructors-Methods Overloading-Static Members-Nesting of Methods-Final Variables and Methods- Final Classes- Finalize Methods-Visibility Control

UNIT III:INHERITANCE AND INTERFACES 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface,

implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, ArrayLists – Strings

UNIT IV:MANAGING ERRORS AND EXCEPTION HANDLING 9

Motivation – Exception handling – Exception hierarchy – Throwing and Catching exceptions - Syntax of Exception Handling Code - Types of Errors -Multiple Catch Statements - Using Finally Statement -User defined Exceptions - Using Exceptions for Debugging.

UNIT V: MULTITHREADING AND GENERIC PROGRAMMING 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups.Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

Total Hours:45

TEXT BOOKS:

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2015.
2. Cay S. Horstmann, Gary cornell,"Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2016.

REFERENCES:

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.
2. Steven Holzner, ―Java 2 Black book, Dreamtech press, 2016.
3. Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2013.

WEBSITES:

1. https://nptel.ac.in/courses/106105153/
2. https://www.javatpoint.com/java-oops-concepts

(ii) Laboratory

COURSE OBJECTIVES:

The goal of this course is for the students to

- A competence to design, write, compile, test and execute straightforward programs using a high level language
- An awareness of the need for a professional approach to design and the importance of good documentation to the finished programs.
- Be able to implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.
- Demonstrate the ability to use simple data structures like arrays in a Java program.
- Implement appropriate program design using good programming style.

COURSE OUTCOMES:

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

- Understand the principles of OOP.
- Demonstrate good object-oriented programming skills in Java.
- Understand the capabilities and limitations of Java.
- Be able to describe, recognize, apply and implement selected design patterns in Java.
- Be familiar with common errors in Java and its associated libraries.
- Be familiar with handling exceptions and templates

LIST OF EXPERIMENTS

1. Write a JAVA program to display default value of all primitive data type of JAVA
2. Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root
3. Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method.
4. Write a JAVA program to implement constructor.
5. Write a JAVA program to implement constructor overloading.
6. Write a JAVA program implement method overloading.
7. Write a JAVA program to implement Single Inheritance
8. Write a JAVA program to implement multi-level Inheritance
9. Write a java program for abstract class to find areas of different shapes
10. Write a JAVA program give example for “super” keyword.
11. Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
12. Write a JAVA program that describes exception handling mechanism
13. Write a JAVA program Illustrating Multiple catch clauses
14. Write a JAVA program that creates threads by extending Thread class .First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds ,(Repeat the same by implementing Runnable)

Total Hours: 30

SEMESTER-IV

21BECS401 **MATHEMATICS-IV** **4H-4C**

(PROBABILITY AND STATISTICS)

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

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

COURSE OUTCOMES:

Upon Completion of this course the students will be ableto:

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

UNIT I –Probability and Random Variables **9**

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 **9**

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 **9**

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

UNIT IV –Design of Experiments **9**

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 **9**

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 for Engineers", Pearson Education, Asia, 8th Edition, 2018.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2019.

REFERENCES

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

WEBSITES:

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

SEMESTER-IV

21BECS402 FORMAL LANGUAGE & AUTOMATA THEORY 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- 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 Distinguish between computability and non-computability and Decidability and
- Undesirability.

COURSE OUTCOMES:

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

- Write a formal notation for strings, languages and machines.
- Design finite automata to accept a set of strings of a language.
- Design context free grammars to generate strings of context free language
- Write the hierarchy of formal languages, grammars and machines.
- Distinguish between computability and non-computability and Decidability and undecidability.
- Demonstrate the relation between regular expressions, automata, languages and grammar with formal mathematical methods

UNIT I **9**

Finite Automata & Regular Expression: Basic Concepts of finite state system, Deterministic and non-deterministic finite automation and designing regular expressions, relationship between regular expression & Finite automata minimization of finite automation mealy & Moore Machines.

UNIT II **9**

Regular Sets of Regular Grammars: Basic Definition of Formal Language and Grammars. Regular Sets and Regular Grammars, closure proportion of regular sets, Pumping lemma for regular sets, decision Algorithms for regular sets, Myhell_Nerod Theory & Organization of Finite Automata

UNIT III **9**

Context Free Languages& Pushdown Automata: Context Free Grammars – Derivations and Languages –Relationship between derivation and derivation trees – ambiguity – simplification of CEG – Greiback Normal form –Chomsky normal forms – Problems related to CNF and GNF Pushdown Automata: Definitions – Moves –Instantaneous descriptions – Deterministic pushdown automata – Pushdown automata and CFL - pumping lemma for CFL -Applications of pumping Lemma.

UNIT IV **9**

Turing Machines: Turing machines – Computable Languages and functions – Turing Machine constructions – Storage infinite control – multiple tracks – checking of symbols – subroutines – two way infinite tape. Undesirability: Properties of recursive and Recursively enumerable languages – Universal Turing Machines as an undecidable problem – Universal Languages – Rice's Theorems.

UNIT V **9**

Linear bounded Automata Context Sensitive Language: Chomsky Hierarchy of Languages and automata, Basic Definition & descriptions of Theory & Organization of Linear bounded Automata Properties of context-sensitive languages.

Total Hours: 45

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Pearson Education,2003 .

REFERENCES:

1. H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", Second Edition, PHI, 2011.
2. J.Martin, "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2016.
3. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole, 2007.
4. Dexter C. Kozen, "Automata and Computability, Undergraduate Texts in Computer Science", Springer,2008.

WEBSITES:

1. https://nptel.ac.in/courses/106103070/
2. https://dl.acm.org/doi/10.1145/2038876.2038893

SEMESTER IV

21BECS403 MICROPROCESSOR AND MICROCONTROLLER 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

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

COURSE OUTCOMES

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

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

UNIT I MICROPROCESSOR 9

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

UNIT II PROGRAMMING OF 8086 9

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

UNIT III ADVANCED PROCESSOR AND MICROCONTROLLER 9

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

UNIT IV INTERFACING WITH PERIPHERALS 9

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

UNIT V INTRODUCTION TO RISC AND ARM 9

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

Total Hours: 45

TEXT BOOKS:

1. R. S. Gaonkar, “Microprocessor Architecture: Programming and Applications with the 8085/8080A”, Penram International Publishing, 2002.
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface”. Morgan Kaufman Publishers 2018
3. Douglas Hall, “Microprocessors Interfacing”, Tata McGraw Hill, 2005.

REFRENCES:

1. Kenneth J. Ayala, “The 8051 Microcontroller”, Clifton Park, NY : Thomson Delmar Learning, 2005.
2. Jonathan W Valvano “Introduction to Arm(r) Cortex-M Microcontrollers”Createspace Independent Publisher 2012

WEBSITES:

1. http://www.engineersgarage.com
2. www.comtechdoc.org
3. www.emu8086.com
4. www.microcontroller.com
5. 5.www.newelectronics.co.uk/electronics
6. 6.http://nptel.ac.in/courses/108107029

SEMESTER IV

21BECS441 **DATABASE MANAGEMENT SYSTEMS** **7H-5C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:1 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for the students

- To understand the different issues involved in the design and implementation of a database system
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database.
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

COURSE OUTCOMES:

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

- Design the databases using ER method and normalization.
- Write queries for relational algebra expressions
- Optimize the developed expressions
- Construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
- Improve the Database Design and Query .
- Understand the advance database concepts like database security, intelligent database, Client/Server and Data Warehousing.

UNIT 1: Database System Architecture **9**

Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

UNIT 2: Relational Query Languages **9**

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. **Query processing and optimization**: Evaluation of

relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

UNIT III Normalization **9**

Introduction and problem of data redundancy-Features of good Relational database design-Functional Dependencies - Normalization – First Normal Form, Second Normal Form and Third Normal Form –Advanced Normalization -Boyce/Codd Normal Form, Fourth Normal Form and Fifth Normal Form- Dependencies preservation-Case Studies of database system.

UNIT IV Transaction And Concurrency **9**

Transaction Concepts – ACID Properties –Transactions and Schedules- Transaction States - Concurrent Execution- Serializability- Types of Failure-Recoverability -System Recovery – Media Recovery – Types of Locks-Two Phase locking – DeadlockDetection, Recovery and Prevention.

UNIT V Physical Storage And Database Concepts **9**

Overview of Physical Storage Media – Magnetic Disks – RAID – Introduction to Distributed Databases and Client/Server Databases- Statistical Databases- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Object Oriented Databases-XML Databases.

Total : 45 Hours

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan,"Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition,Pearson Education, 2011.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2016.
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill
3. College Publications, 2015.
4. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2014.

WEBSITES:

1. https://nptel.ac.in/courses/106105175/
2. https://www.w3schools.in/dbms/

(ii) Laboratory:

COURSE OBJECTIVES:

The goal of this course is for the students

- To understand the different issues involved in the design and implementation of a database system
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database.
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

COURSE OUTCOMES:

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

- Design the databases using ER method and normalization.
- Write queries for relational algebra expressions
- Optimize the developed expressions
- Construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
- Improve the Database Design and Query .
- Understand the advance database concepts like database security, intelligent database, Client/Server and Data Warehousing.

LIST OF EXPERIMENTS

1. Data Definition Language (DDL) commands in RDBMS.
2. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.
3. High-level language extension with Cursors.
2. High level language extension with Triggers
3. Procedures and Functions.
4. Embedded SQL.
5. Database design using E-R model and Normalization.
6. Design and implementation of Payroll Processing System.
7. Design and implementation of Banking System.
8. Design and implementation of Library Information System.
9. Database connectivity using JDBC
10. Database connectivity using ODBC

Total hours: 30

Semester-IV

21BECS442 **COMPUTER NETWORKS** **7H-5C**

(Theory & Lab.)

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

End Semester Exam:3 Hours

(i) Theory:

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Develop and understand the modern network architectures from design and performance perspective.
- Data Link Layer and Medium Access Sub Layer
- Introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- Provide an opportunity to do network programming
- Design and implement a network protocol.

COURSE OUTCOMES:

Upon Completion of the course the student will be able to

- Explain the functions of the different layer of the OSI Protocol.
- Draw the functional block diagram of wide-area networks(WANs), local area
- networks(LANs) and Wireless LANs (WLANs).
- Develop the network programming for a given problem related TCP/IP protocol.
- Configure DNS DDNS,TELNET, EMAIL, File Transfer Protocol(FTP), WWW, HTTP,
- SNMP, Bluetooth, Firewalls using open source available software and tools.
- Explain the types of transmission media with real time applications
- Implement any topology using network devices

UNIT1: INTRODUCTION **9**

Introduction to Computer Networks: Need for Networking - Service Description – Connectionless and Connection-Oriented Services – Circuit and Packet Switching – Access Networks and Physical Media – Wireless Links and Characteristics – Queuing Delay and Packet Loss – Internet Protocol stack – OSI Reference Model - Service Models – History of Computer Networking and the Internet.

UNIT 2: DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER **9** Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols-Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA

UNIT 3: NETWORK LAYER **9**

Switching, Logical addressing – IPV4, IPV6;Address mapping – ARP, RARP,BOOTP and DHCP–

Delivery, Forwarding and Unicast Routing protocols.

UNIT 4: TRANSPORT LAYER **9**

Process to Process Communication, User Datagram Protocol(UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques:Leaky Bucket and Token Bucket algorithm.

UNIT 5: APPLICATION LAYER **9**

Principles of Network Applications – The Web and HTTP – FTP – Electronic Mail – SMTP – Mail Message Formats and MIME – DNS – Socket Programming with TCP and UDP. Multimedia Networking: Internet Telephony – RTP – RTCP – RTSP. Network Security: Principles of Cryptography – Firewalls – Application Gateway – Attacks and Countermeasures.

Total hours: 45

TEXT BOOKS:

1. Behrouz A.Forouzan , Data Communication and Networking,4th Edition,McGraw- Hill, 2017.
2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Prentice Hall India,2018.

REFERENCES:

1. Andrew S.Tanenbaum, Computer Networks,8th Edition,Pearson New International Edition, 2017.
2. Douglas Comer ,Internetworking with TCP/IP, Volume 1, 6th Edition, Prentice Hall of India, 2018.
3. W. Richard Stevens, TCP/IP Illustrated, Volume 1,Addison-Wesley,United States of America,2018.

WEBSITES:

1. https://networkreader.wordpress.com
2. https://w3.cs.jmu.edu/bernstdh/web/common/references/networking.php

(ii) Laboratory:

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Develop and understand the modern network architectures from design and performance perspective.
- Data Link Layer and Medium Access Sub Layer
- Introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- Provide an opportunity to do network programming
- Design and implement a network protocol.

COURSE OUTCOMES:

Upon Completion of the course the student will be able to

- Explain the functions of the different layer of the OSI Protocol.
- Draw the functional block diagram of wide-area networks(WANs), local area
- networks(LANs) and Wireless LANs (WLANs).
- Develop the network programming for a given problem related TCP/IP protocol.
- Configure DNS DDNS,TELNET, EMAIL, File Transfer Protocol(FTP), WWW, HTTP,
- SNMP, Bluetooth, Firewalls using open source available software and tools.
- Explain the types of transmission media with real time applications
- Implement any topology using network devices

LIST OF EXPERIMENTS

1. Implementation of Sliding Window Protocol.
2. Study of Socket Programming and Client - Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting .
8. Applications using TCP Sockets like Echo client and echo server
9. Applications using TCP and UDP Sockets like File Transfer
10. Study of Network simulator (NS3), Wireshark

Total hours: 30

SEMESTER V

21BECS501 **SERVLETS AND JSP** **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 be:

- To Explain the concepts required for developing the web applications using Servlets.
- To introduce concepts of JSP
- To Discuss in detail, the scripting elements and directives in JSP
- To Illustrate the development of Simple and advanced custom tags
- To discuss advance custom tags and jstl
- To Discuss the use of Java Beans and its real world applications.

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to:

- Construct and deploy small-to-medium scale web by using Java Server Page technology and servlets.
- Apply Model-View-Controller architecture to develop projects
- Understand and manage JSP action and custom tags.
- Analyze, design, develop and deploy web applications using Java Beans.
- Able to do server side programming with Java Servlets, JSP and PHP
- Gain Knowledge of client side scripting using java Script and DHTML.

UNIT I SERVLETS 9

Web Application - Java Servlets - Servlet Lifecycle – Servlet API-Servlet Interface-Http Servlet Class-Generic Servlet Class, Servlet Config, Servlet Context, Servlet Communication-Servlet-Browser Communication, Web-Component Communication, Servlet-Applet Communication, Session Tracking, Web Security.

UNIT II INTRODUCTION TO JSP 9

Introduction to Java Server Pages - Features of JSP – JSP Tag Library-Life Cycle of JSP-Syntax-Directives-Actions-Implicit Objects - Client request - Server response - Cookies Handling-Session Tracking-MVC Architecture - 3-tier architecture. Advantages of JSP over competing technologies.

UNIT III JSP SCRIPTING ELEMENTS AND DIRECTIVES 9

Forms of Scripting Elements - Predefined Variables - Examples using Scripting Elements - JSP Directives - JSP Page Directive - JSP Include Directive

UNIT IV JSP ACTIONS AND CUSTOM TAGS 9

JSP Actions - include Action - forward Action - plugin Action - Java Beans - Bean Related – Actions - Custom Tag - Types of Tags - Creating Custom Tags

UNIT V ADVANCE CUSTOM TAGS AND JSTL 9

Introduction - Using Simple Tag - Using tag files - JSP Standard Tag Library – purpose JSTL - Using Expression Language - Using JSTL

Total Hours: 45

TEXT BOOKS:

1. Joel Murach and Michael Urban," Murachs Java Servlets & JSP ", 3rd Edition, 2014.
2. Mahesh P. Matha, "JSP and Servlets: A Comprehensive Study", Prentice-Hall of India Pvt.Ltd,2013.
3. GiulioZambon" Beginning JSP, JSF and Tomcat: Java Web Development", Apress Kindle edition,2012.

REFERENCES:

1. Santosh Kumar K , "Jdbc, Servlets, And Jsp Black Book", Dreamtech Press , New
2. edition 2008.
3. Panduranga, S.N., Goyal, "Beginning Jsp 2", Springer/A Press ,Edition1,2004.
4. Phil Hanna, "The Complete reference JSP 2.0", Tata McGraw-Hill Education, 2003.

WEBSITES:

1. www.jsptut.com/
2. www.**tutorial**spoint.com/**jsp**/
3. www.javatpoint.com/**jsp-tutorial**

SEMESTER V

21BECS502 **ARTIFICIAL INTELLIGENCE** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

COURSE OUTCOMES:

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

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence.

UNIT I: INTRODUCTION **9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–

Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II: PROBLEM-SOLVING METHODS **9**

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

UNIT III: KNOWLEDGE REPRESENTATION **9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward

Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT IV: SOFTWARE AGENTS **9**

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

UNIT V: APPLICATIONS **9**

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

Perception – Planning – Moving.
TOTAL:45 PERIODS

TEXTBOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice-Hall, Third Edition, 2009.
2. I.Bratko, "Prolog: Programming for Artificial Intelligence", Fourth Edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.
2. Nils J. Nilsson,"The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
4. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

WEBSITES:

1. https://swayam.gov.in/nd1_noc20_cs42/preview

SEMESTER V

21BECS503 DESIGN AND ANALYSIS OF ALGORITHMS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The Goal of this course for the students to:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

COURSE OUTCOMES:

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

- Analyze worst-case, average case and the best case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
- Describe the greedy paradigm and explain when an algorithmic design situation calls for it and to develop the greedy algorithms.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. To synthesize divide-and-conquer algorithms.
- Derive and solve recurrence relations

2. Describe the dynamic-programming paradigm and explain when an algorithmic Design situation calls for it. For a given problems of dynamic-programming develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
3. Write the effective algorithms to solve engineering problems

UNIT 1 **9**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

UNIT 2 **9**

Brute Force Method: General Method-Selection Sort-Bubble Sort-Closest-Pair and Convex Hull. Divide and Conquer Method: General Method-Binary Search-Merge Sort-Quick sort-Min & Max- Strassen's Matrix Multiplication. Greedy Method: General Method-Knapsack Problem-Scheduling Algorithm-Optimal Storage on tapes-merge pattern.

UNIT 3 **9**

Dynamic Programming: Multi Stage Graph, Travelling Salesman Problem -0/1 Knapsack Problem. Backtracking: N-Queens Problem-Sum of Subsets-Graph Coloring-Hamiltonian Cycle. Branch and Bound: LC search-15 Puzzle Problem-Bounding-FIFO branch and bound-0/1 Knapsack -Travelling Salesman Problem

UNIT 4 **9**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

UNIT 5 **9**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Total Hours:45

TEXT BOOKS:

1. Anany Levitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

REFERENCES:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.
3. Harsh Bhasin, ―Algorithms Design and Analysis‖, Oxford university press, 2016.
4. S. Sridhar, ―Design and Analysis of Algorithms‖, Oxford university press, 2014.

WEBSITE:

1. https://nptel.ac.in/courses/106106131/
2. https://www.javatpoint.com/daa-tutorial

SEMESTER V

21BECS541 COMPUTER ORGANIZATION &ARCHITECTURE 7H-5C

(THEORY AND 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 the students to:

- To understand the basic principles and organization of computer architecture
- To impart knowledge of Instruction Level Architecture and Instruction Execution
- To understand the current state of art in memory system design
- To understand how I/O devices are accessed.
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on micro programming and advanced pipelining techniques.

COURSE OUTCOMES:

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

- Draw the functional block diagram of a single bus architecture of a computer
- Describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
- Write assembly language program for specified microprocessor for computing
  16 bit multiplication, division and I/O device interface (ADC,
  Control circuit, serial port communication).
- Write a flowchart for Concurrent access to memory and cache coherency in Parallel
  Processors and describe the process.
- Design a memory module and analyze its operation by interfacing with the CPU.
- Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

UNIT 1: 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 2: 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 3: 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 4: 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 5: 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 Hours:45

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kaufmann / Elsevier, 2009.
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", Sixth Edition, Pearson Education, 2003.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 2098.
3. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

WEBSITE:

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

(ii) Laboratory

COURSE OBJECTIVES:

The Goal of this course for the students to:

- To understand the basic principles and organization of computer architecture
- To impart knowledge of Instruction Level Architecture and Instruction Execution
- To understand the current state of art in memory system design
- To understand how I/O devices are accessed.
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on micro programming and advanced pipelining techniques.

COURSE OUTCOMES:

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

- Draw the functional block diagram of a single bus architecture of a computer
- Describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
- Write assembly language program for specified microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
- Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
- Design a memory module and analyze its operation by interfacing with the CPU.
- Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

List of Experiments:

1. Write the working of 8085 simulator GNUsim8085 and basic architecture of 8085 along with small introduction.
2. Study the complete instruction set of 8085 and write the instructions in the instruction set of 8085 along with examples.
3. Write an assembly language code in GNUsim8085 to implement data transfer instruction.
4. Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.
5. Write an assembly language code in GNUsim8085 to implement arithmetic instruction.
6. Write an assembly language code in GNUsim8085 to add two numbers using lxi instruction.
7. Write an assembly language code in GNUsim8085 to add two 8 bit numbers stored in memory and also storing the carry.
8. Write an assembly language code in GNUsim8085 to find the factorial of a number.
9. Write an assembly language code in GNUsim8085 to implement logical instructions.
10. Write an assembly language code in GNUsim8085 to implement stack and branch instructions.

Total Hours:30

SEMESTER V

21BECS542 OPERATING SYSTEMS 4H-5C

(THEORY & LAB)

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

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.

COURSE OUTCOMES:

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

- Understand the different concepts and functions of Operating Systems.
- Design various Scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems.

UNIT1 **9**

Introduction: Mainframe Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems - Real Time Systems – Hardware Protection – System Components – Handheld Systems - Operating System Services – System Calls – System Programs - Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication.

UNIT II **9**

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF,

RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution,Strict Alternation, Peterson's Solution,The Producer\Consumer Problem, Semaphores, Event Counters, Monitors,Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

UNIT III **9**

Process Management: Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors, CPU Scheduling and Deadlocks.

UNIT IV **9**

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT V **9**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File ,free space management (bit vector ,linked list ,grouping)directory implementation (linear list ,hash table)efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Total Hours:45

TEXT BOOKS:

1. D M Dhamdhere, "Operating Systems: A Concept-based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
2. William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition, Prentice Hall, 2011.

REFERENCES:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts Essentials", John Wiley & Sons Inc., 2010.
2. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition,Tata McGraw-Hill Education, 2007.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 2096.

WEBSITES:

1) https://nptel.ac.in/courses/106105214/

2)https://nptel.ac.in/courses/106/106/106106144/

(ii) Laboratory

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.

COURSE OUTCOMES:

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

- Understand the different concepts and functions of Operating Systems.
- Design various Scheduling algorithms.
- Apply the principles of concurrency.
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems.

LIST OF EXPERIMENTS

(Implement the following on LINUX platform. Use C for high level language implementation)

1. Shell programming
   - command syntax
   - write simple functions
   - basic tests
2. Shell programming
   - loops
   - patterns
   - expansions
   - substitutions
3. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
4. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
5. Write C programs to simulate UNIX commands like ls, grep, etc.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
7. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time

8. Implement the Producer – Consumer problem using semaphores.
9. Implement some memory management schemes – I
10. Implement some memory management schemes – II
11. Case study: “awk” Scripting Language.

Total Hours:30

B.E COMPUTER SCIENCE AND ENGINEERING **2021-2022**

SEMESTER V

21BECS551	**INPLANT TRAINING**	**2H-0C**

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

End Semester Exam:3 Hours

SEMESTER-VI

21BECS601 **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:

- Define basic concepts of cloud computing.
- Use and Examine different cloud computing services.
- Understand and appreciate the technological impact of service and cloud computing for future enterprises, and the technologies underpinning it.
- Describe importance of virtualization along with their technologies
- Analyze the key components of Amazon web Service
- Review and assess the risks, opportunities, costs and steps towards migrating existing systems to service and cloud computing.

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 Hours: 45

TEXT BOOKS:

1. John Rittinghouse & 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"
2. (Wiley India Edition), 2015.
3. Antohy T Velte , Cloud Computing : "A Practical Approach", McGraw Hill,2018.

WEBSITES:

1. https://nptel.ac.in/courses/106105167/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/126104006/lec43.pdf
3. https://www.cse.wustl.edu/~jain/cse571-14/ftp/cloud_security/index.html

Semester-VI

21BECS602 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 is for the students 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
- Obtain the knowledge in handling sensitive data.

COURSE OUTCOMES:

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

- Understand why there is a need for data warehouse in addition to traditional operational database system
- Identify components in typical data warehouse architectures
- Understand why there is a need for data mining and in what ways it is different from traditional statistical techniques
- Understand the details of different algorithms
- Solve real data mining problems to find interesting patterns
- Understand a typical knowledge discovery process

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 8

Data mining-KDD versus datamining, Stages of the Data Mining Process-task premitives, 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 10

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 DATA WAREHOUSING AND DATA MINING SOFTWARE'S AND APPLICATIONS 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 Hours: 45

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMc Graw Hill Edition, Tenth Reprint 2007.
3. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Easter EconomyEdition, Prentice Hall of India, 2006.

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

Semester-VI

21BECS641 **COMPILER DESIGN** **7H-5C**

(Theory & Lab.)

Instruction Hours/week: L:3 T:1 P:4 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(ii) Theory

COURSE OBJECTIVES:

The goal of this course is for the students to :

- To learn the various phases of a compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement the front-end of the compiler.
- To learn to implement a code generator.

COURSE OUTCOMES :

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

- Understand the different phases of a compiler.
- Design a lexical analyzer for a sample language.
- Apply different parsing algorithms to develop the parsers for a given grammar.
- Understand syntax-directed translation and run-time environment.
- Learn to implement code optimization techniques and a simple code generator.
- Design and implement a scanner and a parser using LEX and YACC tools.

UNIT I: INTRODUCTION TO COMPILERS **9**

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

UNIT II: SYNTAX ANALYSIS **12**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top-Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR(0) Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT III: INTERMEDIATE CODE GENERATION **8**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

UNIT IV: RUN-TIME ENVIRONMENT AND CODE GENERATION 8

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

UNIT V: CODE OPTIMIZATION 8

Principal Sources of Optimization – Peep-hole optimization - DAG(Direct Acyclic Graph)- Optimization of Basic Blocks Global Data Flow Analysis - Efficient Data Flow Algorithm.

Total Hours: 45

TEXTBOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Second Edition, Pearson Education, 2009.

REFERENCES :

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 2093.

WEBSITES:

1. http://www.tenouk.com/ModuleW.html/
2. http://www.mactech.com/articles/mactech/Vol.06/06.04/Lexical Analysis/index.html
3. https://swayam.gov.in/nd1_noc20_cs13/preview

(ii) Laboratory:

COURSE OBJECTIVES:

The goal of this course is for the students to :

- To learn the various phases of a compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To learn to implement the front-end of the compiler.
- To learn to implement a code generator.

COURSE OUTCOMES :

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

- Understand the different phases of a compiler.
- Design a lexical analyzer for a sample language.
- Apply different parsing algorithms to develop the parsers for a given grammar.
- Understand syntax-directed translation and run-time environment.
- Learn to implement code optimization techniques and a simple code generator.
- Design and implement a scanner and a parser using LEX and YACC tools.

List of Experiments

1. Symbol table
2. Lexical analysis recognize in c
3. Lexical analyzer using lex tool
4. Generate yacc specification for a few syntactic categories: Arithmetic expression that uses operator +,-,* and /.
5. Letter followed by any number of letters or digits
6. Calculator using lex and yacc
7. BNF rules into YACC
8. Type Checking
9. Control flow analysis and data flow analysis
10. Implementation of any one storage allocation strategies(heap, stack, static)
11. Construction of DAG
12. Implement the back end of the compiler
13. Simple code optimization

Total hours: 30

Semester-VI

21BECS642 **OBJECT ORIENTED ANALYSIS & DESIGN** **7H-5C**

(Theory & Lab)

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

End Semester Exam:3 Hours

(i) Theory

COURSE OBJECTIVES:

The goal of this course is for the students to :

- To understand the fundamentals of object modeling
- To understand and differentiate the Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification

COURSE OUTCOMES

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

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
- Understand the various testing methodologies for OO software
- To understand the use-case diagrams.

UNIT I: UNIFIED PROCESS AND USE CASE DIAGRAMS **9**

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study– the NextGen POS system, Inception -Use case Modelling – Relating Use cases –include, extend and generalization – When to use Use-cases.

UNIT II: STATIC UML DIAGRAMS **9**

Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams.

UNIT III: DYNAMIC AND IMPLEMENTATION UML DIAGRAMS **9**

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration

diagram – When to use Communication Diagrams - State machine diagram and Modeling –When to use State Diagrams - Activity diagram – When to use activity diagrams Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams.

UNIT IV: DESIGN PATTERNS **9**

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral – Strategy – the observer –Applying GoF design patterns – Mapping design to code.

UNIT V: TESTING **9**

Object-Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans.

Total Hours: 45

TEXTBOOKS:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.
2. Ali Bahrami," Object-Oriented Systems Development"- McGraw Hill International Edition - 2099.

REFERENCES:

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ―Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 2095.
3. Martin Fowler, ―UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003.

WEBSITES:

1. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-cs25/
2. https://nptel.ac.in/courses/106/105/106105151/

(ii) Laboratory

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To understand the fundamentals of object modeling
- To understand and differentiate the Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification

COURSE OUTCOMES

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

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
- Understand the various testing methodologies for OO software
- To understand the use-case diagrams.

LIST OF EXPERIMENTS

To develop a mini-project following the 13 exercises listed below.

1. To develop a problem statement.
2. Develop an IEEE standard SRS document. Also develop risk management and project
3. plan (Gantt chart).
4. Identify Use Cases and develop the Use Case model.
5. Identify the business activities and develop an UML Activity diagram.
6. Identity the conceptual classes and develop a domain model with UML Class diagram.
7. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
8. Draw the State Chart diagram.
9. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
10. Implement the Technical services layer.
11. Implement the Domain objects layer.
12. Implement the User Interface layer.
13. Draw Component and Deployment diagrams.

Total Hours:30

SEMESTER VII

21BECS701 MACHINE LEARNING 3H-3C

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

Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- To introduce the basic concepts and techniques of Machine Learning.
- To have a complete understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To learn Dimensionality Reduction Techniques.
- To understand Evolutionary Models and Graphical models of machine learning algorithms
- To design appropriate machine learning algorithms for problem solving

COURSE OUTCOMES

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

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Apply the appropriate machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
- Design systems that uses the appropriate graph models of machine learning
- Modify existing machine learning algorithms to improve classification accuracy / efficiency
- Analyse and suggest appropriate machine learning approaches for various types of problems

UNIT I INTRODUCTION 9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING **9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V ADVANCED LEARNING **9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Total Hours: 45

TEXT BOOKS:

1. Michael Bowles, "Machine Learning in Python-Essential Techniques for Predictive Analysis", Wiley Publication, 2015.
2. Stephen Marsland, "MachineLearning – An Algorithmic Perspective",SecondEdition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014.

REFERENCES:

1. EthemAlpaydin,"Introduction to Machine Learning",3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press,2014
2. Tom MMitchell,"Machine Learning",First Edition,McGrawHill Education, 2013.
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.

WEBSITES:

1. https://nptel.ac.in/courses/106106139/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
3. https://www.dataquest.io/blog/machine-learning-python/

Semester-VII

21BECS702 PROFESSIONAL ETHICS AND ENTREPRENEURSHIP DEVELOPMENT **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- To enable the students to create an awareness on engineering professional ethics, to install moral and social values and loyalty and to appreciate the rights of others
- To understand the rights and responsibilities
- To understand Responsibilities of employee, team member and a global citizen.
- To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.
- To have an adequate knowledge about MNC's, Business, Environmental, Computer Ethics, Honesty, Moral Leadership, sample Code of Conduct.

COURSE OUTCOMES:

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

- Discuss and communicate the management evolution and how it will affect future managers.
- Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues.
- Practice the process of management's four functions: planning, organizing, leading, and controlling.
- Excel in competitive and challenging environment and contribute to industry through professional careers.
- Use the engineering principles to update and maintain the technical skills and continuing their education throughout their professional career.
- Understand professional, ethical values and the knowledge of contemporary issues.

UNIT I ENGINEERING ETHICS **9**

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

UNIT II HUMAN VALUES **9**

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

UNIT III GLOBAL ISSUES 9

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

UNIT IV HISTORICAL DEVELOPMENT, PLANNING, ORGANISING 9

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

UNIT V ENTREPRENEURSHIP DEVELOPMENT 9

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

Total Hours: 45

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

REFRENCES:

1. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
2. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
3. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011

WEBSITES:

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

SEMESTER VII

21BECS741 **INTERNET OF THINGS** **7H-5C**

(Theory &Lab)

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

End Semester Exam:3 Hours

(i) Theory:

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the basics of Internet of Things
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things
- To understand the concepts of Web of Things
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing
- To understand the IOT protocols

COURSE OUTCOMES:

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

- Identify and design the new models for various applications using IoT
- Explain the underlying architectures and models in IoT.
- Analyse different connectivity technologies for IoT.
- Develop simple applications using Arduino / Raspberry Pi.
- Analyze and design different models for network dynamics
- Apply data analytics techniques to IoT. Study the needs and suggest appropriate solutions for Industrial applications.

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

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 AND IOT SECURITY **9**

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics – Network Analytics Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

UNIT V IOT IN INDUSTRY **9**

Manufacturing, Architecture, Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, Use cases – Transportation, Architecture, Use cases.

Total Hours: 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 -2012
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, Wiley, 2012

WEBSITES:

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

ii) Laboratory:

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the basics of Internet of Things
- To get an idea of some of the application areas where Internet of Things can be applied
- To understand the middleware for Internet of Things
- To understand the concepts of Web of Things
- To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing
- To understand the IOT protocols

COURSE OUTCOMES:

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

- Identify and design the new models for various applications using IoT
- Explain the underlying architectures and models in IoT.
- Analyse different connectivity technologies for IoT.
- Develop simple applications using Arduino / Raspberry Pi.
- Analyze and design different models for network dynamics
- Apply data analytics techniques to IoT. Study the needs and suggest appropriate solutions for Industrial applications.

LIST OF EXPERIMENTS:

1. Study and Install Python in Eclipse and WAP for data types in python.
2. Write a Program for arithmetic operation in Python.
3. Write a Program for looping statement in Python.
4. Study and Install IDE of Arduino and different types of Arduino.
5. Write program using Arduino IDE for Blink LED.
6. Write Program for RGB LED using Arduino.
7. Study the Temperature sensor and Write Program foe monitor temperature using
8. Arduino. Study and Implement RFID, NFC using Arduino.
9. Study and implement MQTT protocol using Arduino.
10. Study and Configure Raspberry Pi.
11. WAP for LED blink using Raspberry Pi.
12. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.

Total Hours:30

SEMESTER-VII

21BECS703 BIG DATA AND ITS APPLICATIONS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Explore the fundamental concepts of big data analytics
- Learn and analyze big data like Hadoop, NoSQL MapReduce.
- Learn the techniques and principles in achieving big data analytics with scalability and streaming capability
- Understand the various search methods and visualization techniques.
- Learn clustering and classification in big data.

COURSE OUTCOMES:

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

- Gain knowledge of Big Data and Hadoop ecosystem
- Understand clustering and classification concepts in big data
- Design and implement MapReduce programs and implementing HBase
- Implement Hive scripts in the Hadoop Environment.
- Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

UNIT I INTRODUCTION 9

Introduction to BigData Platform –Challenges of Conventional Systems -Intelligent data analysis –Nature of Data -Analytic Processes and Tools -Analysis vs Reporting-Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions -Re-Sampling -Statistical Inference -Prediction Error.

UNIT II MINING DATA STREAMS 9

Introduction To Streams Concepts –Stream Data Model and Architecture -Stream Computing -Sampling Data in a Stream –Filtering Streams –Counting Distinct Elements in a Stream –Estimating Moments –Counting Oneness in a Window –Decaying Window -Real time Analytics Platform(RTAP)Applications -Case Studies -Real Time Sentiment Analysis, Stock Market Predictions.

UNIT III HADOOP 9

History of Hadoop-The Hadoop Distributed File System –Components of Hadoop-Analyzing the Data with Hadoop-Scaling Out-Hadoop Streaming-Design of HDFS-Java interfaces to HDFSBasics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort –Task execution -Map Reduce Types and Formats-Map Reduce Features

UNIT IV CLUSTERING AND CLASSIFICATION 9

Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose

and Cautions .- Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes‘ Theorem – Naïve Bayes Classifier.

UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9

NoSQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Sharding –Hbase – Analyzing big data with twitter – Big data for E-Commerce Big data for blogs – Review of Basic Data Analytic Methods using R programming.

Total Hours: 45

TEXT BOOKS:

1. Zikopoulos, Paul, Chris Eaton, “Understanding Big Data: Analytics for Enterprise Class Hadoopand Streaming Data”, Tata McGraw Hill Publications, 2011
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing,2012
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge UniversityPress,2012.
4. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013.

REFERENCES:

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, JohnWiley& sons, 2012.
2. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007
3. PeteWarden, “Big Data Glossary”, O"Reilly, 2011.
4. Paul Zikopoulos ,DirkdeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles David Corrigan , Harness the Power of Big Data -The IBM Big Data Platform, Tata McGraw HillPublications, 2012.

WEBSITES:

1. https://nptel.ac.in/courses/106104189/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106104189/lec2.pdf
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106104189/lec5.pdf

B.E COMPUTER SCIENCE AND ENGINEERING 2021-2022

SEMESTER VII

21BECS791	**Project Work Phase-I**	**6H-4C**

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

End Semester Exam:3 Hours

SEMESTER-VIII

21BECS801 **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 is for the students:

- To understand the basics of Information Security and its model.
- To learn the legal, ethical and professional issues in Information Security.
- To understand the need for risk management and risk control.
- To study the critical need for ensuring Information Security in Organizations.
- To learn the security policy, standards and security analyzing tools.
- Develop cybersecurity strategies and policies

COURSE OUTCOMES:

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

- Analyze the appropriate techniques to tackle and solve problems in the discipline of information security management.
- Gain the knowledge of security and its management for any modern organization.
- Develop an understanding of security policies to implement such policies in the form of message exchanges.
- Develop a security management system that should be planned, documented, implemented and improved, according to the security standard on information security management.
- Use and Examine the threats by security analysis tools
- Design operational and strategic cybersecurity strategies and policies.

UNIT I **9**

History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

UNIT II **9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues– An Overview of Computer Security – Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT III 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk– Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNIT IV LOGICAL DESIGN **9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN **9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

Total Hours: 45

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord. "Principles of Information Security", Second Edition, Vikas Publishing House, New Delhi, 2018.
2. Charles B. Pfleeger, and Shari Lawrence Pfleeger, "Security in Computing", Pearson Education, Third Edition, 2017.

REFERENCES:

1. Micki Krause, Harold F. Tipton," Handbook of Information Security Management", Auerbach Publications, 4th Edition,2012.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 7th Edition, 2012.

WEBSITES:

1. https://nptel.ac.in/courses/106106129/
2. https://nptel.ac.in/courses/106105031/
3. https://resources.infosecinstitute.com/key-elements-information-security-policy/#gref

SEMESTER VIII

21BECS802 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:

- Understand how blockchain systems (mainly Bitcoin and Ethereum) work
- To securely interact with them
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from blockchain technology into their projects.
- Introduce application areas, current practices, and research activity

COURSE OUTCOMES

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

- Understand the design principles of Bitcoin and Ethereum.
- Understand the Nakamoto consensus.
- Understand the Simplified Payment Verification protocol.
- List and describe differences between proof-of-work and proof-of-stake consensus.
- Interact with a blockchain system by sending and reading transactions.
- Design, build and deploy a distributed application.
- Evaluate the security, privacy, and efficiency of a given blockchain system.

UNIT I: BASICS **9**

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. **Cryptography:** Hash function, Digital Signature - ECDSA(Elliptic Curve Digital Signature Algorithm), Memory Hard Algorithm, Zero Knowledge Proof.

UNIT II: BLOCKCHAIN **9**

Introduction, Advantage over the conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

UNIT III: DISTRIBUTED CONSENSUS **9**

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization, and alternate.

UNIT IV: CRYPTOCURRENCY **9**

History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO(Decentralized Autonomous Organization), Smart Contract, GHOST(Greedy Heaviest Observed Subtree), Vulnerability, Attacks, Sidechain, Namecoin

UNIT V: CRYPTOCURRENCY REGULATION **9**

Stakeholders, Roots of Bitcoin, Legal Aspects-Crypto currency Exchange, Black Market, and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Tutorial & Practical: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

TOTAL: 45 PERIODS

TEXTBOOK:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 20, 2016).
2. 2.Andreas M.Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain" O'Reilly, Media;2 edition(12 June 2017).

REFERENCE BOOKS :

1. Andreas M. Antonopoulos,Gavin Wood "Mastering Ethereum: Building Smart Contracts and DApps" O'Reilly Media; 1 edition (13 November 2018).
2. Don Tapscott, Alex Tapscott "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies" Penguin; 01 edition (10 May 2016)
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
4. Dr.Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger", Yellow paper.2014.
5. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

WEBSITES:

1. https://swayam.gov.in/nd1_noc20_cs01/preview.
2. https://hyperledger.github.io/composer/latest/introduction/introduction.html.
3. https://ethereumbuilders.gitbooks.io/guide/content/en/index.html.

B.E COMPUTER SCIENCE AND ENGINEERING **2021-2022**

SEMESTER VIII

21BECS891	**PROJECT WORK PHASE-II & VIVA VOCE**	**12H-6C**

Instruction Hours/week: L:0 T:0 P:12 **Marks:** Internal**:80** External**:120** Total**:200**

End Semester Exam:3 Hours

COMPUTER SCIENCE AND ENGINEERING
PROFESSIONAL ELECTIVES

SEMESTER VI

21BECS6E01 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

COURSE OBJECTIVES:

The goal of this course is for the students:

- To enhance the students' knowledge of advanced data structures and algorithmic analysis.
- To enhance their expertise in designing and analyzing implementations of data structures for different kinds of problems using heap structures.
- To increase the ability to summarize advanced tree concepts.
- To understand problem solving and applications of Set & Graph Algorithms
- To learn and compute advanced geometric algorithms.
- To explain applications of advanced data structures.

COURSE OUTCOMES:

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

- Understand the advanced concepts of data structures and algorithms
- Apply data structures to design and analyze problems using heap structures.
- Solve problems using classical algorithms and tree data structures.
- Develop various problem-solving applications using Set & Graph Algorithms.
- Interpret and apply various advanced geometric algorithms
- Design and Implement advanced data structure applications.

UNIT I FUNDAMENTALS 9

Asymptotic Notations – Properties of Big-oh Notation –Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – Introduction to NP-Completeness/NP-Hard – Polynomial Time – Polynomial-Time Verification – NP-Completeness Proofs- NP-Complete Problems

UNIT II HEAP STRUCTURES 8

Priority Queues-Min/Max heaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps– lazy Binomial Heaps.

UNIT III TREES 9

Counting Binary Trees- Red-Black trees – Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B trees – Basic operations on B-Trees – Deleting a key from a B-Tree–Splay Trees – Tries.

UNIT IV SET & GRAPH ALGORITHMS 11

Set ADT- Union & Find data structure and Applications- Graph traversals-DFS, BFS, Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra‘s Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The

FloydWarshall Algorithm;

UNIT V GEOMETRIC ALGORITHMS **8**

Segment Trees – 1-Dimensional Range Searching - k-d Trees – Line Segment Intersection – Convex Hulls - Computing the Overlay of Two Subdivisions - Range Trees – Voronoi Diagram.

Total Hours: 45

TEXT BOOKS:

1. T. Cormen, C. Leiserson, R. Rivest, C. Stein, Introduction to Algorithms, Prentice-Hall India, 2009.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

REFERENCES:

1. AnanyLevitin, Introduction to The Design & Analysis of Algorithms, Pearson Education, 3rdEdition, New Delhi, 2014.
2. YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Data Structures using Cand C++, Second Edition, PHI Learning Private Limited, 2010
3. AhoHopcroft and Ullman, "Data Structures and Algorithms, Pearson Education,4th Edition, 2009.

WEBSITES:

1. https://nptel.ac.in/courses/106102064/
2. https://nptel.ac.in/courses/106103069/
3. https://www.geeksforgeeks.org/advanced-data-structures/

SEMESTER V

21BECS6E02	**C# and .NET**	**3H-3C**

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

End Semester Exam:3 H

COURSE OBJECTIVES:

The goal of this course is for the students:

- To Learn the technologies of the .NET framework
- To Know the object-oriented aspects of C#
- To Understand concepts of assemblies, interfaces and collections
- To apply application development in ADO.NET
- Learn Web based applications on. NET(ASP.NET)

COURSE OUTCOMES:

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

- List the major elements of the .NET framework
- Explain how C# fits into the .NET platform
- Analyze and apply the concepts of assemblies, interfaces and collections
- Develop, debug, compile and run simple applications of C#
- Implement applications in ADO.NET
- Design and develop Web based applications on .NET

UNIT I INTRODUCTION TO C# **9**

Introducing C#- Understanding . NET- overview of C#-Literals- Variables- Data Types-Operators-checked and unchecked operators- Expressions-Branching- Looping-Methods-implicit and explicit casting- Constant- Arrays- Array Class- Array List- String- String Builder-Structure- Enumerations-boxing and unboxing.

UNIT II ASSEMBLIES **9**

Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, Assemblies – Versioning – Attributes – Reflection – Viewing metadata – Type discovery – Reflecting on a type –Marshaling – Remoting – Understanding server object types – Specifying a server with an interface – Building a server – Building the client – Exception handling – Garbage collector.

UNIT III INTERFACES AND COLLECTIONS **9**

Interfaces and collections – Enumerator – Cloneable objects – Comparable objects – Collections – Indexes – Delegates – Events – Multithreaded programming. Programming with windows form controls – Windows form control Hierarchy – Adding controls – TextBox – CheckBoxes – RadioButtons – GroupBoxes – ListBoxes – ComboBoxes – TrackBar – Calendar – Spin Control – Panel – ToolTips –

ErrorProvider – Dialog Boxes.

UNIT IV IO Namespace and ADO .NET **9**

Input and output – Introduction to System. IO .namespace – File and folder operations – Stream class– Introduction to ADO .NET – Building data table – Data view – Data set – Data relations – ADO.NET managed providers – OleDb managed provider – SQL.

UNIT V ASP .NET and Web Services **9**

Web development and ASP.NET – Web applications and web servers – HTML form development – Client side scripting – GET and POST – ASP.NET application – ASP.NET namespaces – creating sample C# web Applications. Understanding Web Security – Windows authentication – Forms authentication – Web services – Web services – Web service clients – The City View application.

TotalHours:45

TEXT BOOKS:

1. Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2018.
2. Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2018.

REFERENCES:

1. Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2017.
2. Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, OReilly, 2018.

WEBSITES:

1. https://www.w3schools.com/cs/
2. https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/
3. https://www.geeksforgeeks.org/introduction-to-net-framework/

SEMESTER V

21BECS6E03 **SOFTWARE TESTING** **3H-3C**

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

End Semester Exam:3 H

COURSE OBJECTIVES:

The goal of this course is for the students:

- To explain the basics of software testing
- To highlight the strategies for software testing
- To stress the need and conduct of testing levels
- To identify the issues in testing management
- To bring out the ways and means of controlling and monitoring testing activity.

COURSE OUTCOMES:

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

- Understand complete software testing life cycle.
- Demonstrate understanding of various terms and technologies used in the testing domain.
- Demonstrate understanding usage of the testing framework, process and test management.
- Demonstrate understanding of generating test plans and designing test cases
- Demonstrate knowledge of the test management process.
- Ability to explore and get certified for ISTQB-foundation level certificate.

UNIT- I INTRODUCTION 9

Introduction to Testing – why and what, Why is testing necessary? What is Testing? Role of Tester, Testing and Quality, Overview of STLC**,** Software Testing Life Cycle - V model**,** SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of Testing, different types of Testing

UNIT -II STATIC TESTING 9

Static Testing**,** Static techniques, reviews, walkthroughs**,** Basics of test design techniques**,** various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

UNIT-III TEST MANAGEMENT 9

Test management**,** Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management. Defect management**,** Test Execution, logging defects, defect lifecycle, fixing/closing defects. Use of Bugzilla for logging and tracing defects.

UNIT- IV TEST DATA MANAGEMEN 9

Test Data Management**,** Test Data Management –Overview, Why Test Data Management, Test Data Types, Need for Test Data Setup, Test Data Setup Stages, Test data management Challenges. Creating sample test data using MS-Excel**,** Basics of Automation testing**,** Introduction to automation testing, why

automation, what to automate, tools available for automation testing.

UNIT- V BASICS OF AUTOMATION TESTING USING SELENIUM 9

Basics of Automation testing using Selenium**,** Introduction to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing, understanding TestNG framework with Selenium Web driver for automation testing

Total Hours: 45

TEXT BOOKS:

1. Rex Black, Managing the Testing Process (3rd Edition), Wiley India Pvt Ltd (2018)

REFERENCES:

1. Rex Black, Erik Van Veenendaal, Dorothy Graham, Foundations of software testing (3rd Edition), Cengage Learning (2017)
2. Gauf Garrett Dustin, Implementing Automated Software Testing: How to Save Time and Lower Costs While Raising Quality (3rd Edition), Addison-Wesley Professional (2019)

WEBSITES

1. http://docs.seleniumhq.org/docs/
2. http://www.seleniumhq.org/download/
3. https://www.udemy.com/courses/development/software-testing/
4. https://www.edx.org/learn/software-testing
5. https://swayam.gov.in/nd1_noc20_cs19/preview

SEMESTER VI

21BECS6E04 ADVANCED DATABASES 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 student is

- To Introduce and describe current and emerging database models and technologies.
- To Design and implement relational database solutions for general applications.
- To Explain the query processing and techniques involved in query optimization.
- To Explain common database administration tasks, such as database monitoring, performance tuning, data transfer, and security.
- To Understand the concepts, current practices and issues of data warehouses and databases.

COURSE OUTCOMES:

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

- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Design a semantic based database for meaningful data access
- Embed the rule set in the database to implement intelligent databases
- Represent the data using XML database for better interoperability
- Handle Big data and store in a transparent manner in the cloud
- Solve the issues related to the data storage and retrieval

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases:I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelis– Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing– Case Studies

UNIT II DISTRIBUTED DATABASES 9

Parallel databases – Inter and Intra query parallelism – Distributed database features – Distributed database architecture – Fragmentation – Distributed query processing – Distributed transactions processing – Concurrency control – Recovery – Commit protocols

UNIT III OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance-Complex Objects – Object Database Standards, Languages and Design:

ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

UNIT IV EMERGING SYSTEMS 9

Enhanced data models – Client/Server model – Data warehousing and data mining – Web databases– XML and web databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis.

UNIT V CURRENT ISSUES 9

Rules – Knowledge bases – Active and deductive databases – Multimedia databases – Multimedia data structures – Multimedia query languages – Spatial databases.

Total Hours: 45

TEXT BOOKS:

1. R. Elmasri, S.B.Navathe, "Fundamentals of Database Systems", 6thEdition, Pearson Education, 2011.
2. Thomas Connolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Pearson Education 2009.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6TH Edition, Tata McGraw Hill, 2016.
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8 Edition, Pearson Education, 2018.
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition 2016.

WEBSITES:

1. https://nptel.ac.in/courses/106104135/
2. https://nptel.ac.in/courses/106105175/
3. http://www.inf.ed.ac.uk/teaching/courses/adbs/slides/adbs.pdf

SEMESTER-VII

21BECS6E05 TCP / IP DESIGN AND IMPLEMENTATION 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 student is:

- To understand the IP addressing schemes.
- To learn the fundamentals of network design and implementation
- To understand the design and implementation of TCP/IP networks
- To know the network management issues
- To understand the design and implement network applications.

COURSE OUTCOME:

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

- Design and implement TCP/IP networks.
- Explain network management issues.
- Develop data structures for basic protocol functions of TCP/IP.
- Apply the members in the respective structures.
- Design and implement data structures for maintaining multiple local and global timers.
- Able to solve network management issues.

UNIT- I INTRODUCTION 9

Internetworking concepts and architectural model- classful Internet address – CIDR-Subnetting and Supernetting –AARP- RARP- IP – IP Routing –ICMP – IPV6.

UNIT- II TCP 9

Services – header – connection establishment and termination- interactive data flow- bulk data flow-timeout and retransmission – persist timer - keepalive timer- futures and performance.

UNIT- III IP IMPLEMENTATION 9

IP global software organization – routing table- routing algorithms-fragmentation and reassembly-error processing (ICMP) –Multicast Processing (IGMP)

UNIT- IV TCP IMPLEMENTATION I 9

Data structure and input processing – transmission control blocks- segment format-comparison-finite state machine implementation-Output processing- mutual exclusion-computing the TCP data length.

UNIT- V TCP IMPLEMENTATION II 9

Timers-events and messages- timer process- deleting and inserting timer event- flow control

and adaptive retransmission-congestion avoidance and control – urgent data processing and push function.

Total Hours:45

TEXT BOOKS:

1. Douglas E.Comer, "Internetworking with TCP/IP Principles Protocols and Architecture ",(4th Edition), Pearson Education Asia, 2006.
2. W.Richard Stevens, "TCP/IP Illustrated", Vol 1. Pearson Education, 2003.

REFERENCES:

1. Forouzan, "TCP/IP Protocol Suite" Second Edition, Tata Mc Graw Hill, 2003.
2. W.Richard Stevens, "TCP/IP illustrated", Vol 2. Pearson Education, 2003

WEBSITES:

1. https://nptel.ac.in/courses/106105081/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105183/lec45.pdf
3. https://link.springer.com/chapter/10.1007/978-3-642-14533-9_5

SEMESTER VII

21BECS7E01 NETWORK ROUTING ALGORITHMS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course for the student is:

- To expose the students to the layered architecture for communication networks.
- To explain Internet Routing protocols.
- To discuss specific functionality of the network layer.
- To enable the student to understand the basic principles of routing and implementation in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access network.
- Explain about mobile ad –hoc networks
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

COURSE OUTCOMES:

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

- Understand the layered architecture and its significance.
- Learn network layer and various routing techniques available.
- Apply knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance for any given network and user requirements and the type of channel over which the network has to operate,
- Design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.
- Compare Routing techniques and protocols.
- Acquire the knowledge of how data transfer happens in conventional networks.

UNIT I INTRODUCTION 9

Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Hierarchical routing.

UNIT II INTERNET ROUTING **10**

Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First(OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III ROUTING IN OPTICAL WDM NETWORKS **9**

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting-Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.

UNIT IV MOBILE - IP NETWORKS **8**

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based: Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V ROUTING IN AD HOC NETWORK: **9**

Introduction to Ad hoc Networks – Features/ Characteristics, Types and Applications, Limitations, Advantages and Disadvantages, Classification of Routing Protocols in Ad hoc Networks – Proactive Routing Protocols (DSDV, OLSR), Reactive Routing Protocols (DSR, AODV), Hybrid Routing Protocols (ZRP)

Total Hours: 45

TEXT BOOKS:

1. DeepankarMedhi, Karthikeyan Ramasamy, Network Routing: Algorithms, Protocols, and Architectures, Morgan Kaufmann Publishers, Elsevier, 2019
2. William Stallings, High speed networks and Internets Performance and Quality of Service, 2nd Edition, Pearson Education Asia. Reprint India 2016
3. C.Siva Rama Murthy and Mohan Gurusamy, WDM Optical Networks – Concepts, Design and Algorithms, Prentice Hall of India Pvt. Ltd, New Delhi 2018

REFERENCES:

1. C.E Perkins, Ad Hoc Networking, Addison – Wesley, 2018
2. S. Keshav, An engineering approach to computer networking, Addison Wesley 2019.
3. William Stallings, High speed Networks TCP/IP and ATM Design Principles, Prentice-Hall, New York, 2019

WEBSITES:

1. https://nptel.ac.in/content/storage2/courses/117105076/pdf/8.1%20Lesson%2026.pdf
2. http://opti.tmit.bme.hu/~cinkler/TMP/MYPUBwithcitations/pdf/J_200302_ieeeNetwork_Grooming_c.pdf
3. https://pdfs.semanticscholar.org/9206/4a40da71f5f78b0a33d7ee2e546908ff4909.pdf

SEMESTER-VIII

21BECS7E02 DEVOPS 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 student is:

- To learn the basics of DevOps and its components.
- To understand Configuration Management, Continuous Integration and Continuous Deployment, Continuous Delivery, Continuous Monitoring using DevOps tools-Git, Docker, Jenkins, Puppet and Nagios in practical, hands-on, and interactive approaches.
- To understand automated Testing and test-driven approach by various tools.
- To learn to create containers and dockers using different tools.
- To Understand continuous integration with Teamcity and jekins.

COURSE OUTCOMES:

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

- Analyze DevOps and the modern DevOps toolset
- Ability to automate all the aspects of a modern code delivery and deployment pipeline
- Use Source code management tools, build tools, test automation tools using DevOps tools-Git, Docker, Jenkins, Puppet and Nagios for analysis.
- Create containers and dockers using different tools.
- Configuring management tools.
- Integrate various modules with Teamcity and Jekins.

UNIT-1: INTRODUCTION TO DEVOPS 9

Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps in Dev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement.

UNIT-2: MANAGING SOURCE CODE AND AUTOMATING BUILDS 9

How to manage change by setting up and using a source control system-What is Build Automation, Deployment Automation, Test Automation and Infrastructure Automation-How to automate the process of assembling software components with build tools-How to automate the building of the whole system with continuous integration tools-The major differences between popular tools: CVS, SVN, and Git-How to use Eclipse editor, Advantages of the Eclipse editor-Hands on Projects/Tools covered: 1. Concepts: Ticketing,

Subversion, Using GIT, Java Profiling 2. Jenkins and Git 3. Tools Covered: SCCS and CVS, Subversion, Git, Maven, Make, JaCoCo, Ant, JUnit for Unit test, SonarQube, Sqale, Structure 101 4. Hands on: Setup of Java sample program, Maven, path setup, Run Maven goals, Eclipse.

UNIT- 3: AUTOMATED TESTING AND TEST DRIVEN DEVELOPMENT 9

Principles of Test Driven Development-Benefits of Integrated Development Environments-How to perform Test Driven Development-Code quality-How to utilize code quality analysis tools-Hands on Projects/Tools covered: 1. Concepts: TDD Origins, IDEs, TDD, Approach, Behavior Driven Development, Code Quality Principles, Code Analysis Tools 2. Tools Covered: Eclipse, Intellij, Visual Studio, Xcode, xUnit, SQALE, SonarQube, JaCoCo 3. Hands on: Complete setup of the automated test environment and running it.

UNIT-4: CONTAINERIZATION USING DOCKER 9

What are containers? Why are they used?-Introduction to Docker?-Image distribution and Docker containers?-Creating and managing remote docker instances?-Understanding Docker Networking, Volumes and Files-Hands on Projects/Tools covered: 1. Concepts: Docker containers, image creation and docker instance handling, Docker networking, volumes and files 2. Tools Covered: Docker 3. Hands on: Working on Docker containers,images, and registry.

UNIT-5 :CONTINUOUS INTEGRATION 9

Continuous integration with Teamcity-Integration of Eclipse with Teamcity-Continuous integration with Jenkins.

Total Hours:45

TEXT BOOKS:

1. JoakimVerona , “Practical DevOps", Packt Publishing Limited, 2016.
2. Viktor Farcic, "The DevOps 2.0 Toolkit", Packt Publishing Limited, 2016.
3. Bob Aiello and Leslie Sachs, “Agile Application Lifecycle Management Using DevOps to Drive Process Improvement”, Addison Wesly, First printing, June 2016.

REFERENCES:

1. John Allspaw, Gene Kim**,** The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, IT Revolution Press, 2016.
2. Karl Matthias, Docker: Up and Running, Shroff, 2015.

WEBSITES:

1. https://intellipaat.com/blog/tutorial/devops-tutorial/
2. https://www.guru99.com/devops-tutorial.html
3. https://www.tutorialspoint.com/devops_tutorials.html

SEMESTER VI

21BECS7E03 **DESIGN PATTERNS** **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 student:

- To Understand the concept of Design patterns and their importance
- To Understand the behavioural knowledge of the problems and their solutions
- To Relate the Creational, Structural, behavioural Design patterns
- To Apply the suitable design patterns to refine the basic design for a given context

COURSE OUTCOMES:

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

- Create software designs that are scalable and easily maintainable
- Understand the best use of Object Oriented concepts for creating truly OOP programs
- Use creational design patterns in software design for class instantiation
- Use structural design patterns for better class and object composition
- Use behavioural patterns for better organization and communication between the objects.
- Use refactoring to compose the methods for proper code packaging.

UNIT I INTRODUCTION 9

History and Origin of Patterns – Applying Design Patterns – Prototyping –Testing-Design Patterns in Smalltalk MVC- Describing Design Patterns- The Catalog of Design Patterns- Organizing the Catalog- Design Patterns in Solving Design Problems- Selection of a Design Pattern- Use a Design Pattern.

UNIT II DESIGN PATTERNS 9

Kinds of Pattern – Quality and Elements – Patterns and Rules – Creativity and Patterns– Creational Patterns – Structural Patterns – Behavioral Patterns, Factory Patterns

UNIT III FRAMEWORKS 9

State and Strategy of Patterns. Singleton, Composite, Functions and the Command Patterns, Adaptor, Proxy Pattern, Decorator Pattern – Pattern Frameworks and Algorithms.

UNIT IV CATALOGS 9

Pattern Catalogs and Writing Patterns-Patterns and Case Study- Mediator-Memento-Observer-State-Strategy-Template Method –Visitor-Discussion of Behavioral Patterns.

UNIT V ADVANCED PATTERNS **9**

Anti-Patterns - Case Studies In UML and CORBA, Pattern Community

Total Hours: 45

TEXT BOOKS:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object-oriented Software, Pearson Education, 2015
2. James W- Cooper, Java Design Patterns – A Tutorial, Addison-Wesley, 2015

REFERENCES:

1. Craig Larman, Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and the unified, Process, Pearson Education India, 2014
2. Mowbray, Inside CORBA, Pearson Education India, 2014

WEBSITES:

1. https://nptel.ac.in/content/storage2/courses/106105087/pdf/m08L18.pdf
2. https://nptel.ac.in/content/storage2/courses/106106177/W6A1.pdf
3. http://nptelvideos.com/video.php?id=916

SEMESTER-VII

21BECS7E04 SERVICE ORIENTED 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 is for the student is:

- To gain knowledge of the basic concepts of SOA, comparison with older architectures and principles of service orientation.
- To learn about web services, messaging with SOAP and different layers of SOA.
- To learn about advanced concepts such as Orchestration and Choreography.
- To learn about various service-oriented analyses and designs.
- To know about various WS- specification standards.

COURSE OUTCOMES:

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

- Obtain knowledge on basic concepts of SOA and how it differs from other architectures.
- Gain knowledge on advanced concepts of service composition, Orchestration and Choreography.
- Understand web service framework with respect to SOA.
- Acquire knowledge on various open standards available for developing SOA compliant web services.
- Design and implement Web based services using ASP.NET
- Appreciate the concept of Standards and Security on SOA

UNIT I INTRODUCTION 9

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation

UNIT II SERVICES 9

Web services – Service descriptions – Messaging with SOAP –Service discovery – UDDI – Message exchange Patterns – Coordination -Atomic Transactions – Business activities – Orchestration – Choreography - Service layer abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer.

UNIT III ANALYSIS 9

Service oriented analysis – Business-centric SOA – Deriving business services - service modeling - Service Oriented Design – WSDL basics – SOAP basics – SOA composition guidelines – Entity-centric business service design – Application service design – Task-centric business service design.

UNIT IV XML 9

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery

UNIT V WEB SERVICES EXTENSIONS 9

WS-Addressing – WS-ReliableMessaging-WS Transactions-WS-BPEL basics – WS-Coordination overview - WS-Choreography, WS-Policy, WS- Security

Total Hours: 45

TEXT BOOKS:

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2nd Edition, 2016.
2. Judith Hurwitz, Robin Bloor, "Service Oriented Architecture for Dummies", Willey Publications, 2nd Edition, 2009.
3. Sandeep Chatterjee and James Webber, ―Developing Enterprise Web Services: An Architect's Guide, Prentice Hall, 2004

REFERENCES:

1. Nicolai M. Josuttis, "SOA-The Art of Distributed System Design", O "Reily Publications, 2009.
2. Douglas K. Barry, "Web Services, Service Oriented Architecture and Cloud Computing", Elsevier Publicaions, 2nd Edition, 2013.

WEBSITES:

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105167/lec10.pdf
2. https://www.coursera.org/lecture/service-oriented-architecture/4-1-1-introduction-to-service-oriented-architecture-kEZue
3. https://www.service-architecture.com/articles/web-services/index.html

SEMESTER-VIII

21BECS7E05 **SEMANTIC WEB** **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 student is:

- To understand the basic concepts and layers of the semantic Web.
- To learn RDF data models and querying the semantic Web using SPARQL
- To learn Ontology Engineering, construction and reuse.
- To understand the description logics and monotonic rules.
- To learn Social Network Analysis and semantic Web.

COURSE OUTCOMES:

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

- Describe the rationale behind Semantic Web.
- Model ontologies using Resource Description Framework (RDF).
- Design RDF Schemas for ontologies.
- Model and design ontologies using Web Ontology Language (OWL).
- Query ontologies using SPARQL.
- Apply Semantic web technologies to real world applications.

UNIT I INTRODUCTION 9

Introduction to the Syntactic Web and Semantic Web – Evolution of the Web – The visual and syntactic Web – Levels of Semantics – Metadata for web information - The semantic web architecture and technologies –Contrasting Semantic with Conventional Technologies – Semantic Modeling -Potential of semantic web solutions and challenges of adoption.

UNIT II RDF AND QUERYING THE SEMANTIC WEB 9

RDF data model-syntaxes-Adding semantics -RDF schema-RDF and RDF schema in RDF schema-An axiomatic semantics for RDF and RDF schema-Querying the semantic web-SPARQL-Basics-Filters-Constructs-Organizing result sets-Querying schemas.

UNIT III ONTOLOGICAL ENGINEERING 9

Ontologies – Taxonomies –Topic Maps – Classifying Ontologies – Terminological aspects: concepts, terms, relations between them – Complex Objects –Subclasses and Sub-properties definitions–Upper Ontologies – Quality – Uses - Types of terminological resources for ontology building –Methods and methodologies for building ontologies – Multilingual

Ontologies -Ontology Development process and Life cycle – Methods for Ontology Learning – Ontology Evolution – Versioning

UNIT IV LOGIC AND INFERENCE 9

Logic – Description logics - Rules – Monotonic rules: syntax, semantics and examples – Non-monotonic rules – Motivation, syntax, and examples – Rule markup in XML: Monotonic rules - Non-Monotonic rules

UNIT V APPLICATIONS OF SEMANTIC WEB TECHNOLOGIES 9

Good relations-BBC artists-BBC world cup 2010 website-Government data, Newyork times-Sigma and sindiceopen Calais- schema.org-Future of semantic Web

Total Hours - 45

TEXT BOOKS:

1. Grigorous Antoniou and Van Harmelen, "A Semantic Web Primer". New Delhi: The MIT Press, 2012.
2. James Hendler, Henry Lieberman and Wolfgang Wahlster, “Spinning the Semantic Web: Bringing the World Wide Web to its full potential”. New Delhi: The MIT Press, 2005.
3. Karin K. Breitman, Marco Antonio Casanova and Walter Truszowski, “Semantic Web Concepts: Technologies and Applications”, Springer, 2007

REFERENCES:

1. Shelley Powers, “Practical RDF”. Mumbai: O "Reilly publishers, 2009
2. Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, “Foundations of Semantic Web Technologies”, Chapman & Hall/CRC, 2009.

WEBSITES:

1. https://www.slideshare.net/marinasantini1/lecture-ontologies-and-the-semantic-web
2. https://www.w3.org/TR/owl-guide/
3. https://www.obitko.com/tutorials/ontologies-semantic-web/introduction.html
4. http://kmi.open.ac.uk/events/iswc08-semantic-web-intro/slides/01%20-%20Jim.pdf

SEMESTER-VIII

21BECS8E01 SOFTWARE PROJECT 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 is for the students:

- To understand the concepts of software processes and their models
- To understand software project evaluation and planning
- To learn project life cycle and effort estimation
- To learn in detail about various risks involved and their management.
- To understand the concepts of staffing in various projects.

COURSE OUTCOMES:

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

- Gain essential knowledge on Software project management
- Identify the fundamental concepts of project evaluation and planning
- Identify and analyze software project activities using contemporary work breakdown techniques.
- Identify and apply selected techniques for estimating the effort and duration of project activities.
- Construct a schedule of project activities using contemporary planning techniques
- Construct a quality model for a software development project, including identification of Suitable quality attributes, appropriate metrics for measuring these, and suitable threshold values for these metrics to indicate the acceptable quality

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION

Software Process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

UNIT III PROJECT AND RISK MANAGEMENT 9

Project initiation – Feasibility study - Planning - Estimation - Resource allocation - root cause Analysis. Risk analysis and management - Types of Risk involved - RMM plan.

UNIT IV PROJECT SCHEDULING AND TRACKING SOFTWARE CONFIGURATION MANAGEMENT 9

Scheduling - Critical path – Tracking - Timeline chart – Earned value chart. Baselines - Software configuration items - The SCM process- Version control- Change control - Configuration audit - SCM standards.

UNIT V Staffing In Software Projects 9

Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

Total Hours:45

TEXT BOOKS:

1. Pankaj Jalote, "Software Project Management in practice", Pearson Education, New Delhi, 2018.
2. Bob Hughes and Mike Cotterell, "Software Project Management" McGraw Hill Edition, New Delhi, 2nd Edition, 2017.

REFERENCES:

1. Roger S Pressman, "Software Engineering, A Practitioner "s Approach" McGraw Hill Edition, New Delhi, 8th Edition, 2014.
2. Watts Humphrey, "Managing the Software Process ", Pearson Education, New Delhi, 2000.

WEBSITES:

1. https://nptel.ac.in/courses/106105218/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105218/lec1.pdf
3. https://www.researchgate.net/publication/282121893_PROJECT_MANAGEMENT_SOFTWARE-AN_OVERVIEW

SEMESTER-VIII

21BECS8E02 **E- COMMERCE** **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:

- The goal of this course is for the student is
- To understand the basic concepts of E-commerce and its values.
- To learn key features of the Internet, Intranets and Extranets and explain how they relate to each other.
- To understand web servers, protocol and EC software.
- To obtain knowledge of online security issues to assess existing websites.
- To understand web-based marketing and its advantages.

COURSE OUTCOMES:

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

- Demonstrate an understanding of the foundations and importance of E-commerce.
- Describe the infrastructure required for E-commerce.
- Describe the key features of the Internet, Intranets and Extranets and explain how they relate.
- Analyze the online threats and strategies for marketing.
- Discuss legal issues and privacy in E-Commerce.
- Demonstrate the use of social media technology in a business or government application

UNIT I INTRODUCTION **9**

E-Commerce- Meaning, B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals

UNIT II INFRASTRUCTURE FOR E-COMMERCE **9**

Packet switched networks – TCP/IP protocol script – Internet utility programmes – SGML, HTML and XML – web client and servers – Web client/server architecture – intranet and extranets

UNIT III Web Based Tools For E-Commerce **9**

Web server – performance evaluation - web server software feature sets – web server software and tools – web protocol – search engines – intelligent agents –EC software –

UNIT IV SECURITY **9**

Computer security classification-E-Commerce Security Environment – copyright and Intellectual property – electronic commerce threats – Technology Solutions: Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Securing Channels of Communication, Protecting Networks – electronic payment systems – electronic cash – strategies for marketing – sales and promotion – cryptography –authentication.

UNIT V INTELLIGENT AGENTS **9**

Definition and capabilities – limitation of agents – security – Web based marketing – search engines and Directory registration – online advertisements – Portables and info mechanics – website design issues-Case Study: Identify Key components, strategy, B2B Models of E-commerce Business model of any e-commerce website

Total Hours - 45

TEXT BOOKS:

1. Ravi Kalakota, "Electronic Commerce", Pearson Education,
2. Gary P Schneider “Electronic commerce”, Thomson learning & James T Peny Cambridge USA, 2019.
3. Marilyn Greenstein and Miklos "Electronic commerce" McGraw-Hill, 2017.
4. A textbook on E-commerce**,** Er Arunrajan Mishra, Dr W K Sarwade,Neha Publishers & Distributors, 2018.

REFERENCES:

1. Efraim TurvanJ.Lee, David kug and Chung, "Electronic commerce" Pearson Education Asia 2018.
2. Brenda Kienew E commerce Business Prentice Hall, 2019.

WEBSITES:

1. https://nptel.ac.in/courses/110105083/
2. https://nptel.ac.in/content/storage2/courses/106108103/pdf/PPTs/mod13.pdf
3. https://www.tutorialspoint.com/e_commerce/e_commerce_tutorial.pdf

SEMESTER-VIII

21BECS8E03 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 is for the students:

- To understand the concepts relating to the design of human-computer interfaces in ways making computer-based systems comprehensive, friendly and usable.
- To understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces.
- To understand the essential aspects of the implementation of human-computer interfaces.
- To identify the various tools and techniques for interface analysis, design, and evaluation.

COURSE OUTCOMES:

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

- Analyze the key aspects of human psychology which can determine user actions at and satisfaction of the interface.
- Describe the fundamental design principles for user interfaces.
- Set up and carry out a process to gather requirements for, engage in the iterative design of, and evaluate the usability of a user interface.
- Describe how user interface development can be integrated into an overall software development process.
- Understanding of the ethical issues involved in testing user interfaces.
- Apply Human Computer Interface in real time applications

UNIT I INTRODUCTION TO HUMAN AND THE COMPUTER 9

Human: Input–output channels, Human Memory, Thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems. The computer: Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning, Memory, Processing and networks.

UNIT II DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS 9

Software Process – Usability Engineering – Issue based Information Systems – Iterative Design Practices – Design Rules – Maximum Usability – Principles – Standards and Guidelines – Design Patterns – Programming Tools – Windowing Systems – Interaction Tool Kit – User Interface Management System – Evaluation Techniques – Evaluation Design – Evaluating Implementations

– Observational Methods.

UNIT III THE INTERACTION AND PARADIGMS 9

Models of interaction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity, The context of the interaction. Paradigms: Paradigms for interaction. Interaction design basics: The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping.

UNIT IV EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI 9

Basic Design Structure – Single Independent Variable – Multiple Independent Variable – Factorial Design – Split-Plot Design – Random Errors – Experimental Procedure – Statistical Analysis – T Tests – Analysis of Variance Test – Regression – Chi-Square Test – Survey – Probabilistic Sampling – Non-Probabilistic Sampling – Developing Survey Questions.

UNIT V THEORIES 9

Dialogue Notations and Design – Dialogue Need – Dialogue Design Notations – Graphical – Textual - Representing Dialogue – Formal Descriptions – Dialogue Analysis – System Models – Interaction Models – Relationship with Dialogue – Formalisms – Formal Notations – Interstitial Behavior – Virtual Reality – Modeling Rich Interaction – Status Event Analysis – Properties – Rich Contexts – Sensor-based Systems – Groupware – Applications – Ubiquitous Computing – Virtual Reality

Total Hours:45

TEXT BOOKS:

1. Andrew Sears, Julie A. Jacko, "Human Computer Interaction Fundamentals, First Edition, CRC Press, 2017.
2. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Prentice Hall, 2004.

REFERENCES:

1. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, “Research Methods in Human Computer Interaction”, Wiley, 2010.
2. Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: Strategies for
3. Effective Human-Computer Interaction”, Fifth Edition, Addison-Wesley Publishing Co,2010.

WEBSITES:

1. https://nptel.ac.in/courses/106103115/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106106177/lec14.pdf
3. https://nptel.ac.in/content/storage2/courses/106103115/module1/1.pdf

SEMESTER-VIII

21BECS8E04 NATURAL LANGUAGE PROCESSING 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand Overview and Language Modeling
- To understand the various levels of analysis involved in NLP.
- To learn language modelling.
- To gain knowledge in automated natural language generation and machine translation.
- To understand the concepts of information Retrieval and Lexical resource.
- To discuss concepts of Natural Language Processing in real time application.

COURSE OUTCOMES:

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

- Compose key NLP elements to develop higher level processing chains
- Assess / Evaluate NLP based systems
- Choose appropriate solutions for solving typical NLP subproblems (tokenizing, tagging, parsing)
- Describe the Machine translation approaches.
- Gain knowledge in design features in information retrieval and lexical analysis techniques.
- Analyze Natural Language Processing in real time application

UNIT I MORPHOLOGY AND PART-OF SPEECH PROCESSING 9

Introduction –Regular Expressions and Automata- Non-Deterministic FSAs. Transducers – English Morphology - Finite-State Morphological Parsing - Porter Stemmer - Tokenization- Detection and Correction of Spelling Errors. N-grams – Perplexity - Smoothing - Interpolation - Backoff. Part-of- Speech Tagging – English Word Classes - Tagsets - Rule-Based - HMM - Transformation-Based Tagging - Evaluation and Error Analysis.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS 9

WORD LEVEL ANALYSIS: Introduction- Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. SYNTACTIC ANALYSIS: Introduction-Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING 9

SEMANTIC ANALYSIS: Introduction- Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. DISCOURSE PROCESSING: Introduction- cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION 9

NATURAL LANGUAGE GENERATION**:** Introduction-Architecture of NLG Systems-Generation Tasks and Representations-Application of NLG.MACHINE TRANSLATION: Introduction-Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V APPLICATIONS 9

Information Extraction – Named Entity Recognition - Relation Detection and Classification – Temporal and Event Processing - Template-Filling, Properties of Human Conversations - Basic Dialogue Systems - VoiceXML - Information- State and Dialogue Acts, Machine Translation – Issues in Machine Translation - Classical MT and the Vauquois Triangle -Statistical MT - Phrase-Based Translation Model.

Total Hours: 45

TEXT BOOKS:

1. Jacob Eisenstein, “Introduction to Natural Language Processing and Information Retrieval”, MIT Press, 2020.
2. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

REFERENCES:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008.
2. James Allen, Benjamin/Cummings, "Natural Language Understanding", 2nd Edition, 2095.

WEBSITES:

1. https://nptel.ac.in/courses/106/105/106105158/
2. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_natural_language_processing.htm
3. https://london.ac.uk/sites/default/files/study-guides/introduction-to-natural-language-processing.pdf

SEMESTER-VII

21BECS8E05 AD-HOC NETWORKS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To learn Ad-Hoc Wireless Networks, Issues, and Classification of MAC Protocols.
- To understand the different types of AdHoc Routing Protocols and TCP over AdHoc Protocol.
- To understand Sensor Network Architecture, its Applications and MAC Protocols for sensor networks.
- To learn the Different Issues in Wireless Sensor Routing and Indoor and outdoor Localization and Quality of Service in WSN.
- To learn Mesh Networks, IEEE 802.11s Architecture and different types of Mesh Networks.

COURSE OUTCOMES:

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

- Gain knowledge of Ad-Hoc Network and its issues.
- Identify the basic concepts of TCP and routing algorithms.
- Analyze the current wireless networking mechanisms and MAC protocols
- Analyze and classify various issues and characteristics of WSN routing, localization and QoS
- Understand the concepts of various Mesh configurations in detail.
- Develop an attitude to propose solutions with comparisons for problems related to ad-hoc networks through investigation of different protocols and mobile/wireless networks.

UNIT I INTRODUCTION 9

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of AdHoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT II AD-HOC NETWORK ROUTING & TCP 9

Issues in Mobile Ad Hoc networks classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-Bus, Ad Hoc TCP, and Split TCP

UNIT III WIRELESS SENSOR NETWORKS (WINS) AND MAC PROTOCOLS 9

Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: issues, classification, self-organizing, Hybrid TDMA/FDMA and CSMA based MAC-IEEE 802.15.4.

UNIT IV WSN ROUTING, LOCALIZATION & QOS **9**

Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.

UNIT V MESH NETWORKS **9**

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture –Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness –Heterogeneous Mesh Networks – Vehicular Mesh Networks.

Total Hours: 45

TEXT BOOKS:

1. C.Siva Ram Murthy and B.Smanoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2018.
2. Feng Zhao and LeonidasGuibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers, 2018.

REFERENCES:

1. C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2016.
2. Thomas Krag and SebastinBuettrich, “Wireless Mesh Networking”, O" Reilly Publishers, 2018

WEBSITES:

1. https://nptel.ac.in/courses/106105160/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105160/lec1.pdf

SEMESTER-VIII

21BECS8E06 DIGITAL MARKETING 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 strategic understanding of Digital Marketing
- To understand how to use optimize the search engine
- To learn marketing and tracking metrics
- To learn how digital marketing using social media and strategies for digital marketing.
- To explain email marketing, display advertising, mobile marketing, strategy & planning.
- To explain the applications of digital marketing.

COURSE OUTCOMES:

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

- Define and outline key concepts related to digital marketing
- Categorize digital marketing concepts including e-business models, e-consumer behaviour, online marketing communications, website design and social media marketing.
- Critically assess the role that digital marketing can play in business strategy.
- Develop tactical decisions concerning an effective product, pricing, distribution and promotion decisions in digital marketing
- Reflect on the practical implementation of a digital marketing strategy from a critical and evaluative perspective
- Develop applications like email marketing, display advertising, mobile marketing, strategy & planning

UNIT-1: INTRODUCTION TO DIGITAL MARKETING AND SEARCH ENGINE OPTIMIZATION 9

Digital Marketing definition, Difference b/w Traditional Marketing & Digital Marketing, Digital Marketing Channels, Search Engine Optimization (SEO), How does Search Engine Work? Role of Keywords in SEO, Off-Page Optimization, On-Page Optimization

UNIT-2:SEARCH MARKETING AND WEB SITE ANALYTICS 9

Campaign Management-Conversion Tracking-Targeting & Analytics-Keyword Selection-Conversion Metrics: CPA, CTR, Goal Configuration &Funnels-Intelligence Reporting-Conversions, Bounce Rate, Traffic Sources, Scheduling etc

UNIT-3:SEARCH MARKETING AND WEB SITE ANALYTICS 9

Campaign Management-Conversion Tracking-Targeting & Analytics-Keyword Selection-Conversion Metrics: CPA, CTR, Goal Configuration &Funnels-Intelligence Reporting-Conversions, Bounce Rate, Traffic Sources, Scheduling etc

UNIT-4:SOCIALMEDIA **9**

What is Social Media Marketing?-Overview of Facebook, Twitter, Linked In, Blogging, Youtube and Flickr Building Brand Awareness Using Social Media, Social Media Management-Insights and Analytics-Best Practice Examples & case Studies.

UNIT-5:EMAIL MARKETING, DISPLAY ADVERTISING, MOBILE MARKETING 9

User Behaviour-Segmentation, Key Metrics-Best Practice Case Studies-Split Testing-Campaign Process Optimization, SMS Strategy-Mobile Advertising - Mobile Optimized Websites-7 Step Process for Mobile Apps • Proximity Marketing

Total Hours: 45

TEXT BOOKS:-

1. Ian Dodson, "The Art of Digital Marketing", Hardcover, 2016.
2. Sudhir Sreedharan, "Digital Marketing Paperback" – Import, 2015

REFERENCES:

1. Akins Homlon, Quick win Digital Marketing - Answers To Your, 2012.
2. Philip Kotler, Marketing 4.0: Moving from Traditional to Digital Hardcover, 2017.

WEBSITES:

1. https://www.studocu.com/in/document/guru-gobind-singh-indraprastha-university/mba/lecture-notes/introduction-to-digital-marketing/1731171/view
2. https://optron.in/en/digital-marketing
3. https://nptel.ac.in/courses/110104068/

SEMESTER-VIII

21BECS8E07 ROBOTICS AND ITS APPLICATIONS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Make the students acquainted with the theoretical aspects of Robotics
- Enable the students to acquire practical experience in the field of Robotics through design projects and case studies.
- Make the students understand the importance of robots in various fields of engineering.
- Expose the students to various robots and their operational details.

COURSE OUTCOMES:

After this completion of this course, the student should be able to

- Understand the essential components of robots.
- Differentiate types of robots and robot grippers.
- The model forward and inverse kinematics of robot manipulators.
- Analyze forces in links and joints of a robot.
- Programme a robot to perform tasks in industrial applications.
- Design intelligent robots using sensors.

UNIT – I: ROBOTICS **9**

Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator.

UNIT-II: COMPONENTS OF INDUSTRIAL ROBOTICS **9**

Precession of movement-resolution, accuracy & repeatability-Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors,& Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

UNIT – III: GRIPPERS **9**

Mechanical Gripper-Grasping force-Engelberger-g-factors-mechanisms for actuation, Magnetic gripper, vaccume cup gripper-considerations in gripper selection & design. Industrial robots specifications. Selection based on the Application.

UNIT – IV: KINEMATICS **8**

Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

UNIT–V:ROBOT CONTROL, PROGRAMMING AND APPLICATIONS 10

Robot controls-Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions, Feedback devices, Encoder, Resolver, LVDT, Motion Interpolations, Adaptive control. Introduction to Robotic Programming, On-line and off-line programming, programming examples. Robot applications-Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spraypainting.

Total Hours: 45

Text Books:

1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology programming and Applications", McGraw Hill, 2018.
2. Craig. J. J. "Introduction to Robotics- Mechanics and control", Addison- Wesley, 2019.

References:

1. S.R. Deb, “Robotics Technology and flexible automation”, Tata McGraw-Hill Education., 2009.
2. Richard D. Klafter, Thomas . A, ChriElewski, Michael Negin, "Robotics Engineering an Integrated Approach", PHI Learning., 2009.
3. Francis N. Nagy, Andras Siegler, "Engineering Foundation of Robotics", Prentice Hall Inc., 1987.
4. P.A. Janaki Raman, "Robotics and Image Processing an Introduction", Tata McGraw Hill Publishing company Ltd., 1995.
5. Carl D. Crane and Joseph Duffy, "Kinematic Analysis of Robot manipulators", Cambridge University Press, 2008.

WEBSITES:

1. https://nptel.ac.in/courses/107/106/107106090/
2. https://nptel.ac.in/courses/112/107/112107289/
3. http://www.nptelvideos.in/2012/12/robotics.html

OPEN ELECTIVES OFFERED BY
ELECTRICAL AND ELECTRONICS ENGINEERING
&
ELECTRONICS AND COMMUNICATION ENGINEERING

21BEEEOE01 ELECTRIC HYBRID VEHICLES 3H-3C

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

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To study the basic concepts of electric hybrid vehicles.
- To study energy storage systems for a hybrid vehicle.
- To study energy management strategies

COURSE OUTCOMES (COS)

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

- Understand the models to describe hybrid vehicles and their performance.
- Understand the concept of Electric Trains.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy storage systems.
- Understand the different strategies related to energy management systems.
- Understand the concept of the different Motor drives.

UNIT I INTRODUCTION 9

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

UNIT II HYBRID ELECTRIC DRIVE-TRAINS 9

The basic concept of hybrid traction includes introducing various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, and 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 drive, Configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE 9

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES 9

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

Total Hours: 45

TEXT BOOKS:

1. Iqbal Hussein Electric and Hybrid Vehicles: Design Fundamentals CRC Press – 2nd Edition 2010.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design Standardsmedia – 2nd Edition 2009.
3. James Larminie, John Lowry, Electric Vehicle Technology Wiley – 2nd edition 2012.
4. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and
5. Applications with Practical Perspectives", John Wiley & Sons, 2011.
6. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management
7. Strategies", Springer, 2015.

REFERENCES:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and
2. FuelCell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
3. T. Denton, "Electric and Hybrid Vehicles", 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/

21BEECOE01 PRINCIPLES OF MODERN COMMUNICATION SYSTEM 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To provide explicit knowledge on the evolution of communication systems
- To understand uplink and downlink concepts in mobile phone
- To make aware of mobile communication generations
- To deliver knowledge on wireless communication standards
- To enable students to have a better understanding of launching a satellite
- To study the concept of radar communication

Course Outcomes

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

- Understand past, present and future trends in mobile communication.
- Explain how uplink and downlink is done in mobile phone
- Distinguish various standards in use for wireless communication
- Demonstrate some basic applications of GPS.
- Appreciate launching mechanism of satellite
- Gain knowledge about RADAR working and its applications

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION 9

From smoke signals to smartphones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II MOBILE CELLULAR COMMUNICATIONS 9

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

UNIT III WIRELESS COMMUNICATION 9

Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMAX) - Future mobile and wireless networks: Introduction to 5G- a device to device communication- IoT.

UNIT IV SATELLITE COMMUNICATION 9

History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V RADAR & NAVIGATION 9

Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar.

Navigation Systems: Introduction & navigation methods, Instrument Landing System, Microwave landing system- Modern Navigation systems.

TEXT BOOKS:

1. S.Haykin, —Communication Systems, 4/e, John Wiley 2007
2. B.P.Lathi, —Modern Digital and Analog Communication Systems, 3/e, Oxford University Press,2007
3. Rappaport Theodore S - Wireless Communications: Principles and Practice, 2/E, Pearson Education India, 2010
4. Vijay. K. Garg, —Wireless Communication and Networking, Morgan Kaufmann Publishers, 2007.

REFRENCES:

1. T.Pratt, C. Bostian and J.Allnutt; —Satellite Communications, John Wiley and Sons, Second Edition., 2003
2. M. I . Skolnik —Introduction to Radar Systems, Tata McGraw Hill 2006.
3. Myron Kyton and W.R.Fried —Avionics Navigation Systems, John Wiley & Sons 1997.

WEBSITES

1. https://onlinecourses.nptel.ac.in/noc21_ee65/preview
2. https://nptel.ac.in/courses/108/104/108104091/
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ee06/

Courses Offered to other Departments by
Computer Science and Engineering

21BECSOE01 INTERNET PROGRAMMING 3H-3C

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

End Semester Exam:3 Hours

Course Objectives

The goal of this course for students is :

- To study concepts of Internet, IP addresses and protocols
- To explain the idea of web page development through HTML
- To introduce the PERL and explore its current strengths and Weaknesses
- To write working Java code to demonstrate the use of applets for client side programming
- To study Internet telephony and various multimedia applications
- To Elaborate on the principles of web page development

COURSE OUTCOMES:

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

- Learn the advanced concepts& techniques of the Internet and Java.
- Analyze the requirements for and create and implement the principles of web page development
- Understand the concepts of PERL
- Implement client side programming using java applets
- Generate internet telephony based upon advanced concepts
- Develop applications on internet programming based on java applets and scripts

UNIT I INTRODUCTION 9

Introduction - Network of Networks, Intranet, Extranet and Internet. World Wide Web- Domain and Subdomain, Address Resolution, DNS, Telnet, FTP, HTTP. TCP/IP- Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and Addressing- Classful and Classless Addressing, Subnetting

UNIT II HTML 9

Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color Name, Color value. Image Maps- map, area, attributes of the image area- Extensible Markup Language (XML)- Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts- Introduction-Environment Variable, GET and POST Methods.

UNIT III 9

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie, for example. Java Applets-Container Class, Components, Applet Life-Cycle, Update method, Applications.

UNIT IV CLIENT-SERVER PROGRAMMING 9

Client-Server Programming In Java - Java Socket, Java RMI. Threats - Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks- Network security techniques- Password and Authentication- VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall- Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V INTERNET TELEPHONY 9

Introduction, VoIP- Multimedia Applications- Multimedia over IP: RSVP, RTP, RTCP and RTSP- Streaming media, Codec and Plugins, IPTV- Search Engine and Web Crawler- Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Total Hours: 45

TEXTBOOKS:

1. Robert W. Sebesta, "Programming the World Wide Web", Pearson Education, 2016
2. Paul Deitel, Harvey Deitel and Abby Deitel, "Internet and World Wide Web-How to Program", 5th Edition, 2018.

REFERENCES:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2018.
2. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI Learning, Delhi, 2019.

WEBSITES:

1. https://nptel.ac.in/courses/106/105/106105084/
2. https://supportline.microfocus.com/Documentation/books/sx22sp1/piover.htm
3. https://www.geeksforgeeks.org/internet-and-web-programming/

21BECSOE02 MACHINE LEARNING 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- To introduce the basic concepts and techniques of Machine Learning.
- To have a complete understanding of the Supervised and Unsupervised learning techniques.
- To study the various probability based learning techniques.
- To learn Dimensionality Reduction Techniques.
- To understand Evolutionary Models and Graphical models of machine learning algorithms.
- To design appropriate machine learning algorithms for problem solving.

COURSE OUTCOMES

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

- Distinguish between supervised, unsupervised and semi-supervised learning
- Apply the appropriate machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
- Design systems that use the appropriate graph models of machine learning
- Modify existing machine learning algorithms to improve classification accuracy/efficiency
- Analyze and suggest appropriate machine learning approaches for various types of problems

UNIT I INTRODUCTION 9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING **9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V ADVANCED LEARNING **9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Total Hours: 45

TEXT BOOKS:

1. Michael Bowles, “Machine Learning in Python-Essential Techniques for Predictive Analysis”, Wiley Publication, 2015.
2. Stephen Marsland, “MachineLearning – An Algorithmic Perspective”, SecondEdition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Jason Bell, "Machine learning – Hands-on for Developers and Technical Professionals”, First Edition, Wiley, 2014.

REFERENCES:

4. EthemAlpaydin, "Introduction to Machine Learning”,3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press,2014
5. Tom Mitchell, "Machine Learning", First Edition, McGraw-Hill Education, 2013.
6. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.

WEBSITES:

1. https://nptel.ac.in/courses/106106139/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
3. https://www.dataquest.io/blog/machine-learning-python/

LIST OF MANDATORY COURSES

SEMESTER III

21BECS351 PC HARDWARE ASSEMBLY AND TROUBLE SHOOTING 2H-0C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To study the essential parts of a computer in detail
- Introduce various peripheral devices available for computers and their detailed working concepts
- Overview of multiple interfaces and another hardware overview
- Assemble/set up and upgrade personal computer systems and discuss power supplies and the skills to troubleshoot various power-related problems.
- To study basic concepts and methods in troubleshooting
- To check the installation/connection and maintenance of the computer and its associated peripherals.

COURSE OUTCOME:

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

- Identify the main components for the PC, familiarize themselves with PC memories such as RAM and ROM devices and so on.
- Identify various peripheral devices available and their working
- Understand various concepts of hardware and its interface and control
- Perform basic installation of PC. The importance of maintenance is understood
- Understand Various faults and failures are identified and troubleshooting in detail
- Understand overall PC hardware, interfacing, maintenance and troubleshooting

UNIT I INTRODUCTION 6

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT II PERIPHERAL DEVICES 6

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices – FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax-Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT III PC HARDWARE OVERVIEW 6

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC.

UNIT IV INSTALLATION AND PREVENTIVE MAINTENANCE 6

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT V TROUBLESHOOTING 6

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI" s – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

Total Hours: 30

TEXT BOOK:

1. B. Govindarajalu, “IBM PC Clones Hardware, Troubleshooting and Maintenance”, 2/E, TMH, 2002.

REFERENCES:

1. Peter Abel, Niyaz Nizamuddin, “IMB PC Assembly Language and Programming”, Pearson Education, 2007
2. Scott Mueller, “Repairing PC's”, PHI, 2092

WEBSITES:

1. https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
2. https://courses.lumenlearning.com/zeliite115/chapter/reading-hardware-2/
3. https://www.tutorialspoint.com/computer_fundamentals/computer_hardware.htm

SEMESTER IV

21BECS451 MOBILE APPLICATION DEVELOPMENT 2H-0C

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

Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- Describe those aspects of mobile programming that make it unique from programming for other platforms
- Explain installation and working of Android
- Critique mobile applications on their design pros and cons
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
- Program mobile applications for the Android operating system that use basic and advanced phone features
- Deploy applications to the Android marketplace for distribution.

COURSE OUTCOMES:

Upon completion of the course, the students will have

- Ability to install Android in Eclipse
- Understanding of the Android environment to develop projects
- Ability to create simple Android projects
- Understanding of the android widgets and their inclusion in projects
- Ability to create android application for playing audio and video files
- Ability to deploy the application to the android marketplace for distribution

LIST OF EXPERIMENTS

1. Installation of Android in eclipse and study of Android Development Tools, Components and Architecture.
2. Creating and Running Android Virtual Device (AVD)
3. Running Hello World Android Project
4. Working with different Android User Interface
5. A simple android application to study various android widgets like text boxes, buttons, toggle Buttons and Images
6. Working with Android Activity life cycle
7. Working with intents
8. Working with fragments
9. Working with TTS engine in Android
10. A simple android application for playing audio and video files

Total Hours: 30

SEMESTER VI

21BECS651 CCNA-INTRODUCTION TO NETWORKS 1H-0C

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

Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To describe how networks impact our daily lives.
- To describe the role of data networking in the human network.
- To identify the key components of any data network.
- To describe network access, Ethernet and network layers concept
- To illustrate the characteristics of network architectures: fault tolerance, scalability, quality of service and security.
- To devices that make up the network

COURSE OUTCOMES:

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

- Identify and describe internet architecture, structure, functions, components, and models;
- Describe the use of OSI and TCP layered models;
- Identify and describe the nature and roles of protocols and services at the application, network, data link, and physical layers;
- Describe principles and structure of IP addressing and the fundamentals of Ethernet concepts, media, and operations;
- Build simple LAN topologies by applying basic principles of cabling, device configuration, and IP subnetting
- To develop the applications of networks

UNIT-1 **3**

Exploring the Network: Globally Connected-LANs, WANs, and the Internet -The Network as a Platform-The Changing Network Environment, Configuring a Network Operating System: Introduction-IOS Bootcamp-Getting Basic-Addressing Schemes, Network Protocols and Communications: Rules of Communication-Network Protocols and Standards-Moving Data in the Network

UNIT-2 **4**

Network Access: Physical Layer Protocols-Network Media-Data Link Layer Protocols-Media

Access Control, Ethernet: Introduction-Ethernet Protocol -Address Resolution Protocol -LAN Switches, Network Layer- Network Layer Protocols- Routing-Routers-Configuring a Cisco Router

UNIT-3 **4**

Transport Layer: Introduction-Transport Layer Protocols-TCP and UDP, IP Addressing: Introduction-IPv4 Network Addresses -IPv6 Network Addresses -Connectivity Verification, Subnetting IP Networks: Introduction-Subnetting IPv4 Network-Addressing Schemes-Design Considerations for IPv6

UNIT-4 **4**

Application Layer: Introduction-Application Layer Protocols -Well-Known Application Layer Protocols and Service -The Message Heard around the World, It's a Network: Introduction-Create and Grow-Keeping the Network Safe-Basic Network Performance-Managing IOS Configuration Files-Integrated Routing Services

Total Hours:15

TEXT BOOKS:

1. Todd Lammle, "CCNA Routing and Switching Study Guide", Wiley; 1 edition, 2013.
2. Wendell Odom, "Cisco Ccnet/CCNA ", Icnd1 100 - 101 Official Cert Guide, Pearson Education; 1 edition, 2013.

REFERENCES:

1. Wendell Odom, "Cisco CCNA Routing and Switching", Icnd2 200 - 101 Official Cert Guide, Pearson Education; 1 edition, 2013.
2. Kevin Wallace, "CCNP Routing and Switching ROUTE ", 300-101 Official Cert Guide, Cisco Press, 2014.

WEBSITES:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://www.udemy.com/topic/cisco-ccna/free/

SEMESTER VII

21BECS751 CCNA–ROUTING AND SWITCHING ESSENTIALS 1H-0C

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

Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To discuss the concepts of primary switched networks and Configuration
- To describe the concepts of VLAN and routing concepts
- To illustrate Inter-VLAN Routing and static routing concepts
- To describes the architecture, components, and operation of routers and explains the principles of routing and routing protocols.
- To analyze, configure, verify, and troubleshoot the primary routing protocols RIPv1, RIPv2, EIGRP, and OSPF.
- To Recognize and correct common routing issues and problems. Model and analyze routing processes.

COURSE OUTCOMES:

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

- Describe the purpose, nature, and operations of a router; describe the purpose and nature of routing tables;
- Describe the purpose and procedure of configuring static routes;
- Develop Inter-VLAN Routing and static routing based applications
- Design and implement a classless IP addressing scheme for a given network;
- Describe the basic features and concepts of link-state routing protocols;
- Configure and verify basic RIPv1, RIPv2, single area OSPF, and EIGRP operations in a small routed network

UNIT-1 **3**

Introduction to Switched Networks-Objectives-Key Terms-Introduction-LAN Design The Switched Environment. **Basic Switching Concepts and Configuration**-Objectives-Key Terms-Introduction-Basic Switch Configuration-Configure Switch Ports-Switch Security: Management and Implementation

UNIT-2 **3**

VLANs Objectives-Key Terms-Introduction-VLAN Segmentation-VLANs in a Multiswitched Environment-VLAN Implementations-VLAN Trunks-Dynamic Trunking Protocol-Troubleshoot VLANs and Trunks-VLAN Security and Design-Design Best Practices for VLANs **Routing**

Concepts-Objectives-Key Terms-Introduction-Functions of a Router Connect Devices-Basic Settings on a Router-Verify Connectivity of Directly Connected-Networks Switching Packets Between Networks-Path Determination-Analyze the Routing Table-Directly Connected Routes-Statically Learned Routes- Dynamic Routing Protocols

UNIT-3 **3**

Inter-VLAN Routing-Objectives-Key Terms-Introduction-Inter-VLAN Routing Configuration-Configure Legacy Inter-VLAN Routing-Configure Router-on-a-Stick Inter-VLAN Routing Troubleshoot Inter-VLAN Routing-Layer 3 Switching-Troubleshoot Layer 3 Switching. **Static Routing**-Objectives-Key Terms-Introduction-Static Routing-Types of Static Routes-Configure IPv4 Static Routes-Configure IPv4 Default Routes-Configure IPv6 Static Routes -Configure IPv6 Default Routes-Review of CIDR and VLSM-CIDR-VLSM-Configure IPv6

UNIT-4 **3**

Routing Dynamically-Routing Dynamically-Dynamic Routing Protocol-Operation Dynamic Versus Static Routing-Routing Protocol Operating Fundamentals-Types of Routing Protocols - Distance Vector Routing Protocol Operation-Types of Distance Vector Routing Protocols-RIP and RIPng Routing-Configuring the RIPng Protocol-Link-State Dynamic Routing

Single-Area OSPF-Characteristics of OSPF-OSPF Messages-OSPF Operation-Configuring Single-Area-OSPFv2

UNIT-5 **3**

Access Control Lists-IP ACL Operation-Standard Versus Extended IPv4 ACLS-Wildcard Masks in ACLs-Guidelines for ACL Creation- Securing VTY Ports with a Standard IPv4 ACL-IPv6 ACLs.**DHCP**-Dynamic Host Configuration Protocol v4-Configuring a Basic DHCPv4 Server-Configure DHCPv4 Client-Troubleshoot DHCPv4. **Network Address Translation for IPv4** - NAT Operation-Types of NAT-Benefits of NAT-Configuring NAT- Configuring Dynamic NAT Configuring- Port Address Translation (PAT)-Port Forwarding

Total Hours:15

TEXT BOOKS:

1. Todd Laemmle, "CCNA Routing and Switching Study Guide", Wiley; 1 edition, 2013.
2. Wendell Odom, "Cisco Ccnet/CCNA" Icnd1 100 - 101 Official Cert Guide, Pearson Education; 1 edition, 2013.

REFERENCES:

3. Wendell Odom, "Cisco CCNA Routing and Switching" Icnd2 200 - 101 Official Cert Guide, Pearson Education; 1 edition, 2013.
4. Kevin Wallace, "CCNP Routing and Switching ROUTE" 300-101 Official Cert Guide, Cisco Press, 2014.

WEBSITES:

1. https://www.netacad.com/courses/networking/ccna-switching-routing-wireless-essentials#:~:text=CCNA%207%3A%20Switching%2C%20Routing%2C%20and%20Wireless%20Essentials&text=After%20completing%20all%20three%20CCNA,LANs%20and%20Inter%2DVLAN%20routing

LIST OF VALUE-ADDED COURSES:

1. Server-Side Scripting using Python
2. Data Analytics using R tool
3. Mobile Application Development using Windows
4. Network introduction using Packet Tracer Tools
5. Routing and Switching Essentials using Packet Tracer Tools
6. PHP & MySQL
7. Web Design
8. Building Blocks of JAVA