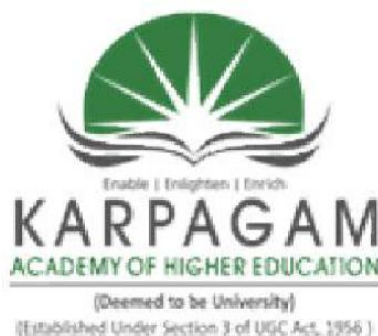# B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SYLLABI 2022-2023

(CHOICE BASED CREDIT SYSTEM)

Department of Computer Science and Engineering

FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act 1956)

(Accredited with A+ Grade by NAAC in Second Cycle)

Pollachi Main Road, Eachanari Post

Coimbatore-641021.

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

FACULTY OF ENGINEERING
DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY
REGULAR PROGRAMME
REGULATIONS 2022
CHOICE BASED CREDIT SYSTEM

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

1. ADMISSION

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

Should have passed the Higher Secondary Examination (10+2) prescribed by the State Government / Central Government with Mathematics/ Physics/ Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship. (Any of the above three subjects) or any similar Examination of any other institution/ University or authority accepted by the Karpagam Academy of Higher Education as equivalent thereto).

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

(OR)

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

1.2 Lateral Entry Admission

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

OR

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

OR

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

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

S. No.	Programme	Eligibility criteria
1.	B.E Bio Medical Engineering	Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks incase of candidates belonging to reserved category) in ANY branch of Engineering and Technology.
2	B. E. Civil Engineering	
3.	B. E. Computer Science and Design	**OR** Passed B.Sc. Degree from a recognizedUniversity as defined by UGC, with at least 45% marks (40%
4.	B. E. Computer Science andEngineering	marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.
5.	B. E. Electrical and ElectronicsEngineering	
6.	B. E. Electronics and Communications Engineering	**OR** Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics,
7.	B. E. Mechanical Engineering	Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)
8.	B. Tech. Artificial Intelligence andData Science	
9.	B. Tech Bio - Technology	
10.	B. Tech Food Technology	

1.3 Migration from other University

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

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

2 . PROGRAMMES OFFERED

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

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

1. B.E Bio Medical Engineering
2. B. E. Civil Engineering
3. B. E. Computer Science and 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, project work, industrial visits, camps, etc.
Every student is encouraged to participate in at least any one of the following programmes
- NSS / Sports/Physical exercise/NCC/YRC/Red Ribbon club/Environment club and Energy club
- Other Co-Curricular and Extra Curricular activities

(v) Choice Based Credit System

CBCS is introduced for students admitted in the academic year 2017-18. As per AICTE guidelines, CBCS is an approach in which students opt for courses of their choice. CBCS provides greater flexibility with multiple courses and enable students to undergo additional courses. CBCS is applicable to Full Time Undergraduate & Post Graduate Programmes of study. It provides a choice for students to select from the prescribed courses(Professional soft core, Professional Hard core, Professional Electives, Open Electives, Value added courses, Humanity Sciences, Basic sciences & Engineering sciences). A course designated as hard core for a particular programme of study must invariably be completed by the student to receive the degree in the programme. The Hardcore courses cannot be substituted by another courses. Students can exercise their choice among a set of Soft core courses from the list of Soft core courses specified for each Programme of study. The student should meet the criteria for prerequisites to become eligible to register for that course. The student should request for the course for every semester within the first week of semester. Maximum no of students to be registered in each course shall depend on availability of physical facilities, classroom availability and lab capacity. Registration of already requested courses by students in previous semester is not allowed.

4.2 Each course is normally assigned certain number of credits.

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

4.3 In every semester, the curriculum shall normally have a blend of theory courses not 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 shall be within the limits specified below.

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

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

4.6 Value Added Course

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

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

5. DURATION OF THE PROGRAMME

5.1 The prescribed duration of the programme shall be

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

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

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

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

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

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

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

7. CLASS ADVISOR

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

8. CLASS COMMITTEE

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

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

- Informing the student representatives the details of Regulations regarding weight age used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar, etc.) the breakup of marks for each experiment / exercise /module of work, should be clearly discussed in the class committee meeting and informed to the students.

- Solving problems experienced by students in the class room and in the laboratories.

- Informing the student representatives the academic schedule, including the dates of assessments and the syllabus coverage for each assessment.

- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.

- Identifying the weak students, if any and requesting the teachers concerned to provide some additional academic support.

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

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

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

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

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

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

8.8 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 Continuous Internal Assessment for Integrated Theory Course is awarded for 40 Marks with marksplit up similar to regular theory course.

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

10.3 ATTENDANCE

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

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

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

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

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

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

PATTERN OF ESE QUESTION PAPER

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

13. PASSING REQUIREMENTS

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

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

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

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

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

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

13.4 ONLINE COURSE(MOOC) COORDINATOR
To help students in planning their online courses and for general advice on online courses, the HOD shall nominate a MOOC coordinator for the online courses. The Online course MOOC coordinator

shall identify the courses which students can select for their programme from the available online courses offered by the different agencies periodically and inform the same to the students. Further, the coordinator shall advice the students regarding the online courses and monitor their course.

13.4.1 Student Shall study atleast one online course from Sawayam/NPTEL in anyone of the first seven semesters for which examination shall be conducted at the end of the course by the respective organization body. The student can register to the course which are approved by the department. The student shall produce a pass certificate from the respective body before the end of the seventh semester.

14. AWARD OF LETTER GRADES

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

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

14.2 GRADE SHEET

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

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

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

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

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

14.3 REVALUATION

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

14.4 TRANSPARENCY AND GRIEVANCE COMMITTEE

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

15. ELIGIBILITY FOR AWARD OF DEGREE

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

- Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

- No disciplinary action is pending against him/her.

  The award of the degree must be approved by the Board of Management of Karpagam

  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 but maintains CGPA of 7.5 and above is not eligible for Honors degree but eligible for First classwith Distinction.

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

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

17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

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

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

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

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

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

17.5 Withdrawal from the ESE is NOT applicable to arrear Examinations.
17.6 The candidate shall reappear for the withdrawn courses during the Examination conducted in the subsequent semester.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

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

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

18.3 The authorized break of study (for a maximum of one year) will not be counted for the duration specified for passing all the courses for the purpose of classification (vide Clause17). However, additional break of study granted will be counted for the purpose of classification.

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

18.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Withdrawal' or 'Break of Study' (Clause18and 18 respectively).

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

20. INDUSTRIAL VISIT

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

21. DISCIPLINE

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

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

22. REVISION OF REGULATION AND CURRICULUM

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

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FACULTY OF ENGINEERING
Department of Computer Science and Engineering
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

List of PEOs, POs and PSOs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAM SPECFIC OUTCOMES (PSOs):

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

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

MAPPING:

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
PEO2	✓	✓	✓	✓	✓			✓	✓	✓				✓
PEO3	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓

Credit Distribution:

S.No.	Course Category	Credit Distribution	Percentage
1	Basic Science	30	18.29
2	Engineering Science	11	6.70
3	Humanities and Science	14	8.53
4	Professional Core	65	39.63
5	Professional Elective	21	12.80
6	Open Elective	6	3.65
7	Project Work	13	7.92
8	Mandatory course	2	1.21
	Total	**162**	**100%**

FACULTY OF ENGINEERING (FOE)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UG PROGRAM (CBCS) - B.Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
(2020-2021 Batch and Onwards)

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
SEMESTER I										
22BTAD101	Technical English – I	HS	3	1	0	4	40	60	100	1
22BTAD102	Mathematics-I (Matrices and Calculus)	BS	4	1	0	5	40	60	100	3
22BTAD103	Environmental Studies	HS	3	0	0	3	40	60	100	5
22BTAD141	Engineering Physics	BS	3	1	2	5	40	60	100	8
22BTAD142	Programming Logic and Design	ES	4	0	2	5	40	60	100	11
22BTAD111	Engineering Practices for Computer Sciences	ES	0	0	4	2	40	60	100	14
SEMESTER TOTAL			**17**	**3**	**8**	**24**	**240**	**360**	**600**	
SEMESTER II										
22BTAD201	Mathematics-II (Vector Calculus and Integral Transforms)	BS	4	1	0	5	40	60	100	16
22BTAD202	Fundamentals of Data Science	PC	3	0	0	3	40	60	100	18
22BTAD241	Technical English–II	HS	3	0	2	4	40	60	100	20
22BTAD242	Object Oriented Programming with Python	ES	3	0	2	4	40	60	100	23
22BTAD243	Data Preparation and Data Handling	PC	3	0	2	4	40	60	100	26
SEMESTER TOTAL			**16**	**1**	**6**	**20**	**200**	**300**	**500**	

SEMESTER III										
22BTAD301	Mathematics-III (Mathematical Foundations of Computing Sciences)	**BS**	4	1	0	5	**40**	**60**	**100**	**29**
22BTAD341	Database Management Systems	**PC**	3	0	2	4	**40**	**60**	**100**	**31**
22BTAD342	Data Structures	**PC**	3	0	2	4	**40**	**60**	**100**	**34**
22BTAD343	Fundamentals of Artificial Intelligence	**PC**	3	0	2	4	**40**	**60**	**100**	**37**
22BTAD344	R Programming	**PC**	3	0	2	4	**40**	**60**	**100**	**40**
22BTAD351	PC hardware assembly and trouble shooting	**MC**	0	0	2	-	**100**	**-**	**100**	**248**
SEMESTER TOTAL			**16**	**1**	**10**	**21**	**300**	**300**	**600**	
SEMESTER IV										
22BTAD401	Mathematics-IV (Probability and Statistics)	**BS**	4	1	0	5	**40**	**60**	**100**	**43**
22BTAD402	Data Visualization	**PC**	3	0	0	3	**40**	**60**	**100**	**45**
22BTAD441	Java Programming	**PC**	3	0	2	4	**40**	**60**	**100**	**47**
22BTAD442	Operating Systems	**PC**	3	0	2	4	**40**	**60**	**100**	**50**
22BTAD443	Machine Learning Techniques	**PC**	3	0	2	4	**40**	**60**	**100**	**53**
22BTAD4Exx	Elective I	**PE**	3	0	0	3	**40**	**60**	**100**	**93-103**
22BTAD451	Internship–I	**MC**	0	0	2	1	**100**	**-**	**100**	**253**
SEMESTER TOTAL			**19**	**1**	**8**	**24**	**340**	**360**	**700**	
SEMESTER V										
22BTAD501	Numerical Linear Algebra	**BS**	4	1	0	5	**40**	**60**	**100**	**56**
22BTAD502	Soft Computing in Data Science	**PC**	3	0	0	3	**40**	**60**	**100**	**59**
22BTAD541	Deep Learning Techniques	**PC**	3	0	2	4	**40**	**60**	**100**	**61**

22BTAD5Exx	Elective II	**PE**	3	0	0	3	**40**	**60**	**100**	**103-135**
22BTAD5Exx	Elective III	**PE**	3	0	0	3	**40**	**60**	**100**	**103-135**
22BTAD551	Web Scripting	**MC**	0	0	3	-	**100**	**-**	**100**	**250**
SEMESTER TOTAL			**16**	**1**	**5**	**18**	**300**	**300**	**600**	
SEMESTER VI (NATURAL LANGUAGE PROCESSING)										
22BTAD641	Speech and language processing	**PC**	3	0	2	4	**40**	**60**	**100**	**64**
22BTAD642	No SQL databases	**PC**	3	0	2	4	**40**	**60**	**100**	**67**
22BTAD643	Pattern recognition	**PC**	3	0	2	4	**40**	**60**	**100**	**70**
22BTAD6Exx	Elective IV	**PE**	3	0	0	3	**40**	**60**	**100**	**138-157**
22BTAD6Exx	Elective V	**PE**	3	0	0	3	**40**	**60**	**100**	**138-157**
22BTAD6Exx	Elective VI	**PE**	3	0	0	3	**40**	**60**	**100**	**138-157**
22BTAD651	Internship–II	**MC**	0	0	2	1	**100**	**-**	**100**	**254**
22BTAD691	Mini Project	**PW**	-	-	2	1	**100**	**-**	**100**	**256**
SEMESTER TOTAL			**18**	**0**	**10**	**23**	**440**	**360**	**800**	
SEMESTER VI (COMPUTER VISIONS)										
22BTAD644	Computer vision	**PC**	3	0	2	4	**40**	**60**	**100**	**73**
22BTAD642	No SQL databases	**PC**	3	0	2	4	**40**	**60**	**100**	**67**
22BTAD645	Digital Image processing	**PC**	3	0	2	4	**40**	**60**	**100**	**76**
22BTAD6Exx	Elective IV	**PE**	3	0	0	3	**40**	**60**	**100**	**138-157**
22BTAD6Exx	Elective V	**PE**	3	0	0	3	**40**	**60**	**100**	**138-157**
22BTAD6Exx	Elective VI	**PE**	3	0	0	3	**40**	**60**	**100**	**138-157**
22BTAD651	Internship–II	**MC**	0	0	2	1	**100**	**-**	**100**	**254**
22BTAD691	Mini Project	**PW**	-	-	2	1	**100**	**-**	**100**	**256**
SEMESTER TOTAL			**18**	**0**	**10**	**23**	**440**	**360**	**800**	

	SEMESTER VI (MODELING)									
22BTAD646	Advanced Data Science	PC	3	0	2	4	40	60	100	79
22BTAD642	No SQL databases	PC	3	0	2	4	40	60	100	67
22BTAD647	Computing systems for Data processing	PC	3	0	2	4	40	60	100	82
22BTAD6Exx	Elective IV	PE	3	0	0	3	40	60	100	135-155
22BTAD6Exx	Elective V	PE	3	0	0	3	40	60	100	135-155
22BTAD6Exx	Elective VI	PE	3	0	0	3	40	60	100	135-155
22BTAD651	Internship–II	MC	0	0	2	1	100	-	100	254
22BTAD691	Mini Project	PW	-	-	2	1	100	-	100	256
SEMESTER TOTAL			18	0	10	23	440	360	800	
	SEMESTER VII									
22BTAD741	Robotics and Automation	PC	3	0	2	4	40	60	100	85
22BTAD742	Data Communication and Computer Networks	PC	3	0	2	4	40	60	100	88
22BTAD7Exx	Elective VII	PE	3	0	0	3	40	60	100	156-161
---	Open Elective-I	OE	3	0	2	3	40	60	100	162-248
22BTAD791	Project Work – Phase I	PW	0	0	8	4	40	60	100	258
SEMESTER TOTAL			12	0	14	18	200	300	500	
22BTAD801	Principles of Management and Engineering Ethics	HS	3	0	0	3	40	60	100	91
----	Open Elective-II	OE	3	0	0	3	40	60	100	162-248
22BTAD891	Project Work & Viva Voce - Phase II	PW	0	0	16	8	80	120	200	259
SEMESTER TOTAL			6	0	16	14	160	240	400	
PROGRAM TOTAL			120	7	77	162	2180	2520	4700	

Total Marks = 4700
Total Credits = 162

LIST OF PROFESSIONAL ELECTIVES

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			Credit(s)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
Professional Electives for semester-IV **Elective I**										
22BTAD4E01	Applied data science	**PE**	3	0	0	3	**40**	**60**	**100**	**94**
22BTAD4E02	Cloud Computing Techniques	**PE**	3	0	0	3	**40**	**60**	**100**	**96**
22BTAD4E03	Mobile and Pervasive Computing	**PE**	3	0	0	3	**40**	**60**	**100**	**98**
22BTAD4E04	Advanced Algorithms	**PE**	3	0	0	3	**40**	**60**	**100**	**100**
22BTAD4E05	Design and Analysis of Algorithms	**PE**	3	0	0	3	**40**	**60**	**100**	**102**
Professional Electives for Semester-V **Elective II & III**										
22BTAD5E01	Information Storage and Management	**PE**	3	0	0	3	**40**	**60**	**100**	**104**
22BTAD5E02	Dot Net Technologies	**PE**	3	0	0	3	**40**	**60**	**100**	**106**
22BTAD5E03	Mobile Application Development	**PE**	3	0	0	3	**40**	**60**	**100**	**108**
22BTAD5E04	Business Intelligence	**PE**	3	0	0	3	**40**	**60**	**100**	**110**
22BTAD5E05	SPARK and Big Data	**PE**	3	0	0	3	**40**	**60**	**100**	**112**
22BTAD5E06	Advanced Java Programming	**PE**	3	0	0	3	**40**	**60**	**100**	**114**
22BTAD5E07	Enterprise Application	**PE**	3	0	0	3	**40**	**60**	**100**	**116**
22BTAD5E08	Service Oriented Architecture	**PE**	3	0	0	3	**40**	**60**	**100**	**118**
22BTAD5E09	Open Source Technologies	**PE**	3	0	0	3	**40**	**60**	**100**	**120**

22BTAD5E10	Cyber Forensics	**PE**	3	0	0	3	**40**	**60**	**100**	**122**
22BTAD5E11	Human Computer Interaction	**PE**	3	0	0	3	**40**	**60**	**100**	**124**
22BTAD5E12	Agile Methodologies	**PE**	3	0	0	3	**40**	**60**	**100**	**126**
22BTAD5E13	Web Application Development Using Java	**PE**	3	0	0	3	**40**	**60**	**100**	**128**
22BTAD5E14	Web Application Development Using Python	**PE**	3	0	0	3	**40**	**60**	**100**	**130**
22BTAD5E15	DevOps in Java	**PE**	3	0	0	3	**40**	**60**	**100**	**132**
22BTAD5E16	DevOps in Python	**PE**	3	0	0	3	**40**	**60**	**100**	**134**
Professional Electives for Semester-VI Elective IV,V & VI										
22BTAD6E01	Internet of Things	**PE**	3	0	0	3	**40**	**60**	**100**	**136**
22BTAD6E02	Advanced Python Programming	**PE**	3	0	0	3	**40**	**60**	**100**	**138**
22BTAD6E03	Advanced Database Management Systems	**PE**	3	0	0	3	**40**	**60**	**100**	**140**
22BTAD6E04	Ethics for AI Engineers	**PE**	3	0	0	3	**40**	**60**	**100**	**142**
22BTAD6E05	E – Commerce Technology	**PE**	3	0	0	3	**40**	**60**	**100**	**144**
22BTAD6E06	Practical reinforcement Learning	**PE**	3	0	0	3	**40**	**60**	**100**	**146**
22BTAD6E07	Drones Technology and its applications	**PE**	3	0	0	3	**40**	**60**	**100**	**148**
22BTAD6E08	Bio Informatics	**PE**	3	0	0	3	**40**	**60**	**100**	**150**
22BTAD6E09	Optimizations for Machine Learning	**PE**	3	0	0	3	**40**	**60**	**100**	**152**
22BTAD6E10	Internet Programming	**PE**	3	0	0	3	**40**	**60**	**100**	**154**
Professional Electives for semester-VII Elective VII										
22BTAD7E01	Industry 4.0	**PE**	3	0	0	3	**40**	**60**	**100**	**156**
22BTAD7E02	Digital Manufacturing and Applications	**PE**	3	0	0	3	**40**	**60**	**100**	**158**

COURSE CODE	NAME OF THE COURSE	CATEGORY	L	T	P	Credit(s)	CIA	ESE	TOTAL	Page No.
22BTAD7E03	Software Quality Assurance and Testing	PE	3	0	0	3	40	60	100	160

LIST OF OPEN ELECTIVES OFFERED BY OTHER DEPARTMENTS

COURSE CODE	NAME OF THE COURSE	CATEGORY	Instruction hours/week			Credit(s)	Maximum Marks			Page No.
			L	T	P		CIA	ESE	TOTAL	
Electrical & Electronics Engineering										
22BEEEOE01	Electric Hybrid Vehicles	OE	3	0	0	3	40	60	100	163
22BEEEOE02	Renewable Energy Resources	OE	3	0	0	3	40	60	100	165
Electronics & Communication Engineering										
22BEECOE01	Neural Networks And Its Applications	OE	3	0	0	3	40	60	100	168
22BEECOE02	Principles of Modern Communication systems	OE	3	0	0	3	40	60	100	172
Bio Medical Engineering										
22BEBMEOE01	Human Anatomy And Physiology	OE	3	0	0	3	40	60	100	175
22BEBMEOE02	Artificial Organs And Implants	OE	3	0	0	3	40	60	100	177
Bio Technology										
22BTBTOE01	Bioreactor Design	OE	3	0	0	3	40	60	100	180
22BTBTOE02	Food Processing And Preservation	OE	3	0	0	3	40	60	100	182
22BTBTOE03	Basic bioinformatics	OE	3	0	0	3	40	60	100	184

22BTBTOE04	Fundamentals Of Nano biotechnology	**OE**	3	0	0	3	**40**	**60**	**100**	**186**
Mechanical Engineering										
22BEMEOE01	Computer aided design	**OE**	3	0	0	3	**40**	**60**	**100**	**189**
22BEMEOE02	Industrial safety and environment	**OE**	3	0	0	3	**40**	**60**	**100**	**191**
22BEMEOE03	Non-Destructive testing	**OE**	3	0	0	3	**40**	**60**	**100**	**193**
Civil Engineering										
22BECEOE01	Housing Plan and Management	**OE**	3	0	0	3	**40**	**60**	**100**	**196**
22BECEOE02	Building services	**OE**	3	0	0	3	**40**	**60**	**100**	**198**
22BECEOE03	Repair And Rehabilitation of Structures	**OE**	3	0	0	3	**40**	**60**	**100**	**200**
22BECEOE04	Computer-Aided Civil Engineering Drawing	**OE**	3	0	0	3	**40**	**60**	**100**	**202**
22BECEOE05	Contracts Management	**OE**	3	0	0	3	**40**	**60**	**100**	**204**
22BECEOE06	Air and Noise Pollution and Control	**OE**	3	0	0	3	**40**	**60**	**100**	**206**
Food Technology										
22BTFTOE01	Processing Of Food Materials	**OE**	3	0	0	3	**40**	**60**	**100**	**209**
22BTFTOE02	Nutrition And Dietetics	**OE**	3	0	0	3	**40**	**60**	**100**	**211**
22BTFTOE03	Ready To Eat Foods	**OE**	3	0	0	3	**40**	**60**	**100**	**213**
22BTFTOE04	Agricultural Waste and By Products Utilization	**OE**	3	0	0	3	**40**	**60**	**100**	**215**

22BTFTOE05	Design of Food Process Equipment	**OE**	3	0	0	3	**40**	**60**	**100**	217
	Science And Humanities									
22BTSHOE01	Solid Waste Management	**OE**	3	0	0	3	**40**	**60**	**100**	220
22BTSHOE02	Green Chemistry	**OE**	3	0	0	3	**40**	**60**	**100**	222
22BTSHOE03	Applied Electrochemistry	**OE**	3	0	0	3	**40**	**60**	**100**	224
	Computer Science and Engineering									
22BECSOE01	Internet of things	**OE**	3	0	0	3	**40**	**60**	**100**	**227**
22BECSOE02	Machine Learning	**OE**	3	0	0	3	**40**	**60**	**100**	**229**
22BECSOE03	Block chain Technologies	**OE**	3	0	0	3	**40**	**60**	**100**	**231**
	Artificial Intelligence &Data Science									
22BTADOE01	Fundamentals of Artificial Intelligence	**OE**	3	0	0	3	**40**	**60**	**100**	**234**
22BTADOE02	Fundamentals of Data Science	**OE**	3	0	0	3	**40**	**60**	**100**	**236**
22BTADOE03	Internet Programming	**OE**	3	0	0	3	**40**	**60**	**100**	**238**
22BTADOE04	Robotics and Automation	**OE**	3	0	0	3	**40**	**60**	**100**	**240**
	Computer Science and Design									
22BECDOE01	Introduction to 3D modeling and animation	**OE**	3	0	0	3	**40**	**60**	**100**	**243**
22BECDOE02	Digital Photography	**OE**	3	0	0	3	**40**	**60**	**100**	**245**
22BECDOE03	Mobile Application development	**OE**	3	0	0	3	**40**	**60**	**100**	**247**

List of Mandatory Courses

1. 22BTAD351 PC hardware assembly and trouble shooting
2. 22BTAD451 Internship– I
3. 22BTAD551 Web scripting
4. 22BTAD651 Internship– II

List of Value Added Courses

1. Big Data Analytics using R Programming
2. Spark for Data Analytics
3. Devops for MVC Framework Using Python
4. Application of Internet of Things
5. Reinforcement Learning Methods
6. Optimization Techniques in Machine Learning
7. PC hardware assembly and trouble shooting

i) CATEGORY

i.   BS-Basic Sciences
ii. ES-Engineering Sciences
iii. HS-Humanities and Sciences
iv. PC-Professional Course
v.   PE- Professional Elective
vi. OE- Open Elective
vii. PW-Project Work
viii. MC-Mandatory Course

B.Tech Artificial Intelligence and Data Science

SEMESTER-I

22BTAD101   **TECHNICAL ENGLISH – 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 recall the usage of grammar and understand the basic reading and writing skills.
- To emphasize on listening and develop speaking skills
- To engage in formal writing.
- To enrich the receptive and productive skills.
- To develop fluency in language.

COURSE OUTCOMES:

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

- Recall the usage of grammar and understand and implement reading and writing skills.
- Know precise transition between sentences, ideas and paragraphs.
- Apply the linguistic parameters in everyday speaking and listening effectively.
- Enrich the vocabulary by understanding word formation.
- Detect the errors and restructure paragraphs and compose, compile and synthesize documents for various purposes.
- Critically listen and interpret ideas and make effective presentation and participate in discussion

UNIT I   **9**

Grammar: Parts of Speech – Gerunds and infinitives

Reading: Reading comprehension: (vocabulary, referents, and inferences/conclusions).

Writing: Letter Writing (Formal and Informal) – Email Writing

UNIT II   **9**

Grammar: Tenses – Simple Present and Present continuous – Types of Sentences – Direct and Indirect – Connectives.

Reading: Identifying main and secondary information, transferring and interpreting information.

UNIT III   **9**

Writing: Resume writing with cover letter – Check lists – Building Itineraries – Paragraph writing.

Speaking: Describing people, places, jobs and things – Self Introduction – Asking questions.

Listening: Listening comprehension – Telephone conversation – Job description

UNIT IV 9

Grammar: Tenses: Perfect and Perfect continuous tenses – Reported speech – Active Passive - Identifying common errors.

Listening: Critical listening – Listening and Interpretation of ideas.

UNIT V 9

Reading: Reading comprehension: Cause and effect identification, reconstruction, rewording.

Writing: Business letters – Creative writing – Memo – Notice – Agenda.

Speaking: Oral presentations – Group discussions.

TOTAL: 45+15

TEXT BOOKS:
1. Jack C Richards with Jonathan Hull and Susan Proctor I, Interchange Student's Book 1, Cambridge University Press, Fourth Edition, 2016.
2. Barun K Mitra, Effective Technical Communication, Oxford University Press, First Edition, 2017

REFERENCE BOOKS:
1. Jack C Richards, Interchange Student's Book 1, Cambridge University Press, Fourth Edition, 2015.
2. Raymond Murphy, Essential English Grammar, Cambridge University Press, Second Edition, 2016.
3. Ashraf Rizvi M, Effective Technical Communication, McGraw Hill Education, First Edition, 2013.
4. University of Cambridge BEC Preliminary 1 (Exam Papers with answers), Cambridge University Press, 2010.

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

		SEMESTER-I
22BTAD102	**MATHEMATICS - I**	**5H-5C**
	(MATRICES AND CALCULUS)	

Instruction Hours/week: L:4 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 compute eigenvalues and eigenvectors of real symmetric matrix.
- To acquaint the students with the concepts of functions of several variables and optimizing multivariate function.
- To make the students acquire sound knowledge in techniques of solving linear ordinary differential equations.
- To impart knowledge in definite integrals and Beta, Gamma integrals.
- To develop the knowledge in multiple integrals and its applications.

COURSE OUTCOMES:

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

- Identify a real symmetric matrix and diagonalize it by orthogonal transformation.
- Solve extreme value problems with or without constraints.
- Apply the knowledge of solving linear differential equations in order to solve engineering problems.
- Make use of concept of definite integrals and Beta, Gamma functions in appropriate context of engineering problems.
- Apply the concept of multiple integrals to find area and volume of any definite shape.
- To apply the knowledge acquired to solve various enginerring problems.

UNIT I   12

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

UNIT II   12

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

UNIT III   12

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

UNIT IV   12

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

UNIT V   12

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

TOTAL: 60+15

TEXT BOOKS:
1. Ramana B V, Higher Engineering Mathematics, McGraw Hill Education, Twenty Ninth Reprint, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Tenth Edition, 2017.

REFERENCE BOOKS:
1. Kandasamy P, Thilagavathy K and Gunavathy K, Higher Engineering Mathematics, S Chand and Co., First Edition, 2016.
2. Grewal B S, Higher Engineering Mathematics, Khanna Publishers, Forty Forth Edition, 2017.
3. Veerarajan T, Engineering Mathematics (For Semesters I and II), McGraw Hill Education, First Edition, 2017.
4. George Brinton Thomas and Ross L Finney, Calculus and Analytic Geometry, Pearson Publishers, Ninth edition, 2002.

WEBSITES:
1. www.nptel.ac.in/courses/122104018/
2. www.nptel.ac.in/courses/122101003/31
3. www.nptel.ac.in/courses/111107098/11

22BTAD103   **ENVIRONMENTAL STUDIES**   **3H-3C**

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

         End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to:

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

COURSE OUTCOMES:

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

- Demonstrate core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Identify concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Distinguish the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Analyze the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Prioritize and analyses the social issues.
- Integrate the environmental principles in the projects undertaken in field of engineering and technology.

UNIT I – INTRODUCTION - ENVIRONMENTAL STUDIES & ECOSYSTEMS   **9**

Environment Definition,Scope and importance; Ecosystem,Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grass and Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

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

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

UNIT III – BIODIVERSITY AND ITS CONSERVATION 9

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

UNIT IV -ENVIRONMENTAL POLLUTION 9

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

UNIT V - SOCIAL ISSUES AND THE ENVIRONMENT 9

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

TOTAL : 45

REFERENCE BOOKS:

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

2. Erach Bharucha. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.

3. Rajagopalan, R. 2016. Environmental Studies: From Crisis to Cure, Oxford University Press.

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

5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S. Chand& Company Pvt. Ltd., New Delhi.

6. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.

7. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.

8. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.

9. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.

10. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

22BTAD141   **ENGINEERING PHYSICS**   **6H-5C**

(Theory & Lab.)

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

End Semester Exam: 3 Hours

(i)THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

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

COURSE OUTCOMES:

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

- Explain 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 : 45+15

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.

REFERENCE BOOKS:
1. P.M. Mathews, K.Venkatesan, A text book of Quantum Mechanics, 2/e, Mc Graw Hill Education, 2017.
2. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
3. Fiber Optics and Optoelectronics, R P Khare, Oxford, 2012.
4. Daniel V.Schroeder, An Introduction to Thermal Physics, Pearson, 2014.
5. D.S. Mathur, Elements of properties of matter, S.Chand, 2010.

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

(ii)   LABORATORY

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

TOTAL: 30

22BTAD142   **PROGRAMMING LOGIC AND DESIGN**   **6H-5C**
(Theory & Lab.)

Instruction Hours/week: L:4 T:0 P:2   **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students :

- To understand the method of developing an algorithm and to understand the simple program design
- To analyse the loop structures
- To apply the concept of console I/O and arrays
- To learn the working of two dimensional arrays
- To evaluate the modularization concepts and storage classes

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

- Ilustrate   steps in program development and basics of C programming.
- Identify the working of loop structure.
- Develop the programs in console I/O and arrays
- Solve the programs using functions
- Describe the working of structures and file management in C
- Apply the knowledge of programming to develop application software.

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

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

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

UNIT IV 9

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

UNIT V 9

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

TOTAL: 45

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

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

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

(ii) LABORATORY

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

TOTAL: 30

22BTAD111   **ENGINEERING PRACTICES FOR COMPUTER SCIENCES**   **4H-2C**

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

                                        End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To check and measure Personal Computer's power supply voltage.
- To study the mother boards and various types of interface cards.
- To study and replaces hard disk.
- To study the different network cables and network devices.
- To assemble a Personal Computer.

COURSE OUTCOMES:

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

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

LIST OF EXPERIMENTS:

PC Hardware Servicing

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

Networking and configuring Networks

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

TOTAL: 60

SEMESTER-II

22BTAD201   MATHEMATICS -II   **5H-5C**

(VECTOR CALCULUS AND INTEGRAL TRANSFORMS)

Instruction Hours/week: L:4 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 familiarize the concept of vector differential operator and its applications.
- To make the students to understand the concept of periodic function and represent them in Fourier series.
- To introduce the concept of Fourier transform techniques.
- To provide knowledge about the Laplace transform and their properties.
- To afford different techniques of finding inverse Laplace transform, which are useful in solving problems in basic engineering sciences.

COURSE OUTCOMES:

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

- Eplain the concept of vector calculus in appropriate context in engineering fields.
- Describe Fourier series in appropriate context of engineering problems.
- Apply differential equations to engineering fields with the help of Fourier transforms.
- Demonstrate Laplace transform of standard functions in an appropriate context.
- Apply inverse Laplace transform techniques and solve linear differential equations.
- Apply the knowledge to solve real world problems.

UNIT I   **12**

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

UNIT II   **12**

Fourier series: Dirichlet's conditions – Odd and even functions – Half range sine and cosine series – Parseval's identity – Harmonic analysis.

UNIT III   12
Fourier transforms: Statement of Fourier integral theorem – Complex Fourier transform – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity of Fourier transform.

UNIT IV   12
Laplace transform: Transforms of standard functions – Transform of unit step function – Dirac-Delta function – Properties of Laplace transform – Transforms of derivatives and integrals –Initial and final value theorem – Transforms of periodic functions.

UNIT V   12
Inverse Laplace transform: Inverse Laplace transforms of standard functions – Inverse Laplace transform using second shifting theorem – Method of partial fractions – Convolution theorem– Solution of ordinary differential equations with constant coefficients using Laplace transforms.

TOTAL: 60+15

TEXT BOOKS:
1. Ramana B V, Higher Engineering Mathematics, McGraw Hill Education, Twenty Ninth Reprint, 2017.
2. Grewal B S, Higher Engineering Mathematics, Khanna Publishers, Forty Forth Edition, 2017.

REFERENCE BOOKS:
1. Kandasamy P, Thilagavathy K and Gunavathy K, Higher Engineering Mathematics, S Chand and Co., First Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Tenth Edition, 2017.
3. Veerarajan T, Transforms and Partial Differential Equation, McGraw Hill Education, Third Edition, 2016.
4. Manish Goyal and Bali N P, A textbook of Engineering mathematics, Laxmi publications, Eighth edition, 2011.

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

SEMESTER-II

22BTAD202   **FUNDAMENTALS OF DATA SCIENCE**   **3H-3C**

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

COURSE OBJECTIVES:
The goal of this course is for the students
- To study the basic concepts of Data Science and data life cycle
- To understand the theoretical and mathematical aspects of Data Science models
- To learn common random variables and their uses, and with the use of empirical distributions
- To obtain the knowledge in data management tools
- To explore the major techniques for data science

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explain the key concepts in data science and data processing.
- Describe about sampling and probabilistic models
- Discuss about data normalization and data management tools.
- Identify the difference between supervised and unsupervised machine learning techniques.
- Explain about the different analytics used in business intelligence.
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

UNIT I   **9**
The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre-processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT II   **9**
Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

UNIT III   **9**
Data Normalization (z-values, transforms) –Random processes –Data Management: Tools for Data Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

UNIT IV   9

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse–
Machine Learning- Supervised Learning, Unsupervised Learning.

UNIT V   9

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive
Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non
commercial cloud service providers.

TOTAL: 45

TEXT BOOKS:
1. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory
   Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.
2. Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.

REFERENCE BOOKS:
1. Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics,
   IBM Press, First Edition, 2015.
2. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly Publication,
   First Edition, 2017.
3. Dawn Griffiths, Head First Statistics, O'Reilly Publication, First Edition, 2008.

WEBSITES:
1. https://www.inferentialthinking.com/chapters/intro
2. https://www.openintro.org/stat/
3. https://swayam.gov.in/nd1_noc20_cs36/preview
4. https://swayam.gov.in/nd1_noc19_cs60/preview
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-
   to-computational-thinking-and-data-science-fall-2016/

SEMESTER-II

22BTAD241 **TECHNICAL ENGLISH – II** **5H-4C**
(Theory & Lab.)

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

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students

- To make students realize the importance of writing reading and Listening.
- To understand the contexts of grammar and listening accompanied by fine reading skills in Speaking.
- To emphasize speaking in English through activities.
- To develop reading and writing skills through analysis of the facts between paragraphs.
- To enhance students' ability to listen and speak effectively in formal and informal contexts.

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

- Identify and recognize the aspects of writing reading and Listening.
- Comprehend the contents and reproduce the essence of it.
- Apply the English speaking and listening skills in the social milieu.
- Analyse and understand grammar and reading contexts
- Apply the rules of writing and Speaking in formal and informal assignments.
- To enable students to prepare for essay writing and interviews.

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

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

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

UNIT IV 9

Grammar: Concord – Use of Imperatives **–** WH Questions – Identifying common errors
Reading: Reading and Making inference – Reading and interpreting visual materials – Critical Reading –Shifting facts from opinions
Writing: Essay writing - Report **–** Proposals – Free writing

UNIT V 9

Speaking: Impromptu Speeches – Making presentations on given topics –Responding to questions – Mock interviews
Listening: Watching videos or documentaries and answering – Listening to different accents– Listening to Speeches

TOTAL: 45

TEXT BOOKS:
1. Jack C Richards with Jonathan Hull and Susan Proctor, Interchange Student's Book 2, Cambridge University Press, Fourth Edition, 2016.
2. Rajesh K Lidiya, Communication Skills, Oxford University Press, Second Edition, 2017.

REFERENCE BOOKS:
1. Meenakshi Raman and Sangeeta Sharma, Fundamentals of Technical Communication, Oxford University Press, First Edition, 2015.
2. Ashraf Rizvi M, Effective Technical Communication, McGraw Hill Education, First Edition, 2013.
3. Russel Whitehead and Micheal Black, Pass Cambridge BEC Vantage (Self Study Practice tests with key), Summer towm Publishing, Second Edition, 2014.
4. University of Cambridge, BEC Vantage 4 (Exam Papers with answers), Cambridge University Press, Second Edition, 2010.

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

(ii)   LABORATORY

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

TOTAL: 30

22BTAD242   OBJECT ORIENTED PROGRAMMING WITH PYTHON   5H-4C
(Theory & Lab.)

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

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students

- To learn about basic python language syntax and semantics, control structures and data structures in python.
- To be comfortable using the built-in functions and creating user-defined functions in python.
- To understand the object-oriented programming concepts in python.
- To gain knowledge in identifying relationships among classes in python.
- To learn how to handle exception and files in python.

COURSE OUTCOMES:
 Upon completion of this course the students will be able to:
- Define and explain the fundamental concepts of python programming.
- Explain about diferrent types of functions in Python.
- Apply the knowledge of python programming concepts and to know about OOPs concepts.
- Apply OOPs concepts to solve engineering probems.
- Explain about file concepts.
- Develop solution using object-oriented concepts in python for a given problem statement.

UNIT I   9
Python Basics: Introduction to Python – Data types – Keywords – Expressions – Comments – Operators – Command line arguments – Control Statements – Break, Continue and Pass statement. Python Data Structures: String – Mutable vs immutable types – indexing and slicing – String functions. Tuple: Tuple operations – List – List operations – List as array – List comprehension. Set – Set operations – Dictionary – Dictionary operations.

UNIT II   9
Functions: Python built-in functions – User defined functions – Creating function – Calling functions – Types of function arguments – Recursion and lambda or anonymous functions. Packages: Defining, Creating and Accessing a Package, importing packages and user defined modules.

UNIT III 9

OOPS: Elements of OOP-Class, Object, Inheritance, Data Abstraction, Encapsulation, Polymorphism – UML Class diagram – access specifiers – Creating classes – Creating object – Accessing members – init() method – instance, static and class methods - Importance of self – Implementing encapsulation.

UNIT IV 9

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

UNIT V 9

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

TOTAL: 45

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

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

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

(ii) LABORATORY

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

TOTAL: 30

SEMESTER-II

22BTAD243   **DATA PREPARATION AND DATA HANDLING**   **5H-4C**
(Theory & Lab.)

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

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students

- To study the basic concepts of Visualization, Data Analysis with visualization and important of visualization role in solving complex data solutions.
- To understand the importance of Visual Analytics and explore the various charts features and techniques used for Visualization.
- To gain visualization concepts of creating simple as well as complex visualizations in various tools.
- To understanding how to establish connection with data and perform various data.
- To explore Data Analysis with charts and Dashboards.

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

- Describe about data visualization and analytics tools to visualize data perfectly.
- Explain about how to combine and append data using visualization tool.
- Show visuals of data using charts and about KPI visuals.
- Explain about report Interface and scripting tool bar.
- Apply different functions available in Qlikview .
- Explain the techniques for handling multi-dimensional data.

UNIT I   **9**
Introduction to Data Visualization and Visual Analytics Data Visualization - Establishing Connection - Joins - Union- Data Blending - Managing Extracts - Managing Metadata - Visual Analytics - Data Granularity using Marks Card - Visual Analytics in Depth I - Visual Analytics in Depth II – Sorting – Filtering – Grouping - Graphical Visualization – Sets – Forecasting – Clustering - Trend Lines - Reference Lines – Parameters - Mappings - Dashboard Layout - Designing Dashboard for Devices - Dashboard Interaction - Using Action,- Introduction to Story Point, Introduction to Maps – Editing Unrecognized Locations -Web Mapping Services. Background Images.

UNIT II 9

Data Sources BI Desktop -Query Editor -Combining Data – Merging and Appending-Modelling Data-Cross Filter Direction-Matrixes and tables Slicers.

UNIT III 9

Map Visualizations-Gauges and Single Number Cards-Modifying colors in charts and visuals -Shapes, text boxes, and images-Page layout and formatting-KPI Visuals-Z-Order-Dashboard vs. Reports-R Integration in BI

UNIT IV 9

Data Ingestion - Report Interface – QVS, QVW and .log files - Sheet Objects - Dimensions and Expressions - Presentation/ Layout / Sort tabs - Scripting - Script Toolbar - Script Menu Commands - Variables (Set,Let) and Fields - Adding Sheet Objects - Inline table

UNIT V 9

Function (Sum, Avg, Count, Date, etc) - Slider Text Box, Calendar Box, Current Selections Box - Bar chart, line, combo, radar, scatter, grid, pie, funnel, block, gauge, mekko - Management console: Server, Publisher.

TOTAL: 45

TEXT BOOKS:
1. N. Milligan, Learning Tableau by Joshua, Packt, First Edition, 2019.
2. Brett Powell, Microsoft Power BI Cookbook Packt, First Edition, 2017.

REFERENCE BOOKS:
1. Kieran Healy, Data Visualization – A Practical Introduction, Paperback – Import, 2019.
2. Devin Knight, Microsoft Power BI Complete Reference: Bring your data to life with the powerful features of Microsoft Power BI, Packt First Edition, 2018.

WEBSITES:
1. www.r-bloggers.com
2. www.docs.microsoft.com/en-us/power-bi/guided-learning
3. https://optimalbi.com/blog/2017/10/05/beginners-guide-to-learning-qlik-sense-part-1
4. www.analyticsvidhya.com/learning-paths-data-science-business-analytics-business-intelligence-big-data/qlikview-learning-path/
5. www.data-flair.training/blogs/bi-tool-for-big-data-visualization/

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Multiple data Joins for different workbooks
2. Data visualization using Demonstrate Hierarchies, Data Granularity and Highlighting features
3. Create Interactive Dashboards using actions
4. Publishing Workbooks to Tableau Online
5. Create a Map and assign Geographic locations to the fields
6. By Use the KPI Visuals create a visualization for location based Data set
7. Configuring a Dashboard in Power bi
8. Downloading and Installing QlikView
9. Using QlikView Operations: Concatenate, If statement create a script to visualization
10. QlikView visualization charts: Bar, line, Combo, Radar, Scatter, Pie, Grid, Funnel &Mekko.

TOTAL: 30

MATHEMATICS III

MATHEMATICAL FOUNDATION OF COMPUTING SCIENCES   5H-5C

Instruction Hours/week: L:4 T:1 P:0   **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To introduce the concepts of mathematical logic.
- To introduce the concepts of sets, relations, and functions.
- To perform the operations associated with sets, functions, and relations. ...
- To introduce generating functions and recurrence relations.

COURSE OUTCOMES:

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

- Explain about normal forms and predict calculus.
- Diffrentiate between Permutation and combination.
- Demonstarte about group algebraic structure.
- Discuss fundamental mathematical concepts such as sets, relations, and functions.
- Illustrate the basics of Lattices and Boolean alllgebra.
- Relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.

UNIT I   LOGIC   9

Statements – Connectives – Truth Tables – Normal forms – Predicate calculus – Inference – Theory for Statement Calculus and Predicate Calculus – automata theorem proving.

UNIT II COMBINATORICS   9

Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion - generating function - Recurrence relations.

UNIT III ALGEBRAIC STRUCTURES   9

Semi group - Monoid - Groups (Definition and Examples only) Cyclic group - Permutation group (Sn and Dn) - Substructures - Homomorphism of semi group, monoid and groups - Cosets and Lagrange Theorem – Normal Subgroups - Rings and Fields (Definition and examples only)

UNIT IV RECURSIVE FUNCTIONS   9

Recursive functions - Primitive recursive functions - computable and non - computable functions.

UNIT V LATTICES   **9**

Partial order relation, poset - Lattices, Hasse diagram - Boolean algebra

TOTAL: 45+15

TEXT BOOK:

1. Gersting J.L., Mathematical Structure for Computer Science, 3rd Edition W.H. Freeman and Co., 2014.

REFERENCE BOOKS:

1. Lidl and pitz., Applied Abstract Algebra, Springer - Verlag, New York, 1984.
2. K.H. Rosen, Discrete Mathematics and its Applications, Mc-Graw Hill Book Company, 1999.

WEBSITE:

1. http://www.mhhe.com//rosen.

SEMESTER-III

22BTAD341	**DATABASE MANAGEMENT SYSTEMS**	**5H-4C**
	(Theory & Lab)	

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

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course 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 modelling, 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 this course the students will be able to:

- Explain about the data base architecture and data models based on size and complexity.
- Apply SQL and programming in SQL to create, manipulate and query the database
- Compare various indexing strategies in different database systems.
- Explain about authentication and authorization and Intrusion detection.
- Apply the data model and querying in Object-relational databasses.
- Devlope a simple database system with fundamental tasks with optimal queries.

UNIT I   **9**
Database system architecture: 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 II   **9**
Relational query languages: 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   **9**
Storage strategies: Indices, B-trees, hashing. Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT IV   **9**
Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

UNIT V   **9**
Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

                                                                                                       TOTAL : 45
TEXT BOOK:
1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

REFERENCE BOOKS:
1. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
2. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
3. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

WEBSITES:
1. https://www.javatpoint.com/dbms-tutorial
2. https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/

(ii) LABORATORY

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.
4. High level language extension with Triggers
5. Procedures and Functions.
6. Embedded SQL.
7. Database design using E-R model and Normalization.
8. Design and implementation of Payroll Processing System.
9. Design and implementation of Banking System.
10. Design and implementation of Library Information System.
11. Database connectivity using JDBC
12. Database connectivity using ODBC

TOTAL: 30

B.Tech Artificial Intelligence and Data Science

SEMESTER-III

22BTAD342   **DATA STRUCTURES**   **5H-4C**
(Theory & Lab)

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

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students:
- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamental data structures

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explain about the time and computation complexity of different algorithhms and justify the correctness.
- Define abstract data types for linear data structures such as stacks and queues.
- Discuss about linked list and non linear data structures..
  Discuss various sorting algorithms and their complexity.
- Model problems as graph problems and implement efficient graph algorithms to solve them.
- Illustrate the importance of data structures in context of writing efficient programs.

UNIT I   **9**
Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching**:** Linear Search and Binary Search Techniques and their complexity analysis.

UNIT II   **9**
Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

UNIT III   **9**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT IV   **9**

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

UNIT V   **9**

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

                                           TOTAL:45

TEXT BOOK:

1. " Fundamentals of Data Structures" , Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

REFERENCE BOOKS:

1. Algorithms, Data Structures, and Problem Solving with C++" , Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. "How to Solve it by Computer" , 2nd Impression by R. G. Dromey, Pearson Education.

WEBSITES:

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial
3. https://www.tutorialspoint.com/data_structures_algorithms/

(ii) LABORATORY

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 Hashing with any one collision resolution method
12. Implementation of Dijkstra's Shortest Path Algorithm

TOTAL: 30

SEMESTER-III

22BTAD343   FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE   5H-4C
(Theory & Lab)

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

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students **:**
- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

COURSE OUTCOME:
Upon completion of the course, the students will be able to:
- Choose appropriate search algorithms for any solving AI related problems.
- Explain about the different methods of knlowdge representation.
- Discuss about Description logic and conceptional dependencies.
- Compare different Game playing techniques.
- Describe applications using fuzzy logic.
- Demonstrate the basic principles, techniques, and applications of Artificial Intelligence.

UNIT I   9
Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II   9
Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, in ferencing, monotonic and non monotonic reasoning. Introduction to prolog.

UNIT III   **9**

Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.

UNIT IV   **9**

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alpha-beta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning

UNIT V   **9**

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models

                                                            TOTAL: 45

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

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

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

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules.
2. Write simple facts for the statements and querying it.
3. Write a program for Family-tree.
4. Write Program for Monkey-banana Problem.
5. Write a program which behaves a small expert for medical Diagnosis.
6. Write programs for computation of recursive functions like factorial Fibonacci numbers,etc.
7. Write program to solve 5-queens problem.
8. Write a Program for water jug problem.
9. Write a program for travelling salesman program.
10. Case study of standard AI programs like Mycin and AI Shell.

TOTAL: 30

SEMESTER-III

22BTAD344   **R PROGRAMMING**   **5H-4C**
(Theory & Lab)

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

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES:
The goal of this course is for the students **:**

- Basics of R-Programming.
- Control structures and functions.
- Coding and simulation of R-Programming.
- To understand the use of R Big Data analytics
- To able to appreciate and apply the R programming from a statistical perspective

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

- Explain basic fundamental concepts to solve the real world problem using R programming language.
- Apply control structures and functions to provide solution for various problems.
- Demonstrate the working of structed and unstructed data base.
- Apply simulation and visualization and statistical analysis using R.
- Demonstrate data processing using R.
- Apply fundamentals concepts of statistical analysis in R environment.

UNIT I   **9**
Introduction: Overview of R - Getting Started with R - Important R Data Structures – R statements- R Loops -Vectors - Matrices and Arrays. Programming structures- Control Statements - Arithmetic and Boolean Operators - Return Values

UNIT II   **9**
Functions are Objects, R -strings and string manipulation functions – Recursion - Replacement Functions. Math functions – functions for statistical distributions.

UNIT III   **9**
Database-Working with structured and unstructured data-Scoping rules in R-Package in R: Installing and Loading Packages in R, using help, access functions from packages.

UNIT IV   **9**

SIMULATIONS in R - Sorting – linear algebra operations – set operations –simulation programming in R. Data Visualization: Histograms charts, Dot Plots, Line Charts, Pie Charts, Boxplots, Scatterplots, saving and exporting results

UNIT V   **9**

Data Pre-processing: Data cleansing, Treating missing values, data transformations, sampling data for modelling- test and training splits, creating sample groups, Data reduction. R - Descriptive Statistics: arithmetic mean, median, Measure of dispersion - Minimum and Maximum values, quantiles, percentiles, IQR, standard deviation, variance.

TOTAL:45

TEXT BOOKS:
1. Andrew Oleksy, Data Science with R: A Step-by-Step Guide with Visual Illustrations & Examples,2018
2. Nina Zumel and John Mount, Practical Data Science with R, Dreamtech/Manning, 2014

REFERENCE BOOKS:
1. R for Data Science, Hadley Wickham and Garett Grolemund, O'Reilly, 2017
2. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
3. Felix Alvaro, "R: Easy R Programming for Beginners", Second edition, Wiley 2018.
4. Data Mining for Business Analytics: Concepts, Techniques and Applications in R‖, Galit Shmueli, et al, Wiley India, 2018.
5. Roger D. Peng, R Programming for Data Science, Lean publishing, 2015
6. An Introduction to Statistical Learning: with Applications in R (Springer Texts in Statistics), G. James, D. Witten, T. Hastie and R. Tibshirani, Springer, 2013.
7. A First Course in Statistical Programming with R, W John Braun, Duncan J Murdoch, Cambridge University Press 2008.

WEBSITES:
1. https://nptel.ac.in/courses/111/104/111104100/
2. https://www.tutorialspoint.com/r/r_overview.html

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Read a CSV & EXCEL file and perform subsets of dataset, Merging datasets
2. Create an R Program:
   a) To add two vectors

   b) To find sum, mean and product of vector

   c) To generate random number from standard distributions

   d) To sample from a population
3. Take the data from two different sources (files), and merge before analysis and analyse the data set using charts
4. Apply table () function to summarize the dataset "Rental Units"
5. Draw a cumulative frequency graph using R with relevant data
6. Perform ANOVA
7. Create Summary statistics for location
8. Perform power analysis
9. Perform PCA
10. Implement Clustering

TOTAL: 30

SEMESTER-IV

22BTAD401   MATHEMATICS IV (PROBABILITY AND STATISTICS)   5H-5C

Instruction Hours/week: L:4 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 able to:

- Explain the fundamental concepts of probability and standard distributions which candescribe real life phenomenon.
- Explain the basic concepts of one- and two-dimensional random variables and theirapplications 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 ofagriculture and statistical quality control.
- Discuss the notion of sampling distributions and statistical techniques used in engineeringand management problems.
- Discuss about the techniques in quality control that model engineering problems.

UNIT I –PROBABILITY AND RANDOM VARIABLES   12

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

UNIT II –TWO - DIMENSIONAL RANDOM VARIABLES   12

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

UNIT III –TESTING OF HYPOTHESIS   12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sampletests 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   12

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

UNIT V –STATISTICAL QUALITY CONTROL   12

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

                                                    TOTAL: 60+15

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, 2015.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.
3. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
4. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGrawHill, 4th Edition, 2007.
5. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rdEdition, Elsevier, 2004.

REFERENCE BOOKS:
1. Walpole. R.E., Myers. R.H., Myers.S.L. and Ye.K., "Probability and Statistics forEngineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
3. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory andProblems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, UniversalBook Stall, 2003 (Reprint).
5. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

WEBSITES:
1. www.cut-theknot.org/probability.shtml
2. www.mathworld. Wolfram.com

		SEMESTER-IV
22BTAD402	**DATA VISUALIZATION**	**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 to accurately represent voluminous complex data set in web and from other data sources.
- To understand the methodologies used to visualize large data sets.
- To understand the various process involved in data visualization.
- To get used to with using interactive data visualization.
- To understand the different security aspects involved in data visualization.

COURSE OUTCOMES:

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

- Explain data representation of complex, voluminous data and the various process and tools used for data visualization.
- Apply interactive data visualization to make inferences.
- Explain about charts , maps and space filling methods.
- Apply various methodologies present in data visualization.
- Analyze the process involved and security issues in data visualization
- Apply the virtualization techniques for research projects.

UNIT I   9

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT II   9

Mapping – Time series – Connections and correlations – Indicator – Area chart – Pivot table – Scatter charts, Scatter maps – Tree maps, Space filling and non-space filling methods

UNIT III 9

Hierarchies and Recursion – Networks and Graphs – Displaying Arbitrary Graphs – Node link graph – Matrix representation for graphs – Info graphics

UNIT IV 9

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity – Layouts – Geomapping – Exporting, Framework – d3.js, tableau. Port scan visualization - Vulnerability assessment and exploitation

UNIT V 9

Firewall log visualization – Intrusion detection log visualization – Attacking and defending visualization systems – Creating security visualization system.

TOTAL: 45

TEXT BOOKS:
1. "Interactive data visualization for the web", 2nd Edition, Scott Murray, O"Reilly Media, 2017.
2. "Visualizing Data", O"Reilly Media, First Edition, Ben Fry, 2007

REFERENCE BOOKS:
1. "Security Data Visualization: Graphical Techniques for Network Analysis", Greg Conti, No Starch Press, First Edition, 2007.
2. "Data Visualization A Handbook for Data Driven Design", Andy Kirk, Sage Publications, First Edition, 2016.
3. "Storytelling With Data: A Data Visualization Guide for Business Professionals", Cole Nussbaumer Knaflic, Wiley Publication, First Edition, 2015.

WEBSITES:
1. www.ocw.mit.edu/courses/sloan-school-of-management/15-071-the-analytics-edge-spring-2017/visualization/
2. www.coursera.org/learn/analytics-tableau
3. www.vis.csail.mit.edu/classes/6.894/
4. www.ocw.mit.edu/resources/res-6-009-how-to-process-analyze-and-visualize-data-january-iap-2012/
5. www.udemy.com/tutorial/python-step-by-step-build-a-data-analysis-program/more-visualization-techniques/

SEMESTER-IV

22BTAD441	JAVA PROGRAMMING	5H-4C
	(Theory & Lab)	

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

End Semester Exam:3 Hours

(i) THEORY
PRE-REQUISITES: Fundamental of Computers

COURSE OBJECTIVES:

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

- To learn the basic fundamental concepts of java programming.
- To gain knowledge of object-oriented programming in Java
- To understand the concepts of interface and packages in Java.
- To handle Exceptions in Java.
- To gain knowledge of Java Collection API.

COURSE OUTCOMES:

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

- Explain the fundamental concepts of Java programming.
- Develop Java programs with the concepts inheritance for developing basic applications.
- Build Java applications using packages.
- Build Java applications using exceptions.
- Explain about java wrapper class and generics classes.
- Develop Java applications to solve real word problems.

UNIT I   **9**
Java fundamentals: Java architecture – Language Basics – Features of java – Comments – Data types – Variables – Operators – Type conversion and casting – Flow control statements – Arrays – OOPS – Classes and objects: Concepts of classes and objects – UML class diagram – Creating classes – Methods – Constructors – Static variables and methods – This Keyword – Encapsulation – Implementing encapsulation.

UNIT II   **9**
Inheritance: Inheritance hierarchies – Super and sub classes – Access control – Super keyword – Final classes and methods – The object class. Polymorphism: Dynamic binding – Method overriding – Garbage collection.

UNIT III   9

String: StringBuffer – Abstraction: Abstract classes and methods. Packages – Defining, creating and accessing a package – importing packages. Interfaces: Interfaces vs. Abstract classes – Defining an interface – Implementing interfaces – Extending interfaces.

UNIT IV   9

Exception handling – Errors vs exceptions – Exception hierarchy – Usage of try, catch, throw, throws and finally, re throwing exceptions – Built-in exceptions – User defined exceptions.

UNIT V   9

Wrapper classes – Byte, Short, Integer, Float, Double, Boolean, Character. Java Collections API – Introduction to collection – Generics – List implementations – Set implementations – Map implementations.

TOTAL: 45

TEXT BOOKS:
1. Cay S Horstmann and Gary Cornell ,Core Java: Volume I – Fundamentals, Prentice Hall, Eleventh Edition, 2018.
2. Herbert Schildt, Java2: The Complete Reference, Tata McGraw-Hill, Tenth Edition, 2017

REFERENCE BOOKS:
1. Paul J Deitel, Java for Programmers, Pearson Education, Second Edition, 2012
2. Deitel and Deitel, Java How to Program, Early Objects, Prentice Hall, Eleventh Edition, 2018
3. Herbert Schildt and Dale Skrien, JAVA Fundamentals, McGraw-Hill, First Edition, 2012

WEBSITES:
1. www.docs.oracle.com/javase/tutorial/java/nutsandbolts
2. www.javabeginner.com/learn-java
3. www.tutorialspoint.com/java/java_abstraction.htm
4. www.docs.oracle.com/javase/tutorial/collections/intro/
5. www.tutorialspoint.com/java/java_exceptions.htm

(ii)LABORATORY

LIST OF EXPERIMENTS

1. Programs using control structures and arrays.
2. Programs using classes and objects.
3. Programs using inheritance.
4. Programs using polymorphs and string class.
5. Programs using interface and package.
6. Programs using exception handling mechanism
7. Programs using wrapper classes.
8. Programs using list collection.
9. Programs using map collection.
10. Programs using set collection.

TOTAL: 30

SEMESTER-IV

22BTAD442   **OPERATING SYSTEMS**   **5H-4C**
(Theory & Lab)

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

End Semester Exam:3 Hours

(i) THEORY
PRE–REQUISITES: Programming Logic and Design
COURSE OBJECTIVES:
The goal of this course is for the students **:**
- To learn the basic concepts of operating systems.
- To understand the concepts of scheduling techniques.
- To learn about different memory management techniques.
- To familiarize with the important mechanisms in file systems.
- To appreciate the emerging trends in memory management and networking.

COURSE OUTCOMES:

Upon Completion of this course the students will be able to:
- Outline the basic services and functionalities of operating systems.
- Analyse various scheduling algorithms, and understand the different deadlock, prevention and avoidance schemes
- Illustrate the different memory management schemes
- Outline the functionality of file systems
- Compare and contrast Linux, Windows operating systems
- Illustrate the different operating sysytems and functions of modern operating systems

UNIT I   **9**
Introduction to operating systems – Computer system organization – Architecture – Operating system structure – Operations – Process – Memory – Storage management – Protection and security – Distributed systems – Computing Environments – Open source operating systems – OS services – Useroperating system interface – System calls – Types – System programs – OS structure – OS generation –System boot – Process concept – Scheduling – Operations on processes – Cooperating processes – Interprocess communication – Examples – Multithreading models – Thread libraries – Threading issues – OS examples.

UNIT II 9

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

UNIT III 9

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

UNIT IV 9

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

UNIT V 9

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

TOTAL:45

TEXT BOOK:

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

REFERNCES BOOKS:

1. Andrew S Tanenbaum, Modern OperatingSystems, Pearson Education,Fourth Edition, 2015

2. Dhamdhere D M, Operating Systems: A Concept–basedApproach, McGraw–Hill, Second Edition, 2012

3.William Stallings, Operating Systems: Internals and DesignPrinciples, Prentice Hall, Seventh Edition, 2011

WEBSITES:

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

(ii) LABORATORY

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

TOTAL: 30

22BTAD443   **MACHINE LEARNING TECHNIQUES**   **5H-4C**
(Theory & Lab)

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

End Semester Exam:3 Hours

(i) THEORY
PRE-REQUISITES: Basics of Programming
COURSE OBJECTIVES:

The goal of this course is for the students **:**
- To understand the concepts of machine learning.
- To appreciate supervised learning and their applications.
- To appreciate the concepts and algorithms of unsupervised learning.
- To understand the theoretical and practical aspects of probabilistic graphical models.
- To appreciate the concepts and algorithms of advanced learning.

COURSE OUTCOMES:

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

- Classify Machine Learning algorithms into Probabilities, and Statistics.
- Explain about supervised machine learning techniques.
- Discuss the back propagation algorithm and clustering algorithms for different applications.
- Compare undirected and directed graphical models
- Demonstrate about sampling process.
- Apply Machine learning approaches to various types of real time problems..

UNIT I   **9**

Machine Learning – Types of Machine Learning – Machine Learning process – preliminaries, testing Machine Learning algorithms, turning data into Probabilities, and Statistics for Machine Learning-Probability theory – Probability Distributions – Decision Theory.

UNIT II   **9**

Supervised Learning: Linear Models for Regression – Linear Models for Classification – Discriminant Functions – Decision Tree Learning – Bayesian Learning, Naïve Bayes – Ensemble Methods, Bagging, Boosting, Neural Networks, Multi-layer Perceptron, Feed- forward Network.

UNIT III 9

Error Back propagation – Support Vector Machines. Unsupervised Learning: Clustering– K-means – EM Algorithm – Mixtures of Gaussians – Dimensionality Reduction, Linear Discriminant Analysis, Factor Analysis, Principal Components Analysis, Independent Components Analysis.

UNIT IV 9

Machine Learning :A Graphical Models – Undirected Graphical Models – Markov Random Fields – Directed Graphical Models – Bayesian Networks – Conditional Independence properties – Markov Random Fields- Hidden Markov Models – Conditional Random Fields (CRFs).

UNIT V 9

Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling – Reinforcement learning – Markov Decision processes, Deterministic and Non-deterministic Rewards and Actions, Temporal Difference Learning Exploration.

TOTAL: 45

TEXT BOOKS:
1. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, First Edition, 2007
2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, CRC Press, Second Edition, 2014

REFERENCE BOOKS:
1. Kevin P Murphy, Machine Learning-Probabilistic Perspective,MIT Press,First Edition,2012
2. EthemAlpaydin, Introduction to Machine Learning, MIT Press, Third Edition,2014
3. Tom Mitchell, Machine Learning, McGraw-Hill, First Edition, 2017

WEBSITES:
1. www.nptel.ac.in/courses/106106139/
2. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-fall-2006/
3. www.kdnuggets.com/2015/11/seven-steps-machine-learning-python.html
4. www.dataquest.io/blog/machine-learning-python/
5. www.analyticsvidhya.com/blog/2016/10/16-new-must-watch-tutorials-courses-on-machine- learning/

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Perform predictions using regression algorithms
2. Data Classification using Decision Trees
3. Data Classification using Bayesian Learning
4. Data Classification using Support Vector Machines
5. Bagging in Classification
6. Bagging, boosting applications using Regression Trees
7. Data & Text Classification using Neural Networks
8. Data & Text Clustering using K-means algorithm
9. Data & Text Clustering using Gaussian Mixture Models
10. Dimensionality Reduction Algorithms in Image Processing applications
11. Implementation of sampling methods.
12. Applications of Hidden Markov Models in Natural Language Processing

TOTAL: 30

22BTAD501 **NUMERICAL LINEAR ALGEBRA**

Instruction Hours/week: L: 4 T:1P:0 **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

PRE-REQUISITES: Matrices and Calculus

COURSE OBJECTIVES:

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

- Explain the basic knowledge in Vector spaces and Subspaces including linear independence and dependence vectors, Basis and its dimensions.
- Explain about linear maps between vector spaces, their matrix representations, null-space and Range spaces.
- Determine Eigen values and eigenvectors, diagonalizability of a real symmetric matrix.
- Demonstrate the concepts of Inner product spaces: Cauchy-Schwarz inequality, orthonormal basis, the Gram-Schmidt procedure, orthogonal complement of a subspace.
- Explain about the basic properties of orthogonal projections as linear transformations and as matrix transformations.

COURSE OUTCOMES:

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

- Solve the system of linear equations using direct and indirect methods.
- Identify the vector space and the subspaces, the linear transformation and its
- Describe Matrix representation of linear transformation.
- Apply diagonalization in linear system of equations.
- Recall the concept of orthogonal projection of a vector onto a subspace.
- Explain how orthogonal projections relate to least square approximations.

UNIT I **12**

Linear System of Equations – Elementary Operations – Row Echelon form – Rank of a Matrix – Solving system of equations – Direct methods: Gauss Elimination and Gauss Jordan Methods — Inverses of Matrices by Gauss Jordan method – LU Factorizations – QR decomposition – Iterative methods: Gauss Jacobi and Gauss Seidel method – Power method for finding Eigen values.

UNIT II   **12**

Vector Spaces – Subspaces – Linear Span – Linear Independence and dependence of vectors – Basis and Dimension – Linear Transformation – Properties of Linear Transformation — Null Space and Nullity of a matrix.

UNIT III   **12**

Rank-Nullity theorem – Range Space – Dimension Theorem – Matrix Representation of Linear Transformation – Characteristic values – Diagonalization of Linear operators.

UNIT IV   **12**

Inner Products and Norms – Inner Product Spaces – Cauchy-Schwartz inequality – Orthogonal Vectors – Gram- Schmidt Orthogonalization Process – Orthogonal Complement – Orthogonal Projection.

UNIT V   **12**

Projection Theorem – Least Square Approximations – Positive Definite Matrices – Minima, Maxima and Saddle points – Tests for positive definite, semi definite and indefinite matrices – Singular value Decomposition(SVD).

TOTAL: 60+15

TEXT BOOKS:
1. Friedberg S H, Insel A J and Spence E, Linear Algebra, Pearson Education, Fifth Edition,2018
2. Gilbert Strang, Linear Algebra and Learning from Data, Cambridge University Press, First Edition,2019

REFERENCE BOOKS:
1. Bernard Kolman and David R Hill, Introductory Linear Algebra, Pearson Education, First Reprint, New Delhi,2010
2. Kumaresan S, Linear Algebra – A geometric approach, Prentice – Hall of India, Reprint, New Delhi,2010
3. Williams G, Linear Algebra with Applications, Jones and Bartlett Learning, First Indian Edition, New Delhi,2019
4. Gene H Golub and Charles F Van Loan, Matrix Computations, The Johns Hopkins University Press, Fourth Edition,2013

WEBSITES :

1. www.nptel.ac.in/courses/111106051/
2. www.nptel.ac.in/courses/111/101/111101115/
3. www.nptel.ac.in/courses/111/107/111107106/
4. www.nptel.ac.in/courses/111/102/111102011/
5. www.nptel.ac.in/courses/111/108/111108066/

SEMESTER-V

22BTAD502   **SOFT COMPUTING IN DATA SCIENCE**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing-based solutions for real-world problems.
- To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- To understand the fundamentals of nature inspired optimization algorithms
- To reveal different applications of soft computing techniques to solve engineering and other problems.

COURSE OUTCOMES:

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

- Explain about the main compnemts of soft computing and fuzzy logic.
- Apply optimization algorithm to solve different engineering problems.
- Explain various nature inspired optimization algorithms.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Outline the applications of Fuzzy logic in Data Science.
- Identify the use of existing software tools to solve real problems using a soft computing approach.

UNIT I   **9**

Introduction to soft computing – Importance of Soft Computing – Main Components of Soft Computing – Fuzzy Logic – Artificial Neural Networks – Support Vector machine – Evolutionary Algorithms – Introduction to Genetic Algorithms (GA) – Binary and real-coded GA.

UNIT II   **9**

Swarm Intelligence: Ant Colony Optimization Algorithm – Application of ACO to combinatorial problems – Particle Swarm Optimization Algorithm Working Principles – Introduction to Differential Evolution Algorithm.

UNIT III 9

Bacterial Foraging Algorithms – Cuckoo Search Algorithm – Firefly Algorithm and Artificial Bee Colony Algorithm – Applications of nature inspired optimization algorithms in Data Science.

UNIT IV 9

Fuzzy Logic Systems: Introduction to Fuzzy logic – Classical sets vs fuzzy sets – Membership functions and its features – Properties and operations on Fuzzy sets – Classical relations vs Fuzzy relation – Operations of Fuzzy relation.

UNIT V 9

Defuzzification – Fuzzy rule base and approximate reasoning – Fuzzy Inference Systems – Design of fuzzy logic system: Mamdani & Sugeno Architecture – Applications of Fuzzy logic in Data Science

TOTAL: 45

TEXT BOOKS:

1. **"**Neural networks in a soft computing framework**",** Ke-Lin Du and Madisetti NS Swamy, Springer Science & Business Media, First Edition, 2013.
2. "Principles of Soft computing", Sivanandam. S.N and Deepa. S.N, Wiley India Edition, Third Edition, 2018.

REFERENCE BOOKS:

1. "An introduction to Fuzzy Control", Driankov. D, Narosa Publication, First Edition, 2020.
2. "Fuzzy Logic with Engineering Applications**",** Ross. J.T, John Wiley & Sons, Fourth Edition, 2009.
3. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Rajasekaran. S and Vijayalakshmi Pai, G.A, PHI Learning, First Edition, 2003.
4. "Artificial Neural Networks: An Introduction", Priddy. L.K and Keller. E.P, SPIE Press, First Edition, 2005.

WEBSITES:

1. www./nptel.ac.in/courses/106/105/106105173/
2. www.nptel.ac.in/courses/112/105/112105235/
3. www.ocw.mit.edu/courses/brain-and-cognitive-sciences/9-641j-introduction-to-neural-networks-spring-2005/
4. www.udemy.com/course/fuzzy-logic/
5. www.swarmintelligence.org/tutorials.php

B.Tech Artificial Intelligence and Data Science

SEMESTER-V

| 22BTAD541 | **DEEP LEARNING TECHNIQUES** | 5H-4C |
| | **(Theory & Lab)** | |

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

End Semester Exam: 3 Hours

(i) THEORY

PRE-REQUISITES: Machine Learning Techniques

COURSE OBJECTIVES:

The goal of this course is for the students **:**
- To understand the basic ideas and principles of Neural Networks
- To understand the basic concepts of Big Data and Statistical Data Analysis
- To familiarize the student with The Image Processing facilities like Tensorflow and Keras
- To appreciate the use of Deep Learning Applications
- To understand and implement Deep Learning Architectures

COURSE OUTCOMES:

Upon Completion of this course the students will be able to:
- Explain the basic concepts of Neural network.
- Illustrate about the feed forward neural networks..
- Explain about Convolutional neural network architecture.
- Describe Encoder/Decoder Architectures and Image segmentation process.
- Identify sentence classification using Convolutional Neural Networks .
- Apply wide variety of learning algorithms to solve real world problems.

UNIT I   9
Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

UNIT II   9
Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training.

UNIT III 9

Nestors Accelerated Gradient Descent – Regularization – Dropout. CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification usingTransfer Learning

UNIT IV 9

RNN, LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM-Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models.

UNIT V 9

Attention Models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

TOTAL: 45

TEXT BOOKS:
1. Ian Good Fellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, First Edition,2017
2. Francois Chollet, Deep Learning with Python, Manning Publications, First Edition,2018

REFERENCE BOOKS:
1. Ragav Venkatesan,Baoxin Li, Convolutional NeuralNetworks in Visual Computing, CRC Press, First Edition,2018
2. Phil Kim, Matlab Deep Learning: With Machine Learning,Neural Networks and Artificial Intelligence, APress, Third Edition,20173. NavinKumar Manaswi, Deep Learning with Applications Using Python, Apress, First Edition, 2018
3. Joshua F. Wiley, R Deep Learning Essentials, Packt Publications, First Edition,2016

WEBSITES:
1.www.nptel.ac.in/courses/106/106/106106184/
2.www.nptel.ac.in/courses/106/106/106106201/
3.www.nptel.ac.in/courses/106/105/106105215/
4.www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-s191-introduction- to-deep-learning-january-iap-2020/
5.www.kaggle.com/learn/intro-to-deep-learning

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Implement Simple Programs like vector addition in TensorFlow.
2. Implement a simple problem like regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Implement a Transfer Learning concept in Image Classification.
7. Implement an Autoencoder in TensorFlow/Keras.
8. Implement a Simple LSTM using TensorFlow/Keras.
9. Implement an Opinion Mining in Recurrent Neural network.
10. Implement an Object Detection using CNN.

TOTAL: 30

SEMESTER-VI

22BTAD641   **SPEECH AND LANGUAGE PROCESSING**   **5H-4C**
(Theory & Lab)

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

PRE-REQUISITES: Basics of Programming

(i)THEORY
COURSE OBJECTIVES:
The goal of this course is for the students **:**
- To understand the representation and processing of Morphology and Part-of Speech Taggers.
- To appreciate various techniques used for speech synthesis and recognition.
- To understand different aspects of natural language syntax and the various methods used for processing syntax and disambiguating word senses.
- To appreciate the various representations of semantics and discourse.
- To know about various applications of natural language processing.

COURSE OUTCOMES:
Upon Completion of this course the students will be able to:
- Describe text normalization and sentiment classification.
- Apply machine learning techniques used in NLP
- Analyze different parsing methods to design a business application.
- Apply NLP algorithms to extract information.
- Describe Speech Recognition techniques and Text-to-Speech conversion process.
- Apply conventional techniques in NLP to solve problems.

UNIT I   **9**
Introduction–Regular Expressions, Text Normalization, Edit Distance–N-gram Language Models–Naive Bayes and Sentiment Classification–Logistic Regression.

UNIT II   **9**
Vector Semantics and Embeddings – Neural Networks and Neural Language Models – Sequence Labeling for Parts of Speech and Named Entities – Deep Learning Architectures for Sequence Processing – Contextual Embeddings.

UNIT III   **9**

Machine Translation and Encoder – Decoder Models –Constituency Grammars – Constituency Parsing – Dependency Parsing – Logical Representations of Sentence Meaning – Computational Semantics and Semantic Parsing.

UNIT IV   **9**

Information Extraction – Word Senses and WordNet – Semantic Role Labeling – Lexicons for Sentiment, Affect, and Connotation – Coreference Resolution.

UNIT V   **9**

Discourse Coherence – Question Answering – Chatbots & Dialogue Systems – Phonetics – Automatic Speech Recognition and Text-to-Speech.

                                                                                       TOTAL: 45

TEXT BOOKS:
   1. Jurafsky and Martin, Speech and Language Processing, Pearson Prentice Hall, Third Edition,2020
   2. Christopher D Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press, First Edition,1999

REFERENCE BOOKS:
   1. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, O'Reilly   Publication, First Edition,2009
   2. James Allen, Natural Language Understanding, Addison Wesley, Second Edition,2007
   3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, (Chapman&   Hall/CRC Machine Learning & Pattern Recognition), Second Edition,2010
   4. Alexander Clark, Chris Fox and Shalom Lappin, The Handbook of Computational Linguistics and Natural Language Processing, Wiley-Blackwell, First Edition,2012

WEBSITES:
   1. www.nptel.ac.in/courses/106/101/106101007/
   2. www.nptel.ac.in/courses/106/106/106106211/
   3. www.coursera.org/specializations/natural-language-processing
   4. www.udemy.com/course/natural-language-processing/
   5. www.ibm.com/cloud/learn/natural-language-processing

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Program on Word Trends and N-grams
2. Program on Text Classification
3. Program on POS Tagging
4. Develop Sentiment Analysis Applications
5. Program on Named Entity Recognition
6. Program on Machine Translation
7. Program on Word Sense Disambiguation
8. Program on Text Summarization
9. Implementation of Question Answering System
10. Implementation of ChatBot application

TOTAL: 30

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

PRE-REQUISITE: Database Management Systems

(i)THEORY

COURSE OBJECTIVES:

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

- To learn NoSQL, its characteristics and history, and the primary benefits for using NoSQLdata.
- To define the major types of NoSQL databases including a primary use case andadvantages/disadvantages of each type
- To understand wide-column, document, key-value, graph and object-oriented databases, addcontent, and run queries.
- To describe the NoSQL data architecture patterns.
- To perform basic database administration tasks.

COURSE OUTCOMES:

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

- Explain various types of nosql Databases , architecture and operations.
- Apply nosql data management methods using MongoDB.
- Describe Querying mechanisms and importance of keys.
- Discuss about Cassandra architecture , Query Language and data modeling.
- Explain about the graph data bases and apply object oriented concepts.
- Compare four types of NoSQL Databases for solving problems

UNIT I   **9**

NoSQL Overview–NoSQL Database Environment–NoSQL Options–Benefits to using NoSQL DB–Drawbacks to Using NoSQL DB–NoSQL vs. SQL3–Introduction to NoSQL Development–Schemaless Development–Data Models–Distribution Models–Consistency–Categories of NoSQL–Key–Value Stores–Wide-Column Family Stores–Document Databases–Graph Databases–Object-Oriented Databases–NoSQL Scalability

UNIT II   9

Attributes–Metadata–Formats–XML–JSON and BSON–MongoDB–Introduction to MongoDB key features–Core Server tools–MongoDB through the JavaScript's Shell–Creating and Querying through Indexes–Document-Oriented, principles of schema design.

UNIT III   9

Constructing queries on Databases– collections and Documents– MongoDB Query Language–Key-Value Databases – NoSQL: Major Keys–Minor Keys–Values–Examples–Redis

UNIT IV   9

Column Family–Key and Keyspace – Categories of NoSQL – Examples – Cassandra – Introduction to Cassandra – Cassandra Query Language (CQL) – Cassandra Data Modeling – Cassandra Architecture.

UNIT V   9

Graph Databases – NoSQL: Edges – Nodes – Relationships – Examples – Neo4J – InfoGrid – GraphBase Object-Oriented Databases – NoSQL: Object-Oriented Concepts – Object Stores – Examples – ZODB–ObjectDB

TOTAL: 45

TEXT BOOKS:
1. Dan Sullivan, NoSQL for Mere Mortals, Addison-Wesley Professional, First Edition,2015
2. Meier A and Kaufmann. M E, SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management

REFERENCE BOOKS:
1. Parmod J Sadalage and Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley, First Edition,2012
2. Kristina Chodorow, MongoDB: The Definitive Guide: Powerful and Scalable Data Storage, O'reilly Publishers, Third Edition,2019
3. David Hows, Peter Membrey, Eelco Plugge and Tim Hawkins, The Definitive Guide to MongoDB: A Complete Guide to Dealing with Big Data using MongoDB, Apress Publishers, Third Edition,2015
4. Nishant Neeraj, Tejaswi Malepati and Aaron Ploetz, Mastering Apache Cassandra 3.x, Pakt Publishers, Third Edition, 2018

WEBSITES:
1. www.nptel.ac.in/noc/courses/noc15/SEM2/noc15-cs14/
2. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/readings/lec19/
3. www.udemy.com/course/nosql-databases-for-beginners/
4. www.university.mongodb.com/
5. www.www.udemy.com/course/learn-mongodb-leading-nosql-database-from-scratch/

(ii) LABORATORY

LIST OF LAB EXPERIMENTS:

1. Installing and setting up MongoDB.
2. Designing a NoSQL database employing the NoSQL models.
3. Querying a database updating and deleting database content using MongoDB.
4. Employing XML and JSON to retrieve data in MongoDB.
5. Querying a database updating and deleting database content using Redis.
6. Querying the database using Cassandra.
7. Write applications that use Cassandra Query Language to fetch and display data.
8. Using NoSQL technologies to extract and manipulate web-based data.
9. Non-relational, distributed database design and creation using NoSQL web-based databases.
10. Write applications that use visualization and graphing to display data.

TOTAL: 30

SEMESTER-VI

22BTAD643   **PATTERN RECOGNITION**   **5H-4C**
                        (Theory & Lab)

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

PRE-REQUISITES: Basics of Programming

COURSE OBJECTIVES:
The goal of this course is for the students **:**
- To provide basic knowledge about the fundamentals of pattern recognition and its application.
- To understand about unsupervised algorithms suitable for pattern classification.
- To familiarize with the feature selection algorithms and method of implementing them in applications.
- To learn about the basis of algorithm used for training and testing the dataset.
- To learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision.

COURSE OUTCOMES:
Upon Completion of this course the students will be able to:
- Explain the basic concepts of pattern recognition and its applications.
- Demonstrate the concept of clustering and advantages.
- Explain the concept of feature selection through function approximation..
- Discuss various approaches in Hidden Markov Models.
- Explain the concept of Neural Network for Pattern Recognition.
- Apply pattern recognition techniques to real-world problems such as document analysis and recognition

UNIT I   **9**
Overview of Pattern Recognition – Discriminant Functions – Supervised Learning – Parametric Estimation – Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network–Naive Bayesian Classifier.

UNIT II 9

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering– Density Based Clustering.

UNIT III 9

Entropy Minimization – Karhunenloeve Transformation – Feature Selection through Functions Approximation – Binary Feature Selection – K-NN.

UNIT IV 9

State Machines – Hidden Markov Models: Maximum Likelihood for the HMM, Forward - Backward Algorithm, Sum and Product Algorithm for the HMM, Scaling Factors, Viterbi Algorithm, Extensions of the Hidden Markov Model – Support Vector Machines.

UNIT V 9

Maximum Margin Classifiers, Relevance Vector Machines. Fuzzy Classification: Fuzzy Set Theory, Fuzzy and Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition– Introduction to Neural Networks: Elementary Neural Network for Pattern Recognition, Hebbnet, Perceptron, ADALINE, and Back Propagation.

TOTAL: 45

TEXT BOOKS:
1. Christopher Bishop, Pattern Recognition and Machine Learning, Springer Publishers, Second Edition, 2010
2. Narasimha Murthy. M and Susheela Devi. V, Pattern Recognition, Springer Publishers, Second, 2019

REFERENCE BOOKS:
1. Andrew Webb, Statistical Pattern Recognition, Arnold Publishers, First Edition, 2002
2. Richard O. Duda, Peter. E. Hart and David. G. Stork, Pattern Classification, John Wiley, Second Edition,2001
3. Rajasekaran. S and Vijayalakshmi Pai. G.A, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice Hall, Fifteenth Printing,2011

WEBSITES:
1. www.nptel.ac.in/courses/117/108/117108048/
2. www.nptel.ac.in/courses/117/105/117105101/
3. www.nptel.ac.in/courses/106/106/106106046/
4. www.ocw.mit.edu/courses/media-arts-and-sciences/mas-622j-pattern-recognition-and-analysis-fall-2006/
5. www.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee56/

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implementation of Image classification using Hebbnet method.
2. Implementation of Image classification using Perceptron method.
3. Implementation of Fuzzy pattern recognition.
4. Implementation of Feature extraction using KL transform.
5. Implementation of Clustering using partitional based clustering.
6. Implementation of Clustering using density-based clustering.
7. Implementation of Classification using SVM.
8. Implementation of Classification using HMM.
9. Implementation of Classification using Bayes Methods.
10. Implementation of Neural Network methods.

TOTAL: 30

                                                                          SEMESTER-VI
22BTAD644   **COMPUTER VISION**   **5H-4C**
                            (Theory & Lab)
Instruction Hours/week: L:3 T:0 P:2   **Marks:** Internal:**40** External:**60** Total:**100**
                                               End Semester Exam:3 Hours

PRE-REQUISITE: Basics of Programming

COURSE OBJECTIVES:

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

- To provide knowledge about computer vision algorithms.
- To understand the basic concepts of camera calibration, stereoscopic imaging and higher-levelimage processing operations.
- To familiarize the student with the image processing facilities in Octave and its equivalentopen-source tools like OpenCV.
- To appreciate the use of compute vision in Industrial applications and to understand the role ofcomputer vision.
- To understand and implement Object detection and Object tracking Algorithms.

COURSE OUTCOMES:

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

- Explain basic computer vision algorithms for Computer Vision Applications.
- Apply and develop various object detection methods.
- Explain about Features Reduction methods.
- Demonstrate model based vision methods.
- Explain about real time object detection and face detection process.
- Develop solutions to problems in computer vision

UNIT I   **9**

Image Formation and Representation–Intensity and Range Images – Camera models – Camera parameters – Light and colour – Image Noise – Image Filtering (spatial domain) – Mask based filtering– Image Smoothing –Sharpening.

UNIT II   **9**

Point and Line Detection – Hough Transform and Shape detection – Edge Detection – Corner Detection – Harris Detector- Stereopsis – Correspondence Problem –RANSAC and Alignment – Epipolar Geometry. Image Features – Textures.

UNIT III 9

Deformable Contours – Features Reduction – Principal Component analysis – Feature Descriptors – SIFT and SURF– Motion field of rigid objects – Notation of Optical flow – Estimation Motion Field – Horn and Schunck Algorithm – Lucas and Kanade Algorithm.

UNIT IV 9

Shape from Shading and shape from Texture Model based Vision – Smooth Surfaces and their Outlines–Aspect Graphs and Range Data – Localization – Classification and Evaluation.

UNIT V 9

AdaBoost – Random Decision Forests – Pedestrian Detection. Emotion Recognition – Real Time Object Detection– Gesture Recognition – Face Detection.

TOTAL:45

TEXT BOOKS:
1. Richard Szeliski, Computer Vision:Algorithms and Applications, Springer International, First Edition,2011
2. Reinhard Klette, Concise Computer Vision:An Introduction into Theory and Algorithms, Springer International, First Edition,2014

REFERENCE BOOKS:
1. Davies E R, Computer and MachineVision, Elsevier Publication,Fourth Edition,2012
2. David Forsyth and JeanPonce, Computer Vision: AModern Approach, Pearson International, Second Edition,2012
3. Richard Hartley andAndrew Zisserman, Multiple View Geometryin Computer Vision, Cambridge University Press, Second Edition,2004

WEBSITES:
1.www.nptel.ac.in/courses/106/106/106106224/
2.www.nptel.ac.in/courses/108/103/108103174/
3.www.6.869.csail.mit.edu/sp21/
4.www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-801-machine-vision- fall-2004/
5.www.greatlearning.in/academy/learn-for-free/courses/computer-vision-essentials

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implementation of Noise removal algorithms using OpenCV.
2. Implementation of Object detection based on Edge detection algorithms on any application using OpenCV.
3. Implementation of Perspective projection of the lane borders using OpenCV.
4. Implementation of Principal Component Analysis.
5. Implementations of Feature Extraction of an object using SIFT in OpenCV.
6. Implementation of Feature Extraction of an object using SURF in OpenCV.
7. Implementation of Emotion Recognition in OpenCV.
8. Implementation of Gesture Recognition in OpenCV.
9. Implementation of Face Detection in OpenCV.
10. Implementation of Object detection using AdaBoost in OpenCV

TOTAL: 30

22BTAD645   **DIGITAL IMAGE PROCESSING**
(Theory & Lab)

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

PRE-REQUISITES: Basics of Programming

COURSE OBJECTIVES:
The goal of this course is for the students **:**
- To learn about the basic concepts of digital image processing and various image transforms.
- To familiarize the student with the image enhancement techniques.
- To expose the student to a broad range of image processing techniques and their applications.
- To appreciate the use of current technologies those are specific to image processing systems.
- To expose the students to real-world applications of image processing

COURSE OUTCOMES:
Upon Completion of this course the students will be able to:
- Understand basic image processing operations such as digitization, sampling and quantization.
- Apply suitable techniques in the areas of image enhancement and restoration.
- Analyse the image processing methods and choose suitable methods to extract features from images.
- Compare feature eExtraction using SIFT and SURF
- Identify classifier and clustering algorithms for image classification and clustering.
- Explain different techniques employed for the enhancement of images

UNIT I   9
Introduction–Applications of Image Processing – Steps in Image Processing Applications – Digital Imaging System – Sampling and Quantization – Pixel Connectivity – Distance Measures – Colour Fundamentals and Models – File Formats, Image Operations

UNIT II   9
Image Transforms: Fast Fourier Transform and Discrete Fourier Transform – Image Enhancement in Spatial and Frequency Domain – Grey level Transformations–Histogram Processing – Spatial Filtering – Smoothing and Sharpening – Filtering in Frequency Domain.

UNIT III 9

MultiResolution Analysis: Image Pyramids – Multi Resolution Expansion – Wavelet Transforms–Image Restoration–Image Degradation Model–Noise Modelling- Blur – Order Statistic Filters–Image restoration Algorithms.

UNIT IV 9

Image Segmentation – Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region based Segmentation –Image Features and Extraction–Image Features– Types of Features–Feature Extraction–SIFT, SURF and Texture–Feature Reduction Algorithms.

UNIT V 9

Image Classifiers – Supervised Learning – Support Vector Machines, Image Clustering – Unsupervised Learning – Hierarchical and Partition Based Clustering Algorithms – EM Algorithm – Case Studies

TOTAL: 45

TEXT BOOKS:
1. Rafael Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education, Fourth Edition,2018
2. Sridhar. S, Digital Image Processing, Oxford University,2016

REFERENCE BOOKS:
1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Thompson Learning, Second Edition,2007
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, First Edition,2011
3. Oges Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press, First Edition,2011
4. Wilhelm Burger and Mark J. Burge, Principles of Digital Image Processing, Springer Publishers, First Edition ,2013

WEBSITES:
1. www.nptel.ac.in/courses/117/105/117105135/
2. www.nptel.ac.in/courses/117/105/117105079/
3. www.nptel.ac.in/courses/106/105/106105032/
4. www.nptel.ac.in/courses/105/107/105107160/
5. www.ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/introduction/

(ii) LABORATORY

COURSE OBJECTIVES:

LIST OF EXPERIMENTS:
1. Implementation of Reading and Writing of Images in OpenCV/Octave/SciLab.
2. Implementation of simple spatial filters like Low Pass Filters and High Pass Filters in Octave/OpenCV.
3. Implementation of Histogram Techniques in Octave/OpenCV.
4. Implementation of noise modelling in Octave/SciLab.
5. Implementation of Wavelet Transforms and Deconvolution Algorithms in Octave.
6. Implementation of SIFT, SURF in Octave/SciLab.
7. Implementation of PCA in Octave.
8. Implementation of Image Classifier using SVM in Octave.
9. Implementation of Image Clustering algorithms in Octave.
10. Implementation of Feature extraction Fingerprint using Octave.

TOTAL: 30

22BTAD646   **ADVANCED DATA SCIENCE**   **5H-4C**
                         (Theory & Lab)

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

End Semester Exam:3 Hours

(i) Theory
PRE-REQUISITES: Basics of Programming
COURSE OBJECTIVES:
The goal of this course is for the students **:**

- To learn the fundamentals of data science and big data.
- To gain in-depth knowledge on descriptive data analytical techniques.
- To gain knowledge to implement simple to complex analytical algorithms in big data frameworks.
- To learn the use of big data processing methods in data science
- To understand and perform data visualization, web scraping and machine learning using various Data Science tools.

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

- Describe the fundamentals of advanced data science.
- Demonstarte about Hadoop file system implementation.
- Explain about Hive archietecture and MongoDB.
- Analyze various open-source frameworks for modelling and storing data and data analytics methods to choose best approaches.
- Develop simple applications involving Essential Data Science Packages.
- Solve data science problems that can be used by a broad audience.

UNIT I   **9**
Data Science – Fundamentals and Components – Data Scientist – Terminologies Used in Big Data Environments – Types of Digital Data – Classification of Digital Data – Introduction to Big Data – Characteristics of Data – Evolution of Big Data – Big Data Analytics – Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics – Data Analytics Tools. Linear Regression – Polynomial Regression – Multivariate Regression

UNIT II   **9**
Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce –

UNIT III 9

Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL).

UNIT IV 9

Introduction to Essential Data Science Packages: Numpy, Scipy, Jupyter, Statsmodels and Pandas Package – Data Munging: Introduction to Data Munging, Data Pipeline and Machine Learning in Python

UNIT V 9

Data Visualization Using Matplotlib – Interactive Visualization with Advanced Data Learning Representation in Python.

TOTAL: 45

TEXT BOOKS:
1. Frank Pane, Hands on Data Science and Python Machine Learning, Packt
   Publishers, First Edition, 2017
2. Seema Acharya and Subhashini Chellapan, Big Data and Analytics, Wiley Publishers, Second
   Edition, 2015

REFERENCE BOOKS:
1. Alberto Boschetti and Luca Massaron, Python Data Science Essentials, Packt Publishers,
   Second Edition,2016
2. DT Editorial Services, Big Data, Black Book, Dream Tech Press,
   First Edition,2015
3. Yuxi (Hayden) Liu, Python Machine Learning By Example, Packt Publication, Second
   Edition,2017

WEBSITES:
1. www.nptel.ac.in/courses/106/106/106106179/
2. www.nptel.ac.in/courses/106/106/106106212/
3. www.nptel.ac.in/noc/courses/noc17/SEM2/noc17-mg24/
4. www.nptel.ac.in/courses/106/104/106104189/
5. www.coursera.org/specializations/advanced-data-science-ibm

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages. Reading data from text file, Excel and the web.
2. Exploring various commands for doing descriptive analytics on state-of-the-art data set.
3. Perform Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
4. Perform bivariate and multivariate analysis: Linear and logistic regression modeling
5. Apply and explore various plotting functions on data sets.
6. Install and configure Hadoop in its two operating modes
7. Implement the following file management tasks in Hadoop: Adding files and directories, retrieving files and deleting files.
8. Create a retail data base with the following tables: Product, Customer, Manufacturer, Shipping and Time using MongoDB and perform data replication using sharding techniques.
9. Install HIVE and implement the above retail schema definition and perform CRUD operations.
10. Perform data visualization using python.

TOTAL : 30

	SEMESTER IV
22BTAD647 **COMPUTING SYSTEMS FOR DATA PROCESSING**	**5H-4C**

(Theory & Lab)

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

End Semester Exam:3 Hours

PRE-REQUISITE: Basics of Programming

COURSE OBJECTIVES:
The goal of this course is for the students **:**
- To understand the fundamentals of large-scale data processing and data flow programming
- To familiarize in distributed data processing methods such as mapreduce
- To impart the algorithms used for mapreduce task
- To understand the basics of data streams and its models
- To conquer basic knowledge in the applications of data processing algorithms

COURSE OUTCOMES:
Upon Completion of this course the students will be able to:
- Explain the key concepts of scalable data processing approaches in future computer systems.
- Discuss about distributed file system using map reduce concept to solve problems.
- Explain the concept of complexity theory for mapreduce.
- Analyze data mining algorithms in a data streams and build intelligent models
- Explain about decaying windows and its applications.
- Apply knowledge in the applications of data processing algorithms

UNIT I   **9**
Introduction to large-scale data processing and optimization - Data flow programming: Map/Reduce to TensorFlow.

UNIT II   **9**
MapReduce and the New Software Stack-Distributed File Systems-MapReduce-Algorithms Using MapReduce.

UNIT III   **9**
Extensions to MapReduce-The Communication Cost Model-Complexity Theory for MapReduce.

UNIT IV   **9**

Mining Data Streams - The Stream Data Model - Sampling Data in a Stream - Filtering Streams - Counting Distinct Elements in a Stream.

UNIT V   **9**

Estimating Moments - Counting Ones in a Window - Decaying Windows.

                                                  TOTAL: 45

TEXT BOOKS:

1. Jure Leskovec, Anand Rajaraman and JeffreyD Ullman, Mining of MassiveDatasets, Cambridge University Press,Third Edition, 2014
2. Tom White, Hadoop: The DefinitiveGuide, O'reilly Publication, First Edition, 2012

REFERENCE BOOKS:

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis and Paul Zikopoulos, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Publication, FirstEdition, 2012
2. Jure Leskovec, Anand Rajaraman and Jeffrey D Ullman, Mining of Massive Datasets, Cambridge University Press,Third Edition, 2014
3. Glenn J Myatt, Making Sense of Data, John Wiley & Sons, FirstEdition, 2007

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1. www.nptel.ac.in/courses/110/106/110106072/
2. www.nptel.ac.in/courses/110/104/110104094/
3. www.ocw.mit.edu/resources/res-str-002-data-management-spring-2016/
4. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002 introduction- to-computational-thinking-and-data-science-fall-2016/
5. www.ocw.mit.edu/courses/sloan-school-of-management/15-062-data-mining-spring-2003/

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Perform setting up and Installing Hadoop in its two operating modes such as pseudo distributed and fully distributed. Use web-based tools to monitor your Hadoop setup.
2. Implement the file management tasks in Hadoop:
3. Implement a simple Map Reduce program to understand Map Reduce Paradigm.
4. Implement Stop word elimination problem
5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at:https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all.
    a. Find average, max and min temperature for each year in NCDC data set?
    b. Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.
    c   Purchases.txt Dataset
6. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
7. Program to perform data stream mining.
8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
9. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.
10. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together. Write a single Spark application that counts the frequencies of all the pairs of products reviewed together;

TOTAL: 30

SEMESTER-VII

| 22BTAD741 | ROBOTICS AND AUTOMATION | 5H-4C |

(Theory & Lab)

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

End Semester Exam:3 Hours

(i)THEORY

COURSE OBJECTIVES:
The goal of this course is for the students

- To introduce the functional elements of Robotics
- To impart knowledge on the forward and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce about hydraulics system
- To introduce the concept of automation

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

- Explain the basic concept of robotics and automation in robotics industries.
- Identify planning and control process in mobile robots..
- Discuss about vision based controls and their applications.
- Demonstarte the working of a hydraulic system.
- Explain about Pneumatic logic circuits and choose suitable circuits.
- Apply advanced robotics principles to solve real time problems.

UNIT I   **9**
Introduction – Actuators – Sensors – Rigid body – coordinate systems – Kinematics – Forward Kinematics & Inverse Kinematics – Velocity Kinematics – Angular velocity – Linear velocity – Singularity – Force and torque

UNIT II   **9**
Dynamics – Mobile Robots – Planning and Control – Path & Trajectory planning – Probabilistic Roadmaps – Localization.

UNIT III 9

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

UNIT IV 9

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

UNIT V 9

Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders

TOTAL: 45

TEXT BOOKS:
1. **"**Robot Modeling and Control**",** Mark W. Spong, Seth Hutchinson and Vidyasagar. M, Wiley Publishers, Second Edition, 2020.
2. **"**Robot Building for Beginners**",** David Cook, Apress Publishers, Third Edition, 2015.

REFERENCE BOOKS:
1. **"**Industrial Automation and Robotics**",** Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
2. **"**Industrial Robotics**",** Groover. M.P, Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017
3. **"**Embedded Systems & Robotics**",** Ghoshal. S, Cengage Learning, First Edition, 2009.
4. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

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

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Write a computer program to plot the joint angles as a function of time given the tool locations and velocities as a function of time in Cartesian coordinate

2. Write a computer program to compute the inverse kinematic equations for the elbow manipulator. Include procedures for identifying singular configurations and choosing a particular solution when the configuration is singular. Test your routine for various special cases, including singular configurations.

3. Write a computer program to generate an LSPB trajectory, given appropriate initial data

4. Simulate an inverse dynamic control law for a two-link elbow manipulator

5. Study of Rhino with hard home and soft home configuration

6. Program to control the Rhino robots

7. Solve forward kinematics problem with a physical implementation on the Rhino robot

8. Solve inverse kinematics problem with a physical implementation on the Rhino robot

9. Program to integrate computer vision and control of the Rhino robot

10. Program on Camera Calibration

TOTAL: 30

22BTAD742   **DATA COMMUNICATION AND COMPUTER NETWORKS**   **5H-4C**
(Theory & Lab)

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

End Semester Exam: 3 Hours

(i)THEORY
PRE-REQUISITES: Fundamental of Computers

COURSE OBJECTIVES:

The goal of this course is for the students

- To understand the concept of data communication and functionalities of layers.
- To be familiar with switching techniques.
- To impart knowledge in wired and wireless communication protocols.
- To get adequate knowledge in flow control and congestion control mechanisms.
- To understand the data encryption and decryption techniques.

COURSE OUTCOMES:

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

- Define the fundamental concept of data communication and functionalities of all the layers.
- Apply probability concepts to solve the problems of various network protocols and apply routing techniques to solve problems of congestion and flow control techniques.
- Analyze routing techniques using tcp/udp protocols.
- Discuss about the encryption and decryption of plain text using public key cryptosystems.
- Identify the significance and purpose of protocols and standards and their key elements in data communications and networking.
- Demonstrate the fundamental concepts of data communication in computer networking.

UNIT I   **9**

Data communication: Components – Data representation – Data flow – Networks: Categories of network – Protocols and standard – Network topologies – OSI model – TCP/IP protocol suite – Digital signals – Digital transmission: Digital to digital transmission – Multiplexing – Transmission media.

UNIT II 9

Circuit switched networks – Datagram networks – Types of errors – Block coding – Framing – Noiseless channels – Noisy channels – HDLC – ALOHA – IEEE standards – Standard Ethernet.

UNIT III 9

Wireless LANs: IEEE 802.11 – Bluetooth – Satellite networks – Connecting devices – IPv4 and IPv6 Addresses and Datagram – Address mapping – ICMP – Unicast routing protocols.

UNIT IV 9

Transport layer: Process to process delivery – User datagram protocol – TCP – Congestion control – Congestion control in TCP and frame relay – Techniques to improve QoS.

UNIT V 9

Integrated Services – Domain name space – Electronic mail – WWW – HTTTP – SNMP – Cryptography: Introduction – DES – RSA – Diffie-Hellman – Digital Signature – X.509 authentication certificate – Firewalls.

TOTAL: 45

TEXT BOOKS:
1. "Data communication andNetworking", Behrouz A Forouzan ,Tata McGraw –Hill,Fourth Edition-2011
2. "Cryptography and Networksecurity -Principles andPractices", William Stallings,Pearson Education,Fifth Edition-2011

REFERENCE BOOKS:
1. " Computer Networks: ASystems Approach", Larry L Peterson andBruce S Davie,Morgan KaufmannPublishers,Fifth Edition-2011
2. " Computer Networking – ATop Down Approach", James F Kurose andKeith Woss,Pearson Education,Fifth Edition-2009
3. " Computer and Communication Networks",ader F Mir,Pearson Education,First Edition-2010

WEBSITES:
1. www.nptel.ac.in/courses/Webcoursecontents/ IIT%20 Kharagpur/ Computer%20 networks/New_index1.html.
2. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computersystem - engineering-spring-2009/lecture-notes/.
3. www.mcmcse.com/cisco/guides/osi.shtml.
4.www.compnetworking.about.com/od/vpn/a/vpn_tunneling.htm.
5.www.iana.org/numbers.

(ii) LABORATORY

LIST OF EXPERIMENTS:
1. Study of network IP address and network simulator.
2. Implement to connect a set of nodes
3. Implementation of stop and wait protocol and sliding window protocol.
4. Implementation of subnetting.
5. Implement routing algorithms.
6. Installation and configuration of netanim.
7. Implementation of transmission control protocol and user datagram protocol.
8. Implementation of file transfer protocol.
9. Implementation of data encryption and decryption.

TOTAL: 30

SEMESTER-VII

22BTAD801   PRINCIPLES OF MANAGEMENT AND ENGINEERING ETHICS   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

 The goal of this course is for the students

- To enable the students to study the evolution of Management
- To study the functions and principles of management.
- To learn the application of the principles in an organization.
- To enable the effective and barriers communication in the organization
- To study the system and process of effective controlling in the organization.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

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

UNIT I   MANAGEMENT FUNCTIONS AND STRUCTURE   **9**

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

UNIT II   MANAGEMENT OF ORGANISATION   **9**

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

UNIT III   ORGANISATIONAL BEHAVIOUR   9

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

UNIT IV GROUP DYNAMICS   9

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

UNIT V PROFESSIONAL ETHICS   9

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

TOTAL:45

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

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

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

B.TECH ARTIFICIAL INTELLIGENCE & DATA SCIENCE

PROFESSIONAL ELECTIVES

SEMESTER IV
22BTAD4E01   **APPLIED DATA SCIENCE**   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the students :
- To familiarize the data manipulation in R.
- To impart knowledge on supervised learning techniques using mathematical modelling.
- To learn and implement the advanced machine learning techniques.
- To understand the concepts of integrating R with Hadoop environment.
- To enhance the knowledge to write Map Reduce join R and executing in Hadoop.

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Illustrate on solving the problems in big data and to perform the data manipulation in R.
- Discuss supervised classification and regression techniques using mathematical approach.
- Apply the appropriate machine learning strategies for any given problems.
- Describe and implementing to integrate the R environment with Hadoop.
- Choose writing a code in one environment and execution in other environment.
- Apply mathematical principles to the analysis of data

UNIT I   **9**
Introduction to Data Science and Basic Data Manipulation using R–Introduction to Big Data – Roles played by a Data Scientist – Analyzing Big Data using Hadoop and R – Methodologies used for analysis–The architecture and methodologies used to solve the Big Data problems–Data Acquisition from various sources, data preparation, data transformation using Map Reduce (RMR) –Application of Machine Learning Technique – Data visualization – Problem statement of few data science problems–Vectorsin R–Reading data–Combining data–Subsetting data–Sortingdataand some basic data generation functions.

UNIT II   **9**
Machine Learning Techniques Using R Part I – Machine Learning Techniques Using R Part II – Machine Learning Techniques Using R Part III – Machine Learning Overview – ML Common Use Cases – Understanding Supervised and Unsupervised Learning Techniques – Clustering – Similarity Metrics –Distance Measure– Types: Euclidean, Cosine Measures, Creating predictive models.

UNIT III   **9**

Understanding K-Means Clustering – Understanding TF-IDF– Cosine Similarity and Their application to Vector Space Model – Implementing Association rule mining in R – Understanding Process flow of Supervised Learning Techniques – Decision Tree Classifier – How to build Decision trees – RandomForestClassifier–WhatisRandomForests– FeaturesofRandomForestoutofBoxErrorEstimateand Variable Importance Naive Bayes Classifier.

UNIT IV   **9**

Introduction to Hadoop Architecture – Integrating R with Hadoop– Hadoop Architecture – Common Hadoop commands – MapReduce and Data loading techniques (Directly in R and in Hadoop using SQOOP,FLUME,and other Data Loading Techniques)–Removing anomalies from the data

UNIT V   **9**

Integrating R with Hadoop using RHadoop and RMR package–Exploring RHIPE(RHadoop Integrated Programming Environment)–Writing MapReduce Jobs in R and executing the monHadoop.

TOTAL:45

TEXT BOOKS:

1. Hadley Wickham and Garrett Grolemund, "R for Data Science: Import,Tidy, Transform, Visualize and Model Data", O'Reilly Publisher, 2016
2. Thomas Mailund, "Beginning DataScience in R: Data Analysis, Visualization, and Modelling for Data Scientist",Apress Publihser,First Edition, 2017

REFERENCE BOOKS:

1. Holmes FinchW, Jocelyn BolinE and KenKelley, "Multilevel Modelling using R", CRC Press,First Edition, 2014
2. JaynalAbedin and Kishor Kumar Das, "Data Manipulation with R",Packt Publisher, Second Edition, 2015

WEBSITES:

1. www.mosaic-web.org/go/Master-Modeling.pdf
2. www.cran.r-project.org/doc/
3. www.nptel.ac.in/course.php
4. www.r4ds.had.co.nz/
5. www.statslab.cam.ac.uk/~pat/redwsheets.pdf

		SEMESTER IV
22BTAD4E02	**CLOUD COMPUTING TECHNIQUES**	**3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES:
   The goal of this course is for the students :
   - To understand the fundamentals of cloud computing and its services.
   - To know cloud collaborating communities.
   - To impart knowledge on various collaboration in cloud management.
   - To familiarize different services of cloud in web mail and social networks.
   - To explore the concepts of cloud storage.

COURSE OUTCOMES:
   Upon completion of this course the students will be able to:
   - Define the basic concepts of cloud computing.
   - Apply the concept of cloud in the social networks of blogs and wikis.
   - Analyze the collaboration of cloud computing and cloud management.
   - Understand backup strategies for cloud storages based on features.
   - Understand about cloud file storage and sharing services.
   - Understand the cloud technology and its application.

UNIT I   9
Cloud computing introduction – From collaboration to cloud – Working of cloud computing – The pros and cons of cloud computing – Beneficiary – Developing cloud computing services – Types of cloud service development–Discovering cloud services.

UNIT II   9
Centralizing email communications – Cloud computing for community – Collaborating on schedules –Collaborating on group projects and events – Cloud computing for corporation – Managing schedules managing projects–Presenting on road–Collaborating on calendars, schedules and task management

UNIT III   9
Exploring online scheduling – Exploring online planning and task management – Collaborating on event management – Collaborating on contact management – Collaborating on project management –Collaborating on word processing–Spread sheets and databases.

UNIT IV   **9**

Evaluating web mail services – Evaluating instant messaging services – Evaluating web conference tools – Creating groups on social networks– Evaluating online groupware –Collaborating via blogs and wikis. Understanding cloud storage

UNIT V   **9**

Evaluating online file storage and sharing services–Exploring online bookmarking services– Exploring online photo editing applications– Exploring photo sharing communities–Controlling it with web based desktops.

                                                                                                    TOTAL:45

TEXT BOOK:
1. Michael Miller, "Cloud Computing: Web Based Applications That Change the Way You Work and Collaborate", QuePublishing,FirstEdition,2011

REFERENCE BOOK:
1. Kumar Saurabh, "Cloud Computing: Insights into New-era Infrastructure", Wiley IndiaFirstEdition,2011

WEBSITES:
1. www.chettinadtech.ac.in/storage/11-12-30/11-12-30-10-52-02-1373-mahendra.pdf
2. www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf
3. www.thbs.com/downloads/Cloud-Computing-Overview.pdf
4. www.tutorial.wmlcloud.com/windows_azure/Using-Cloud-Services---Collaborating-onWord-Processing-(part-1).aspx
5. www.techrepublic.com/blog/the-enterprise-cloud/cloud-app-vs-web-app-understandingthedifferences

SEMESTER IV

22BTAD4E03   MOBILE AND PERVASIVE COMPUTING   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES:

The goal of this course is for the students :

- To provide guidelines, design principles and experience in developing wireless communication.
- To develop an appreciation of interaction modalities with small, mobile devices (including interface design for non-standard display surfaces) through the implementation of Wireless LAN.
- To introduce wireless communication and networking principles, that support mobile network, connectivity to cellular networks, wireless internet and sensor devices and application Layer.
- To understand the concept of pervasive computing basics.
- To enhance the knowledge of device technology.

COURSE OUTCOMES:

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

- Define the basic concepts modulation types and overview of networks.
- Apply computing services in Bluetooth and Ethernet.
- Analyze routing techniques of mobile computing architecture
- Understand the general issues in pervasive computing.
- Understand the Web architectures
- Recognize the state-of-the art of research in pervasive computing.

UNIT I   **9**

Introduction – Wireless transmission – Multiplexing – Modulations – Types of modulation – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular wireless networks – Overview ofGSM–GPRS –Satellite networks –Broadcast systems.

UNIT II   **9**

Wireless LAN – IEEE 802.11 – Architecture – Services – MAC – Physical layer – IEEE 802.11a –802.11b standards – HIPERLAN – Bluetooth – Zigbee – PAN – IEEE 802.15 –

UNIT III   **9**

Mobile IP – Dynamic host configuration protocol – Routing – DSDV – DSR – Alternative metrics – Traditional TCP –Classical TCP improvements–WAP–WAP architecture–WAE.

UNIT IV 9

Relationship of wireless computing–Ubiquitous computing–Internet computing–Ambient computing – Elements of pervasive architecture – Requirements of computational – Infrastructure –Failure management. General issues in pervasive – Security – Performance – Dependability

UNIT V 9

Web architectures – Local networks – Store and forward –Multi-network architectures. Device and network technologies–Devices categories–Devices characteristic Heterogeneity and Interoperability–Mobile Agents – Device management – 3G devices – Windows CE devices–Symbian devices –J2ME –enabled devices–ios devices.

TOTAL:45

TEXT BOOKS:
1. Jochen Schiller, "Mobile Communications", Pearson Education Second Edition, 2009
2. Jochen Burkhardt, Horst Henn, Klaus Rintdorffand Thomas Schaeck, "Pervasive Computing: Technology and Architecture of internet Applications", Pearson Education Sixth Edition, 2009

REFERENCE BOOKS:
1. Stephen A Rackley, "Wireless Networking Technology: From Principles to Successful Implementation", Newnes,First Edition, 2011
2. Krzyszt of Wesolowshi, "Mobile Communications System", John Wiley,Second Edition, 2007
3. Adelstein F,SandeepK SGuptaand Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", Tata McGraw-Hill,Fourth Edition, 2008
4. William Stallings, "Wireless Communications and Networks", Pearson Education, Second Edition, 2009

WEBSITES:
1. www.disco.ethz.ch/lectures/ss04/mobicomp/lecture/1/Chapter1Introduction4Slides.pdf
2. www.icta.ufl.edu/books.htm
3. www.cise.ufl.edu/class/cen5531fa06/notes/intro-mobilecomputing.pdf
4. www.bnrg.eecs.berkeley.edu/~randy/Courses/CS294.S96/CS
5. www.tutorialspoint.com/mobile_computing/mobile_computing_quick_guide.html

	SEMESTER IV
22BTAD4E04 **ADVANCED ALGORITHMS**	**3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Data Structures and Design Analysis of Algorithms
COURSE OBJECTIVES:
The goal of this course is for the students :

- To learn programming and mathematical backgrounds for design and analysis of algorithm.
- To study the concept of designing an algorithm.
- To have a complete understanding of the various advanced data structures.
- To learn and implement advanced algorithms using appropriate design techniques.
- To inculcate advanced graph algorithms and applications.

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

- Explain advanced data structures and algorithms.
- Apply advanced data structures to solve the problems.
- Analyze the application of algorithm paradigms to many engineering problems.
- Understand efficient algorithms to solve the problems
- Demonstrate the application of algorithm design techniques, synthesize it and derive the recurrences describing the performance to ascertain the running time
- Analyze various non-linear data structures and discuss their running time.

UNIT I   9

Programming language backgrounds: STL in C++ – Data structures support in python. Mathematical backgrounds: Logarithmic exponentiation – Efficient prime factorization – Combinatorics – Sieve oferatosthenes–Geometry–Co-ordinatecompression–Binomialcoefficients– Euclid'sextendedalgorithm – Line intersections – Probability – Modular multiplicative inverse – Matrix exponentiation –Millerrabin primality test–Heavy light decomposition–Convexhull – Hungarian algorithm –Sweepline algorithm – Gaussian algorithm – Pollard rho factorization – Euler's totient function –Burnside lemma.

UNIT II   9

Recursion – Dynamic programming – Backtracking – Branch and bound – Suffix automata – Game theory – Meet in the middle – Arbitrary precision integer – Square root decomposition. Knapsack problem – Stable marriage problem – N-queen problems – Tug of wars – Sudoku problem.

UNIT III   9

Advanced Trees: Binary indexed tree – Segment tree – Lowest common ancestors – Counting inversions – Suffix tree –Interval tree–Sparse table–K-Dtree–Treap–Link/cuttree.

UNIT IV   9

Advanced Graph Algorithms: Union find/disjoint set – Cycle detection – Bellman ford – Maxflow –Ford-fulkerson – Edmonds karp algorithm – Min cut – min cost flow – Dinic's algorithm – Maximumbipartitematching–Topologicalsorting– Eulerianandhamiltonianpaths– Graphcoloring– Blossom's algorithm – Jarvis algorithm – Graham Scan – Johnson's algorithm.

UNIT V   9

Searching and pattern matching: Rabin-karp algorithm – Z-algorithm – Aho-corasick string matching algorithm – Manacher's algorithm–Kasai's algorithm – Levenshtein distance. Sorting: Quick select.

TOTAL:45

TEXT BOOKS:
1. CormenTH, Leiserson CE and Stein C, Introduction to Algorithms, PHI Learning, Third Edition, 2011
2. Anany Levitin, Introduction to Design and Analysis of Algorithm, Pearson Education, Third Edition, 2017

REFERENCES BOOKS:
1. Jeff Edmonds, How to Think about Algorithms, Cambridge University,First Edition,2014
2. Dasgupta, Algorithms, TataMcGrawHill,FirstEdition,2016
3. Harsh Bhasin, Algorithms Design and Analysis, Oxford university, First Edition, 2016

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

SEMESTER IV

22BTAD4E05   **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

PRE-REQUISITES: Data Structures

COURSE OBJECTIVES:

The goal of this course is for the students :

- To understand basic concepts of algorithms and analyze the asymptotic performance.

- To be familiar with major algorithm design strategies and data structures.
- To apply important algorithmic design paradigms to engineering problems in various domains and methods of analyzing it.
- To learn and implement advanced algorithms efficiently using appropriate design techniques.
- To use the concept of approximation and randomization to find efficient algorithms for hard problems.

COURSE OUTCOMES:

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

- Outline the basics of problem solving techniques and asymptotic notations.
- Apply various problem solving strategies to solve real-time applications.
- Choose appropriate problem solving strategy to solve problems
- Describe efficient algorithms using suitable data structure and algorithm design paradigm for developing real-time applications.
- Discuss about mini-projects using various problem solving techniques and assess their running time.
- Choose efficient algorithms in common engineering design situations.

UNIT I   **9**

Algorithm analysis: Introduction to algorithm – Notion of algorithm – Euclids algorithm – Reduction of algorithm to curve-growth rate analysis – Asymptotic analysis – Asymptotic notations – Amortized analysis –Recurrence equations–Analysis of recursive and non-recursive algorithms–General method.

UNIT II   **9**

Divide and conquer: Brute force – Selection sort – Bubble sort. Divide and conquer: General method –Binary search–Min-max problem–Median finding–Merge sort–Quick sort– Integermultiplication Strassen's matrix multiplication – Convex hull problem.

UNIT III   9

Greedy algorithms: General method–Fractionalknapsack–Jobsequencingwithdeadlines–Huffmancoding–Minimumcostspanningtrees – Single source shortest path problem. Transform and conquer: Binary tree – BST – AVL treeo perations–Heaps –Heapsort –Horner'srule.

UNIT IV   9

Dynamic programming–General method–Principle of optimality–Making change problem – Assemblylinescheduling–0/1Knapsack–Travellingsalesmanproblem–Longest common subsequence – Optimal search tree – Matrix chain multiplication – A machine scheduling problem –Case-studies. Backtracking: General method–8Queensproblem–Sum of subsets–Graph colouring Hamiltonian problems.

UNIT V   9

Randomization: Introduction to randomized algorithms **-** Random numbers, randomized quick sort, Min cut problem. NP-Completeness and approximation: The class P and NP –Polynomial time reduction – NP-completeness – NP-hard problems – Hamiltonian cycle – Travelling salesman problem–Approximation algorithms.

TOTAL:45

TEXT BOOKS:
1. CormenTH,Leiserson C E and Stein C, "IntroductiontoAlgorithms", PHI Learning,Third Edition, 2011
2. Anany Levitin,"Introduction to Design and Analysis of Algorithm", Pearson Education,Third Edition, 2017

REFERENCE BOOKS:
1. Jeff Edmonds, "How to Think about Algorithms", Cambridge University,First Edition,2014
2. Dasgupta, "Algorithms", TataMcGraw Hill,First Edition,2016
3. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university,First Edition, 2016

WEBSITES:
1. www.cs.usfca.edu/~galles/visualization/Algorithms.html
2. www.lcm.csa.iisc.ernet.in/dsa/dsa.html
3. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2012/lecture-notes/
4. www.openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithm
5. www.nptel.ac.in/course.php

SEMESTER V

22BTAD5E01 **INFORMATION STORAGE AND MANAGEMENT** 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students
- To understand the content and successfully complete this course, a student must have an understanding of computers, operating systems, networking, and databases.
- Experience in specific segments of storage infrastructure would also be helpful to fully assimilate the course material.
- To evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, CAS
- To define backup, recovery, disaster recovery, business continuity, and replication
- To examine emerging technologies including IP-SAN
- To understand logical and physical components of a storage infrastructure
- To understand the local and remote replication technologies.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:
- Describe important storage technologies features such as availability, replication, scalability and performance
- Describe to install, administer and upgrade popular storage solutions
- Identify and install current storage virtualization technologies
- Explain about virtual servers and storage between remote locations
- Analyze and manage clusters of resources
- Differentiate between IT industry-specific certifications

UNIT I 9

The value of information and data creation to a business – Overview of Data Center infrastructure elements and their requirements – Physical and logical components of host, connectivity and storages –Disk drive architecture and performance – RAID – Different RAID levels (RAID 0, 1, 3, 4, 5, 0+1/1+0 and 6)–Overview of Intelligent Storage System(ISS)–Components of ISS– Implementation of ISS as storage arrays.

UNIT II 9

DAS Implementation–Overview of SCSI–Architecture,Components.Topologies:FC-SAN,IP-SAN, FCoE–NAS, Overview of Object based storage system–CAS.

UNIT III   9

Application: Long term archiving solution – Unified storage – Block level and File level storage virtualization technologies–processes. Overview of emerging technologies: Cloud service models – Cloud deployment models –Cloud challenge.

UNIT IV   9

Information Availability – Measurement – Downtime: causes – consequences – RTO – RPO – Storage infrastructure: Single point of failure and solution–Backup/Recovery: Purpose,Architecture,Topologies–Local and remote replication:Technologies,Operation

UNIT V   9

Emerging Technologies: Duplication, Offsite Backup – Introduction to information security – Critical security attributes for information system – Elements of a shared storage model and security extensions – Storage security domains–Common threats in each domain.

TOTAL:45

TEXT BOOKS:

1. Somasundaram G and Alok Shrivastava, "Information storage and Management", John Willey, Second Edition, 2012
2. Robert Spalding, "Storage Networks:The Complete Reference", Tata McGrawHill, First Edition, 2008

REFERENCE BOOKS:

1. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Second Edition, 2007.
2. Meeta Gupta, "Storage Area Network Fundamentals", Cisco Press, FirstEdition, 2002.
3. Thejendra BS, "Disaster Recovery and Business Continuity", IT Governance, First Edition,2008

WEBSITES :

1. www.emc.com
2. www.education.emc.com/ismbook
3. www.cse.unr.edu
4. www.siglpu.files.wordpress.com
5. www.metalab.uniten.edu

SEMESTER V
22BTAD5E02   DOT NET 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 code solutions and compile C# projects within the .NET framework.
- To design and develop professional console and window based .NET application
- To demonstrate knowledge of object – oriented concepts, design user experience and functional requirements.
- To construct classes, methods and assessors and instantiate objects.
- To understand and implement string manipulation, events and exception handling within .NET application environment.
- To create and manipulate GUI components in C#.

COURSE OUTCOMES:

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

- Explain about the use and features of .NET.
- Apply delegates and events for .NET framework.
- Demonstrate software architecture in web services.
- Discuss about server side applications and web services.
- Discuss about professional console and window based .NET application.
- Identify the problems in C#.Net window based application and solve real word problems.

UNIT I   9

.NET framework overview: .NET framework architecture. Introduction to C# language: Primitive datatypes–Enumerations–Expressions–Statements–Control structures(if,for,while,do..while,foreach).

UNIT II   9

Object-oriented concepts in.NET–Common type system. Delegates and events: Delegates and multicast delegates–Events. Attributes–Arrays and collections– Working with strings – Regular expressions

UNIT III   9

Memory and resource management – Input/output –Working with XML–DataaccesswithADO.NET–Windows forms–ASP.NET and Web applications–Concurrency–Internet access – Reflection – Serialization.

UNIT IV 9

Web services – Remoting – Interoperability and unmanaged code – Assemblies and deployment – Security. Enterprise services: Introduction to multi-tier software architectures – COM+ – Creating, deploying and using COM+ components–Using message queues–MSMQ.

UNIT V 9

ASP.NET Mobile Controls: Introduction to WAP and WML – ASP.NET and WAP/WML – Using mobile controls. Microsoft.NET compact framework: .NETcompact framework architecture–.NET frame work vs. .NET compact framework–Creating mobile applications.

TOTAL:45

TEXT BOOKS:
1. "Mastering C# and .NETFramework", Marino Posadas, Packet Publishing, First Edition, 2016.
2. "Computing with C# and the.NET Framework", ArtGittleman, Jonesand Bartlett Learning, Second Edition, 2012.

REFERENCE BOOK:
1. "Pro.NET Framework with the Base Class Library", RogerVillela, Apress,First Edition, 2019.

WEBSITES:
1. www.nlp.stanford.edu/IR-book/html/htmledition/irbook.html
2. www.text-analytics101.rxnlp.com/2014/11/what-are-n-grams.html
3. www.nptel.ac.in/courses/106105084/
4. www.nitttrchd.ac.in/sitenew1/nctel/ppt/CS0.ppt
5. www.pragimtech.com/c-sharp-video-tutorials.aspx

SEMESTER V

22BTAD5E03   MOBILE APPLICATION DEVELOPMENT   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- To develop knowledge about mobile application development.
- To understand the building blocks of mobile apps.
- To gain knowledge about graphics and animations in mobile apps.
- To know about testing of mobile apps.
- To know about the threading concepts
- To understand more about how to distribute apps on mobile marketplace.

COURSE OUTCOMES:

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

- Define overview of android with its states and lifecycle.
- Apply the mobile applications for e-marketing in android and iphone.
- Demonstrate mobile databases and various types of testing.
- Express simple android applications.
- Identify android applications in different field with modern tools.
- Identify important operating system events.

UNIT I   9

Mobility landscape – Mobile platforms – Mobile apps development – Overview of android platform –Setting up the mobile app development environment along with an emulator – A case study on mobileapp development.

UNIT II   9

App user interface designing – Mobile UI resources (Layout, UI elements, Draw-able, Menu) – Activity – States and life cycle – Interaction amongst activities – App functionality beyond user interface – Threads, async task, services – States and lifecycle, Notifications, Broadcast receivers.

UNIT III   9

Telephony and SMS APIs – Native data handling – On-device file I/O –Shared preferences – Mobile databases such as SQLite and enterprise data access (via Internet/Intranet). Graphics and animation – Customviews– Canvas– AnimationAPIs– Multimedia–Audio/videoplaybackandrecord– Locationawarenessand native hardware access(sensors such as accelerometer and gyroscope).

UNIT IV   9

Debugging mobile apps – White box testing – Black box testing and test automation of mobile apps – JUnit for android, robotium and monkey talk. Versioning – Signing and packaging mobile apps – Distributing apps on mobile marketplace.

UNIT V   9

Introduction to objective C–iOS features–UI implementation – Touch frameworks – Location aware applications using core location and map kit –Integrating calendar and address book with social media application – Using WIFI – iPhone marketplace – Drawbacks on iOS over Android – Various stores available in online market – Configuration of mobileapp– Online ecommerce transaction–E-booking transaction.

TOTAL:45

TEXT BOOK:

1. "Composing Mobile Apps", Anubhav Pradhan and AnilV Deshpande, Wiley, First Edition, 2014.

REFERENCE BOOK:

1. **"**Android Application Development All-in-one for Dummies", BarryBurd, John Wiley, First Edition, 2012.

WEBSITES:

1. www.impetus.com/mobility
2. www.cise.ufl.edu/~helal/classes/f10/notes/intro_to_mobile.ppt
3. www.diva–portal.org/smash/get/diva2:626531/FULLTEXT01.pdf
4. www.law.fsu.edu/library/databases/ppt/Androidapps.ppt
5. www.infosys.com/flypp/resources/Documents/mobile-application-testing.pdf

		SEMESTER V
22BTAD5E04	**BUSINESS 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 learn the BI infrastructure components.
- To understand the need for data integration.
- To identify the goal and primary task of multi dimensional modelling.
- To know in detail about the enterprise reporting.
- Critically evaluate use of BI for supporting decision making in an organisation.
- To study the metrics for business applications.

COURSE OUTCOMES:

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

- Identify the components of BI,data integration and enterprise reporting.
- Explain about data integration using SSIS and perform multi dimensional modelling.
- Analyze scorecard and dashboard.
- Discuss snoflwake schema in a business scenario
- Demonstrate enterprise report using SSRS in real time business scenario.
- Design the technological architecture that underpins BI systems

UNIT I   **9**

Introduction to OLTP and OLAP – BI definitions and concepts – Business applications of BI – BI framework – Role of data warehousing in BI– BI infrastructure components – BI Process – BI technology–BI roles and responsibilities.

UNT II   **9**

Concepts of data integration need and advantages of using data integration – Introduction to common data integration approaches – Introduction to ETL using SSIS – Introduction to data quality – Data profiling concepts and applications.

UNIT III   **9**

Introduction to data and dimension modelling – Multidimensional data model – ER modelling versus multidimensional modelling – Concepts of dimensions – Facts –Cubes – Attribute – Hierarchies – Star and snowflake schema – Introduction to business metrics and KPIs–Creating cubes using SSAS.

UNIT IV   9

Introductiontoenterprisereporting–Conceptsofdashboards–Balancedscorecards–Creatingdashboards – Scorecard vs. Dashboard.

UNIT V   9

Introduction to SSRS architecture – Enterprise reporting using SSRS – Case studies –Real time business scenarios – Identify the metrics – Indicators – Business goals.

TOTAL:45

TEXT BOOKS:
1. "Fundamentals of Business Analytics", Prasad P N and Seema Acharya, Wiley India, First Edition, 2011.

2. "Business Intelligence", David Loshin, Morgan Kaufmann Publishers, Second Edition, 2012.

REFERENCE BOOKS:
1. "The New Era of Enterprise Business Intelligence: Using Analytics to Achieve", Mike Biere, Prentice Hall, First Edition, 2011.
2. "Foundations of SQL Serve r2005 BusinessI ntelligence", Apress, First Edition, Lynn Langit, 2007.

WEBSITES:
1. www.learnbi.com
2. www.techrepublic.com
3. www.nepbusinessdirectory.com
4. www.cio.com/ Applications/BusinessIntelligence(BI)/Tutorial
5. www.assyst–international.com

	SEMESTER V

22BTAD5E05   **SPARK AND BIG DATA**   **3H-3C**

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

End Semester Exam: 3 Hours

PRE-REQUISITES: Database Management Systems and Data Structures

COURSE OBJECTIVES:

The goal of this course is for the students :
- To be familiar with big data batch and real time processing.
- To understand the basic object oriented and functional programming concepts in scala using interactive shell.
- To be aware of operations and functions of transformation and actions used in Resilient Distributed Dataset (RDDs).
- To explore and analyze the spark streaming data.
- To enhance knowledge in MLLibrary and GraphX library in spark.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:
- Explain the limitation of Map Reduce in hadoop, architecture of Apache Spark, execution model, programming model and streaming process in-memory computation.
- Apply the transformation and action functions on RDD to develop a SBT to work in both interactive and GUI environments.
- Discuss about real time stream data to extract using Spark SQL and visualize through Machine Learning and graphx library in spark.
- Define scala object oriented and functional programming.
- Demonstrate streaming data using advanced analytics libraries and visualize the data.
- Explain the characteristics of Big Data and its application

UNIT I   **9**

Introduction to big data and apache spark: Understanding big data – Batch processing – Real time processing – Hadoop architecture – Data processing hadoop – Spark architecture – Spark in hadoop ecosystems – Spark web UI.

UNIT II   **9**

Introduction: Scala for spark – Scala in other frameworks – Scala REPL – Variable types – Type inference – Lazy values – Control structures – Loop – Functions – Procedures. Collections: Array

– Array buffer – Maps – Tuples – Lists. Oops and functional programming in scala: Classes in scala – Getters and setters – Constructor – Singletons – Companion objects – Inheritance in Scala – Traits – Layered traits – Functional style programming in scala.

UNIT III   9

Spark common operations: Invoke spark shell, PySpark and SparkR – Basic spark operation – Analyze sparkcontext and spark properties – Build spark projects – Spark modes – Persistence in spark. Playing with RDD: RDD operation – Load and save data from RDD – RDD function – Transformation – Action – Analyze RDD functions – Advanced RDD operations - Integrating spark with hadoop.

UNIT IV   9

Spark steaming and MLLib: Spark streaming architecture – Run a spark steaming program – Transformation in spark steaming – Window operation in spark streaming – Checkpointing for fault tolerance – Machine Learning algorithms in spark

UNIT V   9

Concepts in ML – Steps in ML pipeline. SQL context and hive context in spark SQL – Dataframe in spark SQL – Data visualization in spark – Accumulators and broadcast variables – GraphX library in spark – Graph algorithms.

TOTAL: 45

TEXT BOOKS:

1. Muhammad Asif Abbasi," Learning Apache Spark 2", Packt Publishing, First Edition, 2017
2. Rezaul Karim Md and Sridhar Alla, "Scala and Spark for Big Data Analytics Explore the Concepts of Functional Programming, Data Streaming, and Machine Learning", Packt Publishing, First Edition, 2017

REFERENCE BOOKS:

1. Romeo Kienzler and Shuen Mei, "Apache Spark 2: Data Processing and Real-Time Analytics", Packt Publishing, First Edition, 2018
2. Pascal Bugnion, "Scala for Data Science", Packt Publishing, First Edition, 2016

WEBSITES:

1. www.scala-exercises.org/scala_tutorial
2. www.databricks.com/spark
3. www.nptel.ac.in/courses/106/105/106105186/
4. www.spark.apache.org/graphx/
5. www.udemy.com/course/apache-spark-with-scala-hands-on-with-big-data/

	SEMESTER V
22BTAD5E06 **ADVANCED JAVA PROGRAMMING**	**3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Java Programming

COURSE OBJECTIVES:
The goal of this course is for the students
- To learn the basic fundamental concepts of advanced java programming.
- To obtain an experience in implementing database connectivity in Java
- To learn about Junit in Java
- To gain knowledge about JDBC CRUD operations.
- To understand Lambda expressions and Streams in Java.

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Define the fundamental concepts of advanced java programming.
- Apply the knowledge of advanced Java programming concepts for developing applications.
- Explain advanced java programming concepts and to attain the appropriate conclusions.
- Demonstrate applications using threads and jdbc for the given specifications.
- Express junit and java8 features for a given problem statement.
- Illustrate in a team to build a console based applications with backend.

UNIT I   **9**
I/O Streams: Introduction to I/O-I/O operations – Streams – Byte streams – Character streams – Text input/output–Binary input/output–Random access file operations–Object serialization. Multithreading: Introduction to Multithreading–ProcessVsThread–Thread lifecycle–Thread class– Runnable interface – Thread creation – Thread control and Priorities – Inter thread communication –Thread synchronization.

UNIT II   **9**
JDBC: Introduction to JDBC – Establishing connection – Executing query and processing results – Performing CRUD operations – Prepared Statement and Meta Data objects – Callable Statement and Transactions.

UNIT III   **9**
JUnit: Introduction to JUnit – JUnit with Eclipse – Assert method and Annotations – Parameterized tests –Test suite–Test runner.

UNIT IV   **9**

Functional Interfaces – Predicates – Functions – Suppliers – Consumers – Lambda expressions – Accessing local and class variables – Function argument in lambda expression – Sorting – Predicates and lambda expressions.

UNIT V   **9**

Streams: Filter– Sorted–Map–Reduce – Count– Parallel Streams.

<div align="right">TOTAL:45</div>

TEXT BOOKS:
1. Herbert Schildt, "Java2:The CompleteReference", McGraw-Hill,Tenth Edition, 2017
2. Cay S Horstmannand Gary, Cornell," Core Java: Volume I –Fundamentals", Prentice Hall, Eleventh Edition, 2018
3. Raoul-Gabriel Urma, Mario Fusco and Alan Mycroft, "Java 8 in Action: Lambdas,Streams and Functional –Style Programming", Manning Publications, First Edition, 2015

REFERENCE BOOKS:
1. Petar Tahchiev,Felipe Leme and Vincent Massol, "JUnitin Action", Manning Publications,Second Edition, 2011
2. David Flanagan and Benjamin Evans, "Java in a Nutshell", O'Reilly Media, Seventh Edition, 2018

WEBSITES:
1. www.javatpoint.com/creating-thread
2. www.tutorialspoint.com/junit/index.htm
3. www.ntu.edu.sg/home/ehchua/programming/java/JDBC_Basic.html
4. www.docs.oracle.com/javase/tutorial/java/nutsandbolts
5. www.javatpoint.com/java-8-method-reference

		SEMESTER V
22BTAD5E07	**ENTERPRISE APPLICATION**	**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 describe the life cycle methodologies of enterprise application
- To study the business modeling and non-functional requirements
- To explore the enterprise architecture and data representations
- To learn the construction maps and code analysis concepts
- To evaluate the application using different testing methodologies

COURSE OUTCOMES:

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

- Explain the basic concepts enterprise applications related to software Engineering methodologies
- Apply the user requirements and design use case diagrams
- Explain about data and infrastructure architecture with example.
- Analyze the concept of code review with different categories of testing.
- Implement testing methodologies for real time applications.
- Apply Software engineering methodologies to sovle real time problems.

UNIT I   **9**

Introduction to enterprise applications and its types – Software engineering methodologies – Life cycleof raising enterprise applications – Key determinant of successful enterprise applications – Measuringthe success of enterprise applications.

UNIT II   **9**

Incepting enterprise applications: Enterprise analysis – Business modeling – Requirements elicitationand analysis – Requirements validation – Planning and estimation. Architecting and designingenterpriseapplications : Views and view points

UNIT III   **9**

Enterprise architecture – Logical architecture –Technical architecture – Data architecture and design – Infrastructure architecture and design –Documentation of application architecture and design.

UNIT IV 9

Construction readiness of enterprise applications – Introduction to software construction maps – Construction of solution layers – Methodologies of code review – Static code analysis – Build andtesting – Dynamic code analysis.

UNIT V 9

Testing: Types and methods of testing an enterprise application –Testing levels and approaches – Testing environments – Integration testing – System testing – Useracceptance testing – Rolling out enterprise applications.

TOTAL: 45

TEXT BOOKS:
1. Anubhav Pradhan, Satheesh B,Nanjappa Senthil K Nallasamy and Veerakumar Esakimuthu, "Raising, Enterprise Applications: A Software Engineering Perspective", John Wiley,First Edition, 2010
2. Soren Lauesen, "Software Requirements: Styles and Techniques", Addison Wesley,First Edition, 2002
3. Brian Berenbac, Daniel J Paulish, Juergen Kazmeier and Arnold Rudorfer, "Software Systems Requirements Engineering: In Practice", Tata McGraw Hill,First Edition, 2009
4. Naresh Chauhan, "Software Testing Principles and Practices", Oxford University Press,First Edition, 2010
5. Vasudeva Varma, "Software Architecture: A Case Based Approach", Pearson Education, First Edition, 2009

WEBSITES :
1. www.java.sun.com/blueprints/guidelines/designing_enterprise_applications_2e/
2. www.brahms.st.informatik.tu-darmstadt.de/ead12
3. www.cis.ait.asia/course_offerings/49/lecture_notes
4. www.cs.colorado.edu/~kena/classes/7818/f06/lectures/05
5. www.softwaretestingmentor.com/types-of-testing/globalization-testing/

SEMESTER V

22BTAD5E08   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

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES:
The goal of this course is for the students
- To understand of the basic principles of service orientation.
- To understand service oriented analysis techniques.
- To understand SOA approach and patterns for e-business.
- To learn the concepts service composition, orchestration and choreography.
- To understand various web services specification standards.

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explain the concepts of service orientation and its architecture.
- Apply service orientation for business and web services.
- Analyze the business scenario in e-business and various web services specification standards.
- Discuss about service orientation applications with given specification.
- Discuss service oriented analysis and design.
- Define main components of Web services architectures.

UNIT I   **9**
Principles of service orientation – Client-server architecture – Distributed internet architecture – SOA characteristics – Anatomy of SOA – Components – Interaction – Technical and business benefits –Multi-channel access – Business process management – Web services – Service descriptions –Messaging with SOAP – Message exchange patterns.

UNIT II   **9**
Service oriented architecture – Overview of SOA architecture – Characteristics of SOA, Comparing SOA with client-server and distributed architectures – Benefits of SOA – Service layers – Web services architecture – Enterprise service bus – Service oriented architecture approach – SOA approach and patterns for e-business.

UNIT III   9
Business scenario: Supply chain management – Steps of SOA approach –Technology options –
Transport – Service communication protocol – Service description.

UNIT IV   9
Web services – Service descriptions – WSDL – Messaging with SOAP – Service discovery –
UDDI –Message exchange patterns – Orchestration – Choreography – WS transactions – Building
SOA – Based applications

UNIT V   9
Service oriented analysis and design – Service modeling – Design standards and guidelines –
Composition – WS-BPEL – WS-coordination – WS-policy – WS-security – SOA support in J2EE.

TOTAL: 45

TEXT BOOKS:
1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology and Design, Pearson"
   Education, Second Edition, 2008
2. Mark Endrel, JennyAng and All Arsanjani, "Patterns: Service-Oriented architecture and
   web services", International Business Machines Corporation, First Edition, 2004

REFERENCE BOOKS:
1. Frank P Coyle, XML, "Web Services and the Data Revolution", Pearson Education, Second
   Edition, 2002
2. Ron Schmelzer, "Understanding SOA with Web Services", Pearson Education, Second
   Edition, 2009
3. Eric Newcomer and Greg Lomow, "Understanding SOA with Web Services", Pearson
   Education, Second Edition, 2009
4. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An
   Architect's Guide", Prentice Hall, Second Edition, 2004

WEBSITES:
1. ww.serviceorientation.com/serviceorientation/the_service_orientation_design_paradigm.
2. www.xmlfiles.com/xml/xml-intro/
3. www.service-architecture.com/articles/web-services/
4. www.guru99.com/wsdl-web-services-description-language.html
5. www.docs.jboss.org/savara/releases/2.0.x/gettingstartedguide/html/sid-3735782.html

SEMESTER V
22BTAD5E09   OPEN SOURCE TECHNOLOGIES   **3H-3C**

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

PRE-REQUISITES: Basics of Database Management Systems and Operating Systems

COURSE OBJECTIVES:
The goal of this course is for the students
- To introduce technological, social and pragmatic aspects of developing open source software.
- To understand information about free and open source software projects from software
- releases.
- To understand how to use a version control system and to interface with version control systems used by development communities.
- To provide an exposure to open source Django.
- To understand the concepts of apache web server.

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explain the basics of open sources, open source database, PHP and Django.
- Apply the tools, techniques and strategies of open source technologies.
- Demonstrate various open source hardware and open source web server.
- Describe an application using Django.
- Apply real time applications using open source technologies
- Explain free open source software environment and apply in real world problems.

UNIT I   **9**
Introduction to open sources – Need to open sources – Advantages of open sources – Application of open sources. LINUX : Introduction – General overview – Kernel mode and user mode – Process –Advanced concepts – Scheduling – Scheduling multiprocessor systems – Personalities – Cloning –Signals – Development with Linux.

UNIT II   **9**
Introduction to open source database: Introduction to MySQL – Setting up account – Starting, stopping the MySQL server – Data and time – Sorting query – Database metadata – Creating and using database– Creating and selecting database.

UNIT III 9

PHP: Introduction – Variables – Constants – Data types – Operators– Statements – Functions – Arrays – Object Oriented Concepts – PHP classes and objects – String Manipulation and regular expression – File handling and data storage – Error handling – Secure e-mail– PHP and SQL database – PHP and LDAP – Connectivity. Sending and receiving e-mails –Debugging and Security – Templates.

UNIT IV 9

Django: Introduction to Django – Templates – Models – Forms – Deploying django – Caching – Integrating with legacy databases and applications – Security. Open Source Hardware: Raspberry pi –Arduino – Building embedded applications with raspberry pi and arduino – Open source 3-D printing.

UNIT V 9

Web server: Apache web server – Working with web server configuring and using MDA – Introduction to MDA – Meta object facility – UML and UML Profiles – MDA applications – Apache web services.

TOTAL: 45

TEXT BOOK:
1. Sampathkumar K S, "Understanding FOSS, GNU Developers",Fourth Edition, 2011

REFERENCE BOOKS:
1. Matt Welsh,Matthias Kalle Daileimer,Terry Dawson andLar Kaufman, "Running Linux", O'Reilly,Fourth Edition, 2006
2. Carla Schroder, "Linux Cookbook", O'Reilly,First Edition, 2004

WEBSITES:
1. www.oreilly.com/catalog/opensources/book/toc.html
2. www.dsl.org/cookbook/cookbook_toc.html
3. www.tldp.org/guides.html
4. www.network– theory.co.uk/docs/gcontrol
5. www.sources.redhat.com/autobook

22BTAD5E10   **CYBER FORENSICS**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES:
The goal of this course is for the students
   • To understand about computer forensics and investigations.
   • To know about digital evidence and crime.
   • To analyze and validate forensics data.
   • To know about e-mail investigation.
   • To understand about Mobile device forensics.

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
   • Define various investigation procedures and summarize duplication of digital evidence.
   • Apply the knowledge of digital evidences.
   • Discuss various forensics tools and analyze the network forensics.
   • Demonstrate the systematic study of high-tech forensics
   • Explain the importance of reports.
   • Demonstrate the tools and tactics associated with Cyber Forensics.

UNIT I   **9**
Computer forensics and investigations as a profession – Preparing for computer investigations –
Taking a systematic approach–Procedures for corporate high-tech investigations–Data recovery
work stations and software– Conducting an investigation.

UNIT II   **9**
Data acquisition – Storage formats for digital evidence – Validating data acquisitions –
Processing crime and incident scenes–Identifying digital evidence–Collecting evidence in private-
sector incident scenes – Preparing for a search-seizing digital evidence at the scene-storing digital
evidence –Reviewing a case.

UNIT III   **9**
Current computer forensics tools–Software tools–Hardware tools–The macintosh file structure
and boot process – Computer forensics analysis and validation – Addressing data –Hiding
techniques.

UNIT IV   **9**

Virtual machines – Network forensics – Developing standard procedures – Live acquisitions – e-mail investigations – Investigating e-mail crimes and violations – Understanding e-mail servers – Cell phone and mobile device forensics

UNIT V   **9**

Understanding mobile device forensics – Acquisition procedures –Report writing for high-tech investigations – Importance of reports – Guidelines for writing reports –Expert testimony in high-tech investigations.

                                                                     TOTAL:45

TEXT BOOK:

1.Bill Nelson, Amelia Phillips and Christopher Steuart,"Computer Forensics and Investigations",Cengage Learning,Fifth Edition,2016

REFERENCE BOOKS:

1. Eoghan Casey, "Handbook of Digital Forensics and Investigation", Academic Press,FirstEdition,2010
2. John R Vacca, "Computer Forensics", CengageLearning, Second Edition,2005

WEBSITES:

1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
2. www.forensicsguru.com/devicedataextractionsimcell.php
3. www.nptel.ac.in/courses/106101060
4. www.samsclass.info/121/ppt/ch11.ppt
5. www.garykessler.net/library/role_of_computer_forensics.html
6. www.ukessays.com/essays/information-technology/computer-forensics- and-crime-investigations-information-technology-essay.php

SEMESTER V

22BTAD5E11   **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

PRE-REQUISITES: Fundamental of Computers

COURSE OBJECTIVES:

The goal of this course is for the students
- To understand the basic concepts of Human Computer Interaction.
- To understand HCI in software process.
- To be aware of implementation and evaluation techniques.
- To be familiar with HCI implications for designing multimedia/ecommerce/e learning Websites.
- To understand the guidelines for user interface.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:
- Define the concepts of computer interaction with web interactions and life cycle models.
- Explain the Software life cycle.
- Apply the implications for designing multimedia/ecommerce/e-learning websites.
- List the stake holder requirements and collaboration models
- Demonstrate web interface with the given specification.
- Explain about tools and techniques for interface analysis, design, and evaluation.

UNIT I   **9**

The Human: I/O channels – Human memory – Reasoning and problem solving. The computer: Text entry devices – Positioning, pointing and drawing – Display devices – Memory – processing and networks; Interaction: Models of interactions–Frameworks–Ergonomics–Interactionstyles–Elementsofthe WIMP interface–Interactivity–Paradigms.

UNIT II   **9**

Interactive Design basics – Process of design – Scenarios – Navigation design – Screen design and layout–Iteration and prototyping.HCI in software process: Software life cycle–Usability engineering- Prototyping in practice

UNIT III   **9**

Design rationale. Design rules principles, standards, guidelines, golden rules and heuristics. Implementation support: Elements of windowing systems–Programming the application–Using Toolkits–User interface management systems–Evaluation Techniques–Universal Design.

UNIT IV   **9**

Cognitive models – Socio Organizational issues and stake holder requirements – Communication and collaboration models–Task analysis–Hypertext, Multimedia and WWW

UNIT V   **9**

Designing Web Interfaces –Drag and Drop –Direct Selection –Contextual Tools–Overlays –Inlays and Virtual Pages–Process flow. Case Studies.

                                                         TOTAL:45

TEXT BOOKS:

1. AlanDix,Janet Finlay Gregory Abowd and Russell Beale, "Human Computer Interaction", Pearson Education, Third Edition,2009
2. Bill Scottand Theresa Neil,Designing Web Interfaces,O'Reilly MediaInc.First Edition,2009

REFERENCE BOOKS:

1. Dan R Olsen, "Human–Computer Interaction", Cengage Learning,Firste dition,2010
2. Andrew Sears and Julie A Jacko, "The Hand book of Formal Methods in Human-Computer Interaction", Lawrence Erlbaum Associates, Second Edition,2017

WEBSITES:

1. www.hcibook.com/e3/plain/resources/
2. www.ebook-dl.com/item/designing_web_interfaces_bill_scott_theresa_neil

	SEMESTER V
22BTAD5E12 **AGILE METHODOLOGIES**	**3H-3C**

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

End Semester Exam: 3 Hours

PRE-REQUISITES: Software Engineering

COURSE OBJECTIVES:

The goal of this course is for the students
- To understand agile methods and roles.
- To understand the XP lifecycle processing.
- To learn different types of planning and development methodology.
- To be familiarized with development environment.
- To gain knowledge on delivery and cyclicality.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:
- Explain the agile software development and XP concepts.
- Outline leasing, planning and development phases of XP.
- Explian about globalization, reflection, change and leadership phases.
- Discuss Agile approach in global software development.
- Apply Agile software development Change process.
- Demonstrate   Project Management process for planning and management

UNIT I   **9**

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

UNIT II   **9**

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

UNIT III   **9**

Version control–Ten minute build, Collective code ownership, Documentation–Planning: Vision, Release Planning–Risk management–Estimating, Developing : Incremental requirements–Customer tests–Refactoring–Incremental design and architecture.

UNIT IV 9

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

UNIT V 9

Agile software development. Change: Transition to an Agile software development environment – Organizational changes. Leadership: Styles – The Agile change leader. Delivery and cyclicality: Reflective session between releases.

TOTAL:45

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

REFERENCE BOOKS:
1.Orit Hazzan Yael Dubinsky, Agile Software Engineering, Springer International, Second Edition,2014
2.James Shore and Shane Warden, The Art of Agile Development, O`REILLY, First Edition,2013

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

SEMESTER V

22BTAD5E13   WEB APPLICATION DEVELOPMENT USING JAVA   3H-3C

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

End Semester Exam:3 Hours

PRE–REQUISITES: Advanced Java Programming
COURSE OBJECTIVES:

The goal of this course is for the students

- To learn the basic fundamental concepts of web application development using java.
- To understand the concepts of Bootstrap and XML.
- To gain knowledge on Servlets and JSP for creating application.
- To learn concepts of Object Relational Mapping for developing web application.
- To understand the concepts of Servlet and JSP with ORM in web applications.

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

- Explain the concepts of web application development using Java.
- Apply the knowledge of front end and bake end technologies for developing web applications.
- Demonstrate the usage of web application development concepts and to attain the appropriate conclusions.
- Express an application using HTML, javascript and XML for given specifications.
- Explain about integrating Servlet and JSP with ORM for a given application / problem statement.
- Discover Web -based application and obtain a solution.

UNIT I   **9**
HTML – Introduction to HTML and its elements – Layout tags – Semantic tags – Application tags –Logical tags. Introduction to HTML5. CSS: Introduction to CSS – Styles and style sheets – Formatting with CSS – Links and lists – CSS box model – CSS3. Bootstrap: Introduction to bootstrap – Formatting and styling using bootstrap – Bootstrap grid system.

UNIT II   **9**
JavaScript: Introduction to javascript – Javascript functions and objects – Javascript validations – Regular expression. XML: Introduction to XML – XML DTD – XML schema.

UNIT III   **9**
Servlets – Introductionto servlets – Get and post requests – Servlet API and lifecycle – Servlet request and response interfaces– Httpservlet – Requestdispatcher – Httpsession – Cookies and session management – Servlet databaseinteraction.

UNIT IV   **9**

JSP: Introduction to JSP – JSP API – Scripting elements – Directive elements – Action elements – implicit objects – Java beans in JSP – Cookies and session management. Object/Relational mapping –Approaches to ORM

UNIT V   **9**

Introduction to hibernate – Hibernate API – Working with objects – Hibernate 3with annotations – Querying in hibernate – Hibernate Query Language (HQL) –Criteria queries –Create queries with native SQL – Basic O/R mapping – Collection mapping – Association mappings –Inheritance mapping – Develop a web application using hibernate.

TOTAL: 45

TEXT BOOKS:
1. Paul Deitel, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web – How to program", Pearson Education, Fifth Edition, 2018
2. Sharanam Shah and Vaishali Shah, "Java EE 6 for Beginners", Shroff Publishers, First Edition, 2011

REFERENCE BOOKS:
1. Santosh Kumar K, "Spring and Hibernate", Tata McGraw-Hill,Second Edition2013
2.Joel Murach andMichael Urban, "Java Servlets and JSP", Pearson Education,Third Edition, 2014
3. Budi Kurniawan, "Servlet and JSP: ATutorial", Brainy Software,Second Edition, 2015

WEBSITES:
1. www.w3schools.com/html/html_css.asp
2. www.w3schools.com/xml/default.asp
3. www.tutorialspoint.com/servlets/
4. www.oracle.com/technetwork/java/javaee/jsp/index.html
5. www.javatpoint.com/hibernate-tutorial

SEMESTER V
22BTAD5E14   WEB APPLICATION DEVELOPMENT USING PYTHON   3H-3C

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

PRE-REQUISITES: Advanced Python Programming

COURSE OBJECTIVES:

The goal of this course is for the students
- To learn the basic fundamental concepts of web application development using python.
- To understand the concepts of Bootstrap and XML.
- To gain knowledge on Flask and Jinja2 template.
- To learn concepts of Object Relational Mapping using SQL Alchemy.
- TounderstandtheconceptsofFlaskSQLAlchemyfordevelopingwebapplications.

COURSE OUTCOMES:

Upon completion of this course the students will be able to:
- Explain the fundamental concepts of web application development using python.
- Apply the knowledge of python for developing basic web applications.
- Explain web application using python and to attain the appropriate conclusions.
- Illustrate useage of html, javascript and xml for given specifications.
- Demonstrate web application using flask sql alchemy.
- Discover web-based application.

UNIT I   **9**
HTML: Introduction to HTML and its elements – Layout tags – Semantic tags – Application tags –
Logical tags – Introduction to HTML5. CSS: Introduction to CSS – Styles and style sheets –
Formatting with CSS – Links and lists – CSS box model – CSS3. Bootstrap: Introduction to
bootstrap – Formatting and styling using bootstrap – Bootstrap grid system.

UNIT II   **9**
JavaScript: Introduction to javascript – Javascript functions and objects – Javascript validations –
Regular expression. XML: Introduction to XML – XML DTD – XML schema. Flask – Application
configuration – HTTP methods – Status code

UNIT III   **9**
Routing – Form handling – Request handling – JSON response – Session – Cookie – Templates –
Jinja2 – Variable – Filters – Macro – Comments – Escaping – Template inheritance – HTML
escaping – Expressions and control structures – Error handling.

UNIT IV **9**

SQL Alchemy: Introduction – Connection – Mapping – Declare mapping – Schema – Creating session– Adding and updating objects – Commit and rollback – Query API – Association mapping– Mapping inheritance.

UNIT V **9**

Flask SQL Alchemy: Introduction – Configuring flask application with SQL Alchemy – Mapping relationship – Mapping inheritance – CRUD operations.

TOTAL:45

TEXT BOOKS:

    1.Paul Deitel,Harvey Deitel and Abbey Deitel, "Internet and World Wide Web – How to program", Pearson Education, Fifth Edition, 2018

    2.Miguel Grinberg, "Flask Web Development", O'Reilly Media,Second Edition, 2018

    3.Rick Copeland, "Essential Sqlalchemy: Mapping Python toDatabases", O'Reilly,Second Edition, 2016

REFERENCE BOOKS:

    1.Dwyer Gareth, "Flask By Example", Packt Publishing,First Edition, 2016

    2.Ron DuPlain, "Instant Flask WebDevelopment", Packt Publishing,First Edition, 2013

WEBSITES:

    1. www.w3schools.com/html/html_css.asp
    2. www.w3schools.com/xml/default.asp
    3. www.docs.sqlalchemy.org/en/latest/orm/tutorial.html
    4. www.flask.pocoo.org/docs/1.0/
    5. www.flask-sqlalchemy.pocoo.org/2.3/

SEMESTER V

22BTAD5E15   **DEVOPS IN JAVA**   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Web Application Development Using Java

COURSE OBJECTIVES:
The goal of this course is for the students:

- To learn DevOps tools, technologies for MVC based web application.
- To understand the steps of Continuous Integration for web application.
- To learn about automated testing in Jenkins environment.
- To gain knowledge in configuration management for web applications.
- To introduce continuous deployment to test and deploy web applications.

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

- Explain the concepts of devops lifecycle for MVC application.
- Apply the knowledge of devops tools for web application deployment
- Explain the usage of devops for Java application.
- Demonstrate MVC application using frameworks.
- Explain to deploy web application using devops tools.
- Demonstrate a web-based applications using DevOps tools.

UNIT I   **9**
DevOps basics: Understanding DevOps movement–DevOps lifecycle–DevOps tools and technologies. Web application framework: Overview – Architecture – Components – Configuration –Model–View–Controller– Developing MVC applications–Integrating ORM.

UNIT II   **9**
Git: Version Control–Repository –Git workflow –Git commands –init, push, pull, commit, clone and log. Continuous integration: Introduction–Installing jenkins–Configuring jenkin sserver–Setting up build jobs

UNIT III   **9**
Understanding projects in java and moving to Jenkins – Creating built-in delivery pipelines – Building pipeline plugin – Deploying a WAR file. Automated Testing: Automating unit tests – Configuring test reports–Code quality and reporting.

UNIT IV   **9**

Configuration management: Getting started with chef – Overview of hosted chef – Installing and configuring the workstation–Converging the node using the workstation. Docker container, Understanding difference between virtual machines and containers.

UNIT V   **9**

Installing and configuring docker, Creating a first docker container – Managing containers. Continuous deployment: Implementing automated and continuous deployment– Deploying a webapplication.

TOTAL:45

TEXT BOOKS:
1. Mitesh Soni, "DevOps for Web Development", Packt Publishing, First Edition, 2016
2. Randy Connolly and Ricardo Hoar, "Fundamentals of WebDevelopment", Pearson Edition,Second Edition, 2018
3. Santosh Kumar K, "Spring and Hibernate", McGraw-Hill, Second Edition, 2013
4. John Fergusan,"SmartJenkins – The definitive guide: ContinuousIntegration for the Masses", O'Reilly, First Edition, 2011

REFERENCE BOOKS:
1. Nikhil Pathania, "Learning Continuous Integration with Jenkins", Packt Publishing,First Edition, 2016.
2. Christophe Vanfleteren,Colin Yates, Marten Deinum and Seth Ladd, "Pro Spring MVC: WithWeb Flow", Apress, First Edition, 2012.

WEBSITES:
1. www.docs.spring.io/spring/docs/3.2.x/spring-framework-reference/html/mvc.html
2. www./jenkins.io/doc/
3. www.tutorialspoint.com/jenkins/jenkins_automated_testing.html
4. www.docs.chef.io/chef_overview.html
5. www.devops.com/continuous-delivery-vs-continuous-deployment/

SEMESTER V

22BTAD5E16   **DEVOPS IN PYTHON**   **3H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Web Application Development Using Python

COURSE OBJECTIVES:

The goal of this course is for the students:

- To learn DevOps tools, technologies for MVC based web application.
- To understand the steps of Continuous Integration for web application.
- To learn about automated testing in Jenkins environment.
- To gain knowledge in configuration management for web applications.
- To introduce continuous deployment to test and deploy web applications.

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

- Explain the concepts of devops lifecycle for MVC application.
- Apply the knowledge of devops tools for web application deployment
- Explain the usage of devops for Java application.
- Demonstrate MVC application using frameworks.
- Explain to deploy web application using devops tools.
- Demonstrate a web-based applications using DevOps tools.

UNIT I   **9**
DevOpsbasics:Understanding DevOps movement– DevOps lifecycle–DevOps tools and technologies. Web application framework: Overview – Architecture – Components – Configuration –Model–View–Controller– Developing MVC applications–Integrating ORM.

UNIT II   **9**
Git: Version Control–Repository –Gitwork flow –Git commands –init, push, pull, commit, clone and log.Continuous integration: Introduction–Installing jenkins–Configuring Jenkins server– Setting up build jobs

UNIT III   **9**
Understanding projects in python and moving to Jenkins – Creating built-in delivery pipelines – Building pipeline plugin – Deploying a WAR file. Automated Testing: Automating unit tests – Configuring test reports–Code quality and reporting.

UNIT IV   **9**

Configuration management: Getting started with chef – Overview of hosted chef – Installing and configuring the workstation–Converging the node using chef workstation. Docker container, Understanding difference between virtual machines and containers.

UNIT V   **9**

Installing and configuring Docker, Creating a first docker container – Managing containers. Continuous deployment: Implementing automated and continuous deployment– Deploying a web application.

TOTAL:45

TEXT BOOKS:

1. Mitesh Soni, "DevOps for Web Development", Packt Publishing, First Edition,2016
2. Adrian Holovatyand Jacob K. Moss, "The Definitive Guide to Django:Web Development Done Right", Apress,Second Edition, 2013
3. John Fergusan,"SmartJenkins – The definitive guide:Continuous Integration for the Masses, O'Reilly, First Edition, 2011
4. Mischa Taylor andSeth Vargo, "Learning Chef", O'Reilly,First Edition, 2014
5. Adrian Mouat, "Using Docker: Developing andDeploying Software with Containers", O'Reilly,First Edition, 2014

REFERENCE BOOKS:

1.Nikhil Pathania, "Learning Continuous Integration with Jenkins", Packt Publishing,First Edition, 2016.
2.Arun Ravindran, "Django Design Patterns and Best Practices", Packt Publishing,   Second Edition, 2018
3. Matthias Marschall, "Chef Infrastructure Automation Cook book", Packt Publishing,Second Edition, 2015

WEBSITES:

1.www.docs.djangoproject.com/en/2.1/
2. www./jenkins.io/doc/
3. www.tutorialspoint.com/jenkins/jenkins_automated_testing.html
4. www.docs.chef.io/chef_overview.html
5. www.devops.com/continuous-delivery-vs-continuous-deployment/

		SEMESTER VI
22BTAD6E01	**INTERNET OF THINGS**	**3H-3C**

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

                                                                    End Semester Exam:3 Hours

PRE–REQUISITES: Nil
COURSE OBJECTIVES:
The goal of this course is for the students:
- To introduce various design aspects of IoT, its communication models and its general
- architecture.
- To study the fundamentals of various sensors and its applications.
- To study the various wireless communication technologies used in IoT.
- To know the need of Data analytics and Cloud computing for IoT.
- To familiarize with security requirements and different smart use cases of IoT.

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explainthe characteristics of IOT, various layers of its architecture, communications
- Models, the types of sensors,various IOT enabling technologies and its security features.
- Apply the acquired knowledge of sensors, various communication technologies, cloud and Data analytics in real life applications.
- Identify the given specification and choose the appropriate sensors, communication Technology and an IOT platform to meet the same.
- Explain fog computing paradigm
- Apply the acquired knowledge in Emerging field of IoTdata analytics.

UNIT I   **9**
Definition of IoT – Characteristics of IoT – Physical design of IoT – Logical design of IoT –
Communication models and APIs – IoT enabling technologies – General architecture of IoT –
Difference between M2M and IoT – Business Scope.

UNIT II   **9**
Sensing and actuation – Sensor fundamentals – Sensor characteristics. Overview of various
sensors:Temperature – Pressure – Humidity – Flow – Acceleration – Position – Motion – Vibration
– Gassensors. Introduction to smart sensors. – Actuators: Relay – Solenoid – DC motors – Stepper
motors –Servo motors

UNIT III   **9**

IoT Communication: Device to Device – Device to gateway and gateway to cloud –RFID – NFC –
QR – WPAN – Wi–Fi – LPWA – Cellular – LTE–M – Sensor node and Introduction toWSN –
Typical IoT network

UNIT IV   **9**

Enablement platform for IoT applications and analytics – Next generation Clouds for
IoTapplicationsand analytics – Emerging field of IoTdata analytics

UNIT V   **9**

 Expounding the Edge / Fog Computing paradigm– Security management of an IoTecosystem –
Smart use cases of IoT.

                                                                                               TOTAL: 45

TEXT BOOKS:
1. Arshdeep Bahgaand Vijay Madisetti, Internet of things, University Press,Second Edition, 2015
2. Pethuru Raj and Anupama C Raman, The Internet of Things:Enabling Technologies, Platforms, and UseCases, CRC Press, First Edition, 2017

REFERENCE BOOKS:
1. Oliver Hersent,DavidBoswarthichkandOmarElloumi, The internet of things – Key applications and Protocols, John Wiley, First Edition, 2012
2. Lyla B Das, Embedded Systems, Pearson Education,2013
3. Dieter Uckelmann, Mark Harrison and Florian Michahelles, Architecting the InternetofThings,Springerpublications, 2011
4. Marco Schwatrz, Internet of Things withArduino Cookbook, PacktPublications,First Edition, 2016

WEBSITES:
1. www.onlinecourses.nptel.ac.in/noc17_cs22/preview.
2. www.csc2.ncsu.edu/faculty/mpsingh/tutorials/IoT/
3. www.codeproject.com/Learn/IoT/
4. www.tutorialspoint.com/internet_of_things/index.htm
5. www.favoriot.com/blog

SEMESTER VI

22BTAD6E02 ADVANCED PYTHON PROGRAMMING **3H-3C**

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

PRE-REQUISITES: Knowledge of Python scripts using basic data types, program structures, and the standard Python library.

COURSE OBJECTIVES:
The goal of this course is for the students:
- To learn the basic fundamental concepts of advanced python programming.
- To be comfortable using the collections API and Decorators in Python.
- To learn about Unit Test module and creating test case in Python
- To gain knowledge about JDBC CRUD operations and database exception handling in Python.
- To apply how to handle modules concepts in Python

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explain the concepts of advanced python programming.
- Apply the knowledge of advanced python programming concepts to for developing applications.
- Explain advanced python programming concepts and to attain the appropriate conclusions.
- Demonstrate application using files, thread and oracle module.
- Explain about py unit, collections and built-in modules for a given problem statement
- Demonstrate a console based application with backend.

UNIT I **9**
File I/O – Text files – File modes – Reading and writing files – Object serialization. Multithreading: Introduction to multithreading – Process Vs Thread – Thread life cycle – The threading module –Thread class – Thread creation – Thread control – Thread synchronization – Multithreaded priority queue.

UNIT II   **9**

Python database connectivity: About cx-oracle package – Creating and closing database connection –Creating and closing cursor – Executing DDL and DML – Commit, rollback and save point –Data binding in query string–Calling functions and procedures– Handling database errors.

UNIT III   **9**

PyUnit:Introduction to unittest module – Test fixtures – Test Case – Assert functions – Skipping and Ignoringtestcase –Testsuite–Testrunner.

UNIT IV   **9**

Python Collections API: OrderedDict – Defaultdict – Counter – Namedtuple – Deque. Decorators:Simple function decorators – Classes as Decorators – Chained Decorators – Decorator arguments.

UNIT V   **9**

Python Modules: Random module – Math and time modules – re module – Using match and searchfunctions–Working withmatchobjects–Other re modulefunctions.

TOTAL:45

TEXT BOOKS:
1.” Think Python:How to Think Like a ComputerS cientist”,AllenB.Downey, O’Reilly,Second Edition, 2016.
2.”An Introduction to Python Revised and updated for Python3.x”, Guido van Rossumand FredL. Drake Jr,Network Theory,First Edition, 2011.

REFERENCE BOOKS:
1.” LearningPython”, Mark Lutz, O’ReillyMedia,Fifth Edition, 2013
2.” Programming in Python3”, Mark Summerfield, Pearson Education ,Second Edition, 2018
3.”The Python3 Standard Library by Example”, DougHellmann, Pearson Education,Second Edition, 2018

WEBSITES :
1. www.docs.python.org/3.5/
2. www.programiz.com/python-programming
3. www.pythonspot.com/
4. www.tutorialedge.net/python/pyunit
5. www.pythonforbeginners.com/api/list-of-python-apis

SEMESTER VI

22BTAD6E03   ADVANCED DATABASE MANAGEMENT SYSTEMS   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the student is:
- Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
- Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.
- Identify advance database concepts and database models. Apply and analyze various terms related to transaction management in centralized and distributed database.
- Produce data modeling and database development process for object –oriented DBMS.
- Analyze and Implement the concept of object- relational database in development of various real time software.
- Examine the issues related to multimedia and mobile database performance.

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Apply query evaluation techniques and query optimization techniques.
- Explain transaction processing systems with concurrency control.
- Discuss about CRUD application.
- Identify physical database design and implementation issues
- Use the persistence framework of a chosen language to perform Object Relational Mapping
- Analyse emerging technologies such as Big Data, NoSQL, On-Line Analytical Processing (OLAP) and Data Warehouses

UNIT I   9
HBase: Introduction to HBase – HBaseVs RDBMS – HBase Components – HBase Architecture – HBase Cluster deployment – HBase Data model – HBase Shell – HBase Client API – Data loading techniques – Zookeeper Data model – Zookeeper Service – Demos on Bulk loading – Getting and Inserting data – Filters in HBase. MangoDB: Basics of Database – Database categories: NoSQL – Benefits over RDBMS – Types of NoSQL – NoSQLVs SQL – ACID properties – CAP theorem – Collection – Documents and Key/Values – JSON and BSON documents.

UNIT – II 9
Schema design and data modelling: Data modelling – Data modelling approach – RDBMS and MongoDB data model – Data model patterns – Relationships between documents – Model tree structures – Model specific application contexts. MongoDB development architecture – MongoDB Production architecture.MongoDB

UNIT III 9
CRUD introduction: MongoDB CRUD – Read and write operations – Concern levels – Journaling – Cursor query optimizations – Query behavior in MongoDB– Distributed read and write Queries – MongoDB datatypes – MongoDB CRUD syntax and queries. Indexing and aggregation framework: Index concepts – Index types – Index properties – Index creation and indexing reference. Aggregation – Approach to aggregation – Types of aggregation: Pipeline – MapReduce and single purpose – Performance tuning.

UNIT IV 9
Introduction to graph databases and Neo4j: Graph – Graph processing space – Graph databases – Graph processing engines – Advantages of graph databases – RDBMS for connected data – Common NoSQL databases for connected data.

UNIT V 9
Graph database natural playground – Graph database use cases and recommendations – Social and ACLs. Neo4j – Graph data Neo4j Vs RDBMS – Neo4j in NoSQL world – Data modelling in Neo4j.

TOTAL: 45

TEXT BOOKS:
1. Luc Perkins, Eric Redmond and Jim R Wilson, Seven Databases in Sevan Weeks, Pragmatic Bookshelf, First Edition,2018
2. Lars GeorgeHBase,The DefinitiveGuideOreilly,FirstEdition,2017

REFERENCE BOOKS:
1. Shannon Bradshaw and Kristina ChodorowMongoDB: TheDefinitive Guide Oreilly, First Edition, 2019
2. Amy Hodler and Mark Needham Graph AlgorithmsOreilly, First Edition, 2019

WEBSITES:
1. www.guru99.com
2. www.mongodb.com
3. www.neo4j.com
4. www.orientdb.com/graph-database
5. www.hbase.apache.org

SEMESTER VI

22BTAD6E04   **ETHICS FOR AI ENGINEERS**   **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 study the basic ethical and moral strategies relevant to Artificial Intelligence field.
- To understand the code of ethics applicable for AI projects.
- To learn the challenges and vulnerabilities in AI that arise out of ethical deliberations.
- To obtain the knowledge of social and cultural impact in building ethical AI.
- To explore the responsibilities of AI engineer and the repercussion in the society.

COURSE OUTCOMES:

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

- Explain the ethical theories and moral strategies required in AI environment.
- Apply code of ethics to AI innovations and evaluate the impact of ethical guidelines.
- Demonstrate the ethical status of AI and obligations of AI Engineers in the society.
- Explain about Universalism and Relativism.
- Discuss Ethical responsibilities of AI engineers.
- Relate the code of ethics to social experimentation.

UNIT I   **9**

Introduction to Artificial Intelligence and ethics – Current initiatives – The challenges in developing ethical principles for artificial intelligence – Epistemic strategies, technological strategies, Moral strategies – Normative ethical theories – Ethics and empirical evidence – Four domains of –Ethics Justification and argument – Moral justification and AI – Moral agents – AI and codes of ethics –Distinctive ethical questions raised by AI – Hype in AI and implications for methodology in ethics.

UNIT II   **9**

Codes of professional ethics – Varieties of ethical codes and commonalities – AI challenging the spectrum of professional ethics – AI Professional organizations and its development

UNIT III   **9**

Gradients of professional power and vulnerability in AI – Complexity in codes-Social, cultural and technological change and ethics – AI and employment – Global reach of AI, Universalism and

Relativism.

UNIT IV 9

Pitfalls in considering the ethics of AI – Idealization of human and machine agency – Building ethics in to AI – Implementing codes – Responsible research and innovation

UNIT V 9

The ART of AI – Accountability – Responsibility, transparency – Ethical status of AI systems – Responsible AI in practice – AI and society – Ethical responsibilities of AI engineers in the society – Case studies.

TOTAL: 45

TEXT BOOKS:
1. "Towards a Code of Ethics for Artificial Intelligence", Paula Boddington, in Springer Publishers, First Edition,2017.
2. "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way ", Virginia Dignum in Springer Publishers, First Edition 2019.

REFERENCE BOOKS:
1. "The Oxford Handbook of Ethics of AI" ,Markus D. Dubber , Frank Pasquale and Sunit Das, in Oxford University Press, First Edition, 2020.
2. "Ethics of Artificial Intelligence", Matthew Liao (Ed) in Oxford University Press, First Edition,2020.
3. "AI Ethics", Mark Coeckelbergh in MIT Press, First Edition, 2020.

WEBSITES:
1. www.theautomationengineer.com/education/ethics-of-artificial-intelligence/
2. www.plato.stanford.edu/entries/ethics-ai/
3. www.intelligence.org/files/EthicsofAI.pdf
4. www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
5. www.createdigital.org.au/engineersartificial-intelligence-ethical/

SEMESTER VI

22BTAD6E05   **E-COMMERCE TECHNOLOGY**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the student is:
- To understand an overview of various E-commerce applications.
- To know the fundamentals of digital marketing and EDI.
- To understand the process of social media marketing and accelerating website performance.
- To learn the concepts of Resource Discovery, Information search, Retrieval and Filtering.
- To understand the usage of multimedia data in E-commerce applications.

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the basic concepts of e-commerce technologies in different fields.
- Apply the concepts of multimedia data processing like digital video processing, desktop video conferencing in e-commerce applications.
- Explain about social media marketing.
- Explain the concept of information search, retrieval, filtering and discovery of resources.
- Outline basic –commerce applications.
- Explain the impact of E-commerce on business models and strategy.

UNIT I   **9**
Electronic commerce – Frame work – Anatomy of E-commerce applications – E-commerce consumer applications – E-commerce organization applications – Consumer oriented electronic commerce–Mercantile process.

UNIT II   **9**
Digital marketing: Digital marketing trends–Paid digital advertising and earned media–Inter organizational commerce–EDI–EDI software implementation–Value added networks–CRM–ERP – Intra organizational commerce – Work flow automation and coordination – Customization and internal commerce – Supply Chain Management (SCM)

UNIT III   9

Accelerating website performance: Website strategy – Home page and secondary page design and architecture – Selecting a content management system – Building a mobile friendly website – Social media marketing: Strategy – Goals – Develop policies and workflow – Creating social media platforms.

UNIT IV   9

Consumer search and resource discovery – Search and resource discovery paradigms – Information search and retrieval – Commerce catalogues

UNIT V   9

Information filtering – Multimedia – Key multimedia concepts–Digital video and electronic commerce–Desktop video processing–Desktop video conferencing.

TOTAL:45

TEXT BOOK:

1. Kalakata Whinston, "Frontiers of electronic commerce", Pearson Education, Second Edition, 2011

REFERENCE BOOKS:

1. David Reske, "Digital Marketing in the Zone: The Ultimate system for Digital Marketing Success", Morgan James Publishing,First Edition, 2017
2. Amir Manzoor, "E-Commerce an Introduction, LAMBERT AcademicPublishing", First Edition2010

WEBSITES:

1. www.ecommerce-digest.com/tut.html
2. www.ecommerce-digest.com/customer-relationship-management.html
3. www.jan.newmarch.name/ecommerce/tutorial.html
4. www.scribd.com/presentation/16390764/E-Commerce-Lecture-Notes
5. www.sites.google.com/site/cemkecommercelab/assignments

SEMESTER VI

22BTAD6E06   **PRACTICAL REINFORCEMENT 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 student is:
- To introduce the basic mathematical foundations of reinforcement learning
- To introduce the foundational ideas on modern reinforcement learning
- To understand and work with tabular methods to solve classical control problems
- To understand and work with approximate solutions
- To learn the policy gradient methods from vanilla to more complex cases
- Application of reinforcement learning

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the basic and advanced reinforcement learning techniques.
- Identify the suitable learning tasks to which these learning techniques can be applied.
- Identify current limitations of reinforcement learning techniques.
- Formulate decision problems, set up and run computational experiments, analysis of results from experiments.
- Understand about non-associative learning algorithms
- Apply reinforcement learning to train structures deep learning models

UNIT I   **9**
The Reinforcement Learning problem: evaluative feedback – Non-associative learning – Rewards and returns – Markov Decision Processes – Value functions – Optimality and approximation.

UNIT II   **9**
Dynamic programming: value iteration – Policy iteration – Asynchronous DP – Generalized policy iteration. Monta-Carlo methods: policy evaluation – Roll outs – On policy and off policy learning – Importance sampling. Temporal Difference learning: TD prediction – Optimality of TD (0) – SARSA-Q-learning – R-learning – Games and after states.

UNIT III   **9**
 Eligibility traces: n-step TD prediction – TD (lambda) – Forward and backward views, Q (lambda), SARSA (lambda), replacing traces and accumulating traces.

UNIT IV   **9**

Function Approximation: Value prediction – Gradient descent methods – Linear function approximation – ANN based function approximation – Lazy learning – Instability issues Policy

UNIT V   **9**

Gradient methods: non-associative learning –REINFORCE algorithm – Exact gradient methods – Estimating gradients – Approximate policy gradient algorithms – Actor-critic methods.

TOTAL: 45

TEXT BOOKS:

1."Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, MIT Press, Second edition, 2017.
2."Algorithms for Reinforcement Learning", Szepesvari., Morgan and Claypool Publishers, First Edition, 2010.

REFERENCES BOOKS:

1. **"Reinforcement Learning: State-of-the-Art",** Wiering. M and van Otterlo. M, Springer Publishers, First Edition, 2012.
2. **"Artificial intelligence: a modern approach",** Peter Norvig and Stuart J. Russell, Pearson Education Limited, Fourth Edition, 2020.
3. **"Python Reinforcement Learning",** SudharsanRavichandiran and RajalingappaaShanmugaman, Packt publication, First Edition, 2019.

WEBSITES:

1. www.nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs27/
2. www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/
3. www.course.inf.ed.ac.uk/rl
4. www.davidsilver.uk/teaching/
5. www.coursera.org/learn/fundamentals-of-reinforcement-learning

22BTAD6E07 **DRONES TECHNOLOGY 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 student is:
- To learn about their basic mechanics and control strategies
- To realize how careful component selection and design affect the vehicles' performance.
- To understand the preliminary concepts of Geometry and Mechanics
- To understand the planning and control in drone technology
- To be familiar in latest topics in UAV.

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Understand the basic working principal behind the electronic components used and its specification to build a drone from scratch.
- Apply drone technology in various domains.
- Analyze various functional modules of the controller using a pre-programmed controller used in the UAV.
- Understand about Motion control.
- Analyze Planning and Control process
- Identify diffrerent mechanisms used in the drone technology to choose best approach for solving real-world problems.

UNIT I **9**
A History of Drones-Introduction to Aerial Robotics: Unmanned Aerial Vehicles–Quadrotors–Key Components of Autonomous Flight–State Estimation–Applications–Basic Mechanics–Dynamics and 1-D Linear Control–Design Considerations–Agility and Maneuverability–Component Selection–Effects of Size

UNIT II **9**
Geometry and Mechanics: Transformations–Rotations–Euler Angles–Axis/Angle Representations for Rotations–Angular Velocity.

UNIT III **9**
Newton-Euler Equations–Principal Axes and Principal Moments of Inertia–Quadrotor Equations of Motion

UNIT IV 9

Planning and Control:2-D Quadrotor Control–3-D Quadrotor Control–Time, Motion, and Trajectories–Motion Planning for Quadrotors.

UNIT V 9

Advanced Topics: Sensing and Estimation–Nonlinear Control–Control of Multiple Robots

TOTAL: 45

TEXT BOOKS:
1. **"Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs",** Baichtal, Que Publishing, First Edition, 2016.
2. "Basics of R/C model Aircraft design", Andey Lennon, Model airplane news publication, 1996.

REFERENCE BOOKS:
1. **"Autonomous Flying Robots Unmanned Aerial Vehicles and Micro Aerial Vehicles",** KenzoNonami, FaridKendoul, Satoshi Suzuki, Wei Wang and Daisuke Nakazawa, Springer Publication, First Edition, 2010.
2. **"Aerial Robots Aerodynamics, Control and Applications",** Omar D Lopez Mejia, In TechOpen, First Edition, 2017.
3. **"Aerial Photography and Videography Using Drones",** Cheng, Peachpit Press, First Edition, 2015.

WEBSITES:
1. www.microsoft.com/en-us/ai/ai-lab-airsim-drones
2. www.dronetraininghq.com/
3. www.3dr.com/
4. www.coursera.org/lecture/robotics-flight/unmanned-aerial-vehicles-V136S
5. www.udemy.com/course/make_a_drone/

	SEMESTER VI
22BTAD6E08 **BIO INFORMATICS**	**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 get exposed to Bioinformatics Technologies.
- To solve various problems in biological sciences- sequence analysis.
- To solve various problems in gene expression analysis, biomedical mage analysis.
- To solve various problems in metabolic pathway analysis.
- To be familiar with working of bioinformatics models.

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain models for Biological Data, symbiology, the pharmacokinetic modelling and the working model of biological data.
- Apply image processing techniques to Bioinformatics Data.
- Analyze the key features of Image Processing
- Analyze micro array over Genome Expression.
- Discuss about Modelling Biological System.
- Demonstrate models for better interpretation of biological data to extract knowledge.

UNIT I   9
Need for Bioinformatics Technologies – Overview of Bioinformatics Technologies – Structural Bioinformatics – Data Format and Processing – Secondary Resources and Applications – Role of Structural Bioinformatics – Biological Data Integration System

UNIT II   9
Sequence Analysis – NGS – Graph Theory – Gene Ontology – Importing Data and Deploying. Microarray Data Analysis – Mass Spectrometry Data Analysis – Statistical Classification of Biological Data.

UNIT III   9
Key Features of Image Processing – Importing and Exporting Images – Image File Formats and Format Conversion – Pre and Post Processing Images.

UNIT IV 9

Spatial Transformations and Image Registration – Microarray Image Analysis.Basics of Enzyme Kinetics – Kinetic Laws.

UNIT V 9

Modelling Biological System: Simulation, Sensitivity Analysis, Parameter Estimation using Symbiology – Pharmacokinetic Modelling: Simulation, Population Study – Model of the Yeast Heterotrimeric G Protein Cycle and Glycolysis

TOTAL: 45

TEXT BOOKS:
1. Michael R. King and Nipa A. Mody, "Numerical and Statistical Methods for Bioengineering: Applications in MATLAB", Cambridge University Press, First Edition, 2011
2. Alterovitz. G and Ramoni. M.F, "Systems Bioinformatics: An Engineering Case-Based Approach", Artech House, First Edition, 2007

REFERENCE BOOKS:
1. John L. Semmlow ,"Bio signal and Medical Image Processing", CRC Press, Third Edition, 2014
2. Frank C. Hoppensteadt and Charles S. Peskin," Modeling and Simulation in Medicine and Life Sciences", Springer Publishers, Third Edition,2012
3. Gibas. C and Per Jambeck, "Developing bioinformatics computer skills", O'Reilly Media, First Edition, 2001

WEBSITES:
1.www.nptel.ac.in/courses/102/106/102106065/

2. www.nptel.ac.in/courses/102/103/102103044/

3.www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-047-computational-biology-fall-2015/

4.www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-bioinformatics-and-proteomics-january-iap-2005/

5.www.nihlibrary.nih.gov/services/bioinformatics-support/online-bioinformatics-tutorials

SEMESTER VI
22BTAD6E09   **OPTIMIZATIONS FOR 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 student is:
- To recognize classes of optimization problems in machine learning and related disciplines.
- To understand the mathematical underpinnings of optimization methods via examples drawn from machine learning, computer vision, engineering, and data analysis.
- To understand foundational optimization ideas including gradient descent, stochastic gradient methods, higher-order methods, and more advanced optimization algorithms.
- To classify optimization problems by their tractability, difficulty, and compatibility with existing software.
- To impart advanced models and optimizations.

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Distinguish the fundamental knowledge of optimization methods for machine learning.
- Use optimization techniques and numerical methods of optimization.
- Enumerate fundamentals of optimization methods and apply different techniques to solve various optimization problems arising from machine learning.
- Explain about Optimization Methods
- Discuss about Parallel and Distributed Optimization Algorithms and applications
- Analyze various methods of optimizations for machine learning and choose best approaches to improve machine learning performance.

UNIT I   **9**
Introduction: Optimization and Machine Learning–Convex Optimization with Sparsity-Inducing Norms–Interior-Point Methods for Large-Scale Cone Programming–Incremental Gradient, Sub-gradient, and Proximal Methods for Convex Optimization

UNIT II   **9**
Stochastic and Online Variants of mentioned methods–Coordinate Descent–Frank-Wolfe–Accelerated Methods– Cutting-Plane Methods in Machine Learning–Introduction to Dual Decomposition for Inference.

UNIT III 9

Augmented Lagrangian Methods for Learning, Selecting, and Combining Features–The Convex Optimization Approach to Regret Minimization–Projected Newton-type Methods in Machine Learning

UNIT IV 9

Robust Optimization in Machine Learning–Improving First and Second-Order Methods by Modeling Uncertainty–Optimization Methods for Sparse Inverse Covariance Selection.

UNIT V 9

A Pathwise Algorithm for Covariance Selection–Advanced models: GANs, adversarial optimization, robust optimization, cycle consistency–Parallel and Distributed Optimization Algorithms

TOTAL: 45

TEXT BOOKS:
1. Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright, "Optimization for Machine Learning", MIT Press, First Edition,2013
2. Stephen Boyd and LievenVandenberghe, "Convex Optimization", Cambridge University Press, First Edition2009

REFERENCE BOOKS:
1. Nocedal. J and Wright. S.J," Numerical Optimization", Springer Publishers, First Edition,, 2006
2. SébastienBubeck, "Convex Optimization: Algorithms and Complexity", Now Publishers Inc, First Edition2015
3. Cong Fang, Huan Li, and Zhouchen Lin, "Accelerated Optimization for Machine Learning", Springer Publishers, First Edition, 2020

WEBSITES:
1. www.arxiv.org/pdf/1405.4980.pdf
2. www.coursera.org/specializations/mathematics-machine-learning
3. www.coursera.org/learn/calculus-and-optimization-for-machine-learning
4. www.optml.mit.edu/teach/6881/
5. www.online.stanford.edu/courses/mse211-introduction-optimization

22BTAD6E10   **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:
- Explain the advanced concepts& techniques of the Internet and Java.
- Analyze the requirements for and create and implement the principles of web page development
- Explain the concepts of PERL
- Demonstrate client side programming using java applets
- Describe internet telephony based upon advanced concepts
- Apply knowedge of java applets and java scripts fr developing application

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.

REFERENCE BOOKS:

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/

22BTAD7E01   **INDUSTRY   4.**

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

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PRE-REQUISITES: Basics of Internet of Things(IoT)

COURSE OBJECTIVES:
The goal of this course is for the student is:
- Introducing the role of IoT in the modern industry and new economy
- Explain how IoT can improve product value and customer experience
- Bring the IoT perspective in designing and building solutions
- Introduce the tools and techniques that enable IoT solution and Security aspects

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Describe about IOT and IIOT
- Explain IOT applications using standard hardware and software
- Discuss various IOT Layers and their relative importance
- Describe the various IOT platforms.
- Enumerate the importance of Data Analytics in IoT
- Explain the opportunities, challenges brought about by Industry 4.0

UNIT I   **9**
Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

UNIT II   **9**
IIoT-Introduction, Industrial IoT: Business Model and Reference Architerture: IIoT-Business Models, Industrial IoT-Protocol Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

UNIT III   **9**
Big Data Analytics and Software Defined Networks, Machine Learning and Data Science,Julia Programming, Data Management with Hadoop.

UNIT IV   **9**
Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT,Security in IIoT - Industrial IoT (Robotics)- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries)

UNIT V   **9**

Real case studies : Milk Processing and Packaging Industries,Manufacturing Industries.

TOTAL :45

TEXT BOOK:

1. Alasdair Gilchrist, 'Industry4.0:The Industrial Internet of Things", Apress, First edition, 2017

REFERENCE BOOKS:

1. GiacomoVeneri,Antonio Capasso, "Hands-On Industrial Internet of Things: Create a power full Industrial IoT", Packt Publishing Birmingham,UK,2018
2. Sabina Jeschke, Christian Brecher, Houbing Songand Danda BRawat, "Industrial Internet of Things: Cyber Manufacturing Systems", SpringerFirstEdition,2017

WEBSITES:

1. www.trendmicro.com/vinfo/us/security/definition/industrial-internet-of-things-iiot
2. www.i-scoop.eu/internet-of-things-guide/industrial-internet-things-iiot-saving-costs-innovation/industrial-internet-things-iiot/
3. www.zdnet.com/article/what-is-the-iiot-everything-you-need-to-know-about-the-industrial-internet-of-things/
4. www.ebos.com.cy/chariotforum/posts/m169-fog-computing--fog-networking--fogging
5. www.rambus.com/iot/industrial-iot/

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

PRE-REQUISITES: Basics of Programming

COURSE OBJECTIVES:
The goal of this course is for the student is:
- To impart the knowledge of basics of digital manufacturing and its importance.
- To provide a strong orientation on the new advancements in manufacturing
- To introduce the basics of industrial internet systems, networks and protocols
- To inculcate thebasicsofIndustry4.0 concepts
- To understand engineering processes, practices, technology and applications of Smart Manufacturing

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the basics of Industrial Internet and its use cases
- Apply intelligent approaches to develop smart applications.
- Analyze the Industrial internet systems, networks and middleware protocols
- Discuss the basics of Middleware.
- Explain supply Chain Processes.
- Apply the technology and applications of Smart Manufacturing

UNIT I   **9**
Introduction to the Industrial Internet–Industrial Internet Use-Cases–The Technical and Business Innovators of the Industrial Internet–IIoT Reference Architecture

UNIT II   **9**
Designing Industrial Internet Systems–Examining the Access Network Technology and Protocols

UNIT III   **9**
Examining the Middleware Transport Protocols–Middleware Software Patterns–Software Design Concepts

UNIT IV   **9**

Middleware Industrial Internet of Things Platforms–IIoT WAN Technologies and Protocols–Securing the Industrial Internet–

UNIT V   **9**

Introducing Industry 4.0–Smart Factories–Smart Applications: Online Predictive Modelling, Monitoring and Intelligent Control of Machining/Manufacturing and Logistics/Supply Chain Processes

TOTAL:45

TEXT BOOKS:
1. Alasdair Gilchrist I, "Industry 4.0- The industrial Internet of Things", Apress Publishers, First Edition, 2016
2. Ian Gibson,David W Rosen and Brent Stucker, "Additive Manufacturing Technologies 3DPrinting, Rapid Prototyping and Direct Digital Manufacturing", Springer Publishers,First Edition,2010

REFERENCE BOOKS:
1. Bruno S Sergi,Elena G Popkova, Aleksei V Bogoviz,and Tatiana N Litvinov, "Understanding Industry 4.0", Emerald Publishing Limited,First Edition,2019
2. Diego Galar Pascual, Pasquale Daponte and UdayKumar, "Hand book of Industry4.0 and SMART Systems", CRC Press, First Edition, 2019
3. Brian Underdahl, "Digital Manufacturing for Dummies", Protolabs publication, First Edition, 2015

WEBSITES:
1. www.nptel.ac.in/courses/110/106/110106146/
2. www.nptel.ac.in/courses/112/107/112107078/
3. www.onlinecourses.nptel.ac.in/noc20_cs69/preview
4. www.coursera.org/specializations/developing-industrial-iot
5. www.udemy.com/course/intro-to-industry-4/

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

End Semester Exam:3 Hours

PRE-REQUISITE: Knowledge on Software Engineering

COURSE OBJECTIVES:

The goal of this course is for the student is:

- To know what is software quality and different components of SQA.
- To know the SQA components in the project life cycle.
- To understand the software testing strategies and implementation.
- To know various quality management standards.
- To test the product finally to check the product quality.

COURSE OUTCOMES:

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

- Identify the basics of software quality assurance techniques and testing components.
- Distinguish between Verification, and validation
- Apply various testing strategies and implementation methods.
- Explain sotware configuration management, testing and quality management standards.
- Understand about SPICE project.
- Identify quality assurance techniques and efficient software quality testing methods.

UNIT I   **9**

Introduction – Software quality challenges – Software quality – Software quality factors – Components of SQA–Contract review – Development and quality plans.

UNIT II   **9**

Classic and other software development methodologies–Factors affecting intensity of quality assurance activities in the development process – Verification, validation and qualification – A model for SQA defect removal effectiveness and cost – Review objectives – Formal design reviews – Peer reviews – A comparison of the team review methods – Expert opinions

UNIT III   **9**

Software testing-strategies: Definition and objectives – Software testing strategies – Software test classifications – White box testing – Black box testing. Software testing-implementation: The testing process – Test case design –Automated testing –Alpha and beta site testing programs.

UNIT IV 9

Software configuration management – Documentation control – Project progress control – Software quality metrics – Costs of software quality – Quality management standards: Scope– ISO 9001 and ISO 9000-3 – Capability Maturity Modes – The bootstrap methodology

UNIT V 9

The SPICE project and the ISO/IEC 15504 software process assessment standard. SQA project process standards – IEEE software engineering standards – Management and its role in software quality assurance – The SQA unit and other actors in the SQA system.

TOTAL:45

TEXTBOOK:

1." SoftwareQuality:ConceptsandPractice", DanielGalin, PearsonEducation,Firstedition, 2018

REFERENCE BOOKS:

1."SoftwareQualityTheoryandManagement", AlanCGillies, CengageLearning,Third edition, 2011

2."SoftwareTesting", YogeshSingh, CambridgeUniversityPress,FirstEdition, 2012

3."FoundationsofSoftwareTesting", AdityaPMathur, Pearson Education,Second Edition, 2013

WEBSITES:

1. www.exforsys.com/tutorials/sqa/what-is-software-quality-assurance.html

2. www.rspa.com/spi/SQA.html

3.www.softwareqatest.com

4.www.faculty.winthrop.edu/dannellys/csci626

5. www.books.google.co.in/books?isbn=1118211634

OPEN ELECTIVES OFFERED BY

ELECTRICAL AND ELECTRONICS ENGINEERING

22BEEEOE01	**ELECTRIC HYBRID VEHICLE**	**3H-3C**

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

COURSE OBJECTIVES:
- To understand the basic concepts of electric hybrid vehicle.
- To gain the knowledge about electric propulsion unit.
- To know the concept of Hybrid Electric Drive-Trains.
- To gain the knowledge about different Energy Management Strategies.
- To study about the efficiency manipulation in drives.
- To understand and gain the knowledge about various energy storage devices.

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

- Summarize the history and environmental importance of hybrid and electric vehicles.
- Choose a suitable drive scheme for developing an electric hybrid vehicle depending onresources.
- Analyze the different motor drives used in Hybrid Electric Vehicles.
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
- Compare the different Energy Storage devices.
- Identify the different Energy Management Strategies.

UNIT I INTRODUCTION   **9**
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS   **9**

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

UNIT III ELECTRIC PROPULSION UNIT   **9**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE 9

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

UNIT V ENERGY MANAGEMENT STRATEGIES 9

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

REFERENCE 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 Standards media – 2nd edition 2009.
3. James Larminie, John Lowry Electric Vehicle Technology Wiley – 2nd edition 2012.
4. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
5. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
6. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and FuelCell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
7. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

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/

22BEEEOE02   RENEWABLE ENERGY RESOURCES   3H-3C

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

End Semester Exam:**3 Hours**

COURSE OBJECTIVES:

- To gain the knowledge about environmental aspects of energy utilization.
- To understand the basic principles of wind energy conversion, solar cells, photovoltaic conversion.
- To study about solar energy collectors and its storages
- To study about the inter connected system in wind power
- To understand the basic principles fuel cell, Geo thermal power plants.
- To gain the knowledge about hydro energy.

COURSE OUTCOMES:

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

- Summarize the Energy Scenario in India.
- Identify the various applications in solar energy.
- Compare the different types of wind machines.
- Understand the concept of Hydro Energy.
- Acquire knowledge about the ocean energy.
- Explain the different energy sources.

UNIT I INTRODUCTION   9

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization - Energy Conservation and Energy Efficiency - Needs and Advantages, Energy Conservation Act 2001.

UNIT II SOLAR ENERGY   9

Introduction to solar energy: solar radiation, availability, measurement and estimation– Solar thermal conversion devices and storage – solar cells and photovoltaic conversion – PV systems – MPPT. Applications of PV Systems – solar energy collectors and storage.

UNIT III WIND ENERGY   9

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

UNIT IV HYDRO ENERGY 9

Hydropower, classification of hydro power, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES 9

Bio energy and types –Fuel cell, Geo-thermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

REFERENCE BOOKS:

1. Rai.G.D Non-conventional sources of energy Khanna publishers 2011
2. Khan.B.H Non-Conventional Energy Resources The McGraw Hills, Second edition 2009
3. Rao.S. & Parulekar Energy Technology Khanna publishers, Eleventh Reprint 2013
4. Godfrey Boyl Renewable Energy: Power sustainable future Oxford University Press, Third edition 2012.
5. John W Twidell and Anthony D Weir Renewable Energy Resources Taylor and Francis – 3rd edition 2015.

WEBSITES

1. https://nptel.ac.in/courses/103/107/103107157/
2. https://nptel.ac.in/courses/121/106/121106014/
3. https://nptel.ac.in/courses/108/108/108108078/

OPEN ELECTIVES OFFERED BY

**ELECTRONICS AND COMMUNICATION
ENGINEERING**

22BEECOE01 NEURAL NETWORKS AND ITS APPLICATIONS 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course for students is :
- To introduce the basic concepts of neural networks and its applications in various domain
- To educate about supervised and unsupervised learning process
- To gain a solid understanding of various neural network model
- To study about annealing technique
- To learn the concepts of Self-Organizing Map (SOM) algorithm
- To understand steps involved in ballisticarmmovements.

COURSE OUTCOMES:
At the end of the course the students will be able to
- Understand the basic concepts of neural networks and its applications in various domains
- Gain knowledge about learning process in Neural Networks
- Design usingAdaptive Resonance Theory (ART) technique
- Describe steps inannealing process
- Acquire knowledge on SOM concepts
- Explain ballisticarmmovements.

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules-types of neural networks-single layer, multiple layer-feed forward, feedback networks

UNIT II LEARNING PROCESS 9

Error– correction learning– memory based learning- hebbian learning-competitive learning-Boltzmann learning-supervised and unsupervised learning-adaptation-statistical learning theory.

UNIT III PERCEPTION 9

Single layer Perception-Adaptive filtering-unconstrained Optimization-Least-mean square algorithm- Leaning Curve-Annealing Technique-perception convergence Theorem-Relationship between perception and Baye's Classifier-Back propagation algorithm

UNIT IV ATTRACTOR NEURAL NETWORK AND ART   9

Hopfield model-BAM model -BAM Stability-Adaptive BAM -Lyapunov function-effect of gain-Hopfield Design-Application to TSP problem-ART-layer 1-layer 2-orienting subsystem- ART algorithm-ARTMAP.

UNIT-V SELF ORGANIZATION   9

Self-organizing map-SOM Algorithm-properties of the feature map-LVQ-Hierarchical Vector Quantization. Applications of self-organizing maps: The Neural Phonetic Type Writer Learning Ballistic Arm Movements.

REFERENCE BOOKS:

1. SimonHaykin Neural Networks and Learning Machines 3rd Edition Pearson/Prentice Hall 2009
2. SatishKumarNeural Networks: A Classroom Approach TMH 2008
3. Rajasekaran.S, VijayalakshmiPai.G.A Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and Applications PHI, New Delhi 2003.
4. LaureneFausettFundamentals of Neural Networks: Architectures, Algorithms, and Applications   Pearson/Prentice Hall 1994
5. Wasserman P.DNeural Computing Theory & PracticeVan Nortrand Reinhold1989.
6. Freeman J.A, S kapura D.M Neural networks, algorithms, applications, and programming techniques AdditionWesley2005.

WEBSITES:

1. https://nptel.ac.in/courses/117105084/
2. https://www.geeksforgeeks.org/adaptive-resonance-theory-art/

21BEECOE02   PRINCIPLES OF MODERN COMMUNICATION SYSTEMS   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course for students is :

- To provide clear knowledge on evolution of communication systems
- To understand uplink and downlink concepts in mobile phone
- To make aware of mobile communication generations
- To deliver knowledge on wireless communication standards
- To enable students to have a better understanding on launching of satellite
- To study the concept of radar communication

COURSE OUTCOMES:

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

- Understand past, present and future trends in mobile communication.
- Explain how uplink and downlink is done in mobile phone
- Distingiush various standards in use for wireless communication
- Demonstrate some basic application of GPS.
- Appreciate launching mechanism of satellite
- Gain knowledge about RADAR working and its applications

UNIT I THE EVOLUTION OF ELECTRONIC COMMUNICATION   9

From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

UNIT II MOBILE CELLULAR COMMUNICATIONS   9

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

UNIT III WIRELESS COMMUNICATION   9

Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMaX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

UNIT IV SATELLITE COMMUNICATION 9

History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

UNIT V RADAR & NAVIGATION 9

Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar. Navigation Systems: Introduction & methods of navigation, Instrument Landing System, Microwave landing system- Modern Navigation systems.

TOTAL : 45

REFERENCE 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.
5. T.Pratt, C. Bostian and J.Allnutt; ―Satellite Communications, John Wiley and Sons, Second Edition., 2003
6. M. I .Skolnik ―Introduction to Radar Systems, Tata McGraw Hill 2006.
7. Myron Kyton and W.R.Fried ―Avionics Navigation Systems, John Wiley & Sons 1997.

OPEN ELECTIVES OFFERED BY

BIO MEDICAL ENGINEERING

SEMESTER VII

22BEBMEOE01   HUMAN ANATOMY AND PHYSIOLOGY   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students
- To discuss all the organelles of an animal cell and their function.
- To perceive structure and functions of the various types of systems of human body.
- To outline about eye, ear and Endocrine glands of human
- To learn organs and structures involving in system formation and functions.
- To understand all systems in the human body.
- To infer basic understanding of the inter connection of various organ systems in human body

COURSE OUTCOMES:

Uponcompletionofthiscourse,studentswillbe ableto:
- Explain basic structure and functions of cells and its organelles
- Demonstrate about anatomy and physiology of various organ systems
- Illustrate eye,ear and Endocrine glands of human
- Explain the interconnect of various organ systems in human body
- Enlighten organs and structures involving in system formation and functions.
- Elucidate special senses in the human body.

UNIT I   CELL   9

Structure of Cell– Organelles and description–Function of each component of the cell–Membranepotential–Action Potential–Generation and Conduction –Electrical Stimulation. Blood Cell–Composition –Origin of RBC–Blood Groups–Estimation of RBC, WBC and Platelet-Tissues and its functions-.Homeostasis - Tissue: Types – Specialized tissues–functions.

UNIT II CARDIAC AND NERVOUS SYSTEM   9

Heart, Major blood vessels– Cardiac Cycle – ECG-Conducting system of heart--importance of blood groups – identification of blood groups- Nervous Control of Heart-Cardiac output–Coronary and Peripheral Circulation–Structure and function of Nervous tissue–Neuron-Synapse-Reflexes-Receptors-Brain-Brainstem-Spinalcord–Reflexaction.

UNIT III RESPIRATORY SYSTEM AND MUSCULOSKELETAL SYSTEM   9

Physiological aspects of respiration–Trachea andlungs -Exchange of gases–Regulation of Respiration -Disturbance of respiration function -Pulmonary function test-Types of respiration - Oxygen and carbon dioxide transport and acid base regulation-Muscles-tissue-types-structure of skeletal muscle-types of muscle and joints.

UNIT IV   DIGESTIVE,EXCRETORY AND LYMPHATIC SYSTEM   9

Organisation of GI System, Digestion and absorption –Movements of GI tract–Intestine-Liver-Pancreas- Structure of Nephron–Mechanism of Urine formation–Urine Reflex–Skin and SweatGland–Temperature regulation, Lymphatic: Parts and Functions of Lymphatic systems–TypesofLymphaticorgansandvessels.

UNIT V   EYE, EAR&ENDOCRINE GLANDS   9

Optics of Eye–Retina–Photochemistry of Vision–Accommodation-Neurophysiology of vision–EOG, Physiology of internal ear–Mechanism of Hearing–Auditory Pathway, Hearing Tests–Endocrine-Pituitary and thyroid glands.

TOTAL:45

TEXTBOOKS:

1**.** Textbook Equity Edition, Anatomy and Physiology : Volume 2 of 3, Lulu.com, 2014

REFERENCE BOOKS:

1. William F. Ganong, Review of Medical Physiology, Mc Graw Hill, New Delhi, 26th Edition, 2019
2. Arthur C. Guyton, Text book of Medical Physiology, Elsevier Saunders, 12th Edition, 2011

WEBSITES:

1. https://dth.ac.in/medical/course.php
2. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

SEMESTER VII

22BEBMEOE02 　　 ARTIFICIAL ORGANS AND IMPLANTS 　　　　**3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES
The goal of this course is for students
- To have an overview of artificial organs &transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution
- To study about various blood interfacing implant
- To study about soft tissue replacement and hard tissue replacement
- To learn about various implants

COURSE OUTCOMES:
Upon completion of this course, students will be able to:
- Understand of artificial organs &transplants
- Know the principles of implant design with a case study
- Explain the implant design parameters and solution in use
- Know about various blood interfacing implants
- Understand about soft tissue replacement and hard tissue replacement
- Know about various implants.

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS 　　　　　　　　　　　　9
ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration – Evaluation process.
TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individual organs –kidney, liver, heart and lung, bone marrow, cornea.

UNIT II PRINCIPLESOFIMPLANTDESIGN 　　　　　　　　　　　　　　9
Principles of implant design - body response to implants, Clinical problems requiring implants for solution, The missing organ and its replacement, Tissue engineering, scaffolds, Biomaterials, Regenerative medicine & Stem cells.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION 　　　　9
Biocompatibility, Local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration. Limb prosthesis, Externally Powered limb Prosthesis.

UNIT IV   BLOOD INTERFACING IMPLANTS   9

Neural and neuromuscular implants, Heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, Prosthetic cardiac valves, Artificial kidney-dialysis membrane and artificial blood.

UNIT V   IMPLANTABLE MEDICAL DEVICES AND ORGANS   9

Gastrointestinal system, Dentistry, Soft tissue replacement & Hard tissue replacement – sutures, surgical tapes, adhesive, percutaneous implants, internal fracture fixation devices, joint replacements. Maxillofacial and craniofacial replacement, Recent advancement and future directions.

                                                                              TOTAL :45

TEXT BOOK:

   1. Park J.B, Biomaterials Science and Engineering, Plenum Press, 2011

REFERENCES :

   1. J D Bronzino, Biomedical Engineering handbook Volume II, CRC Press, 2010
   2. RS Khandpur, Hand book of Biomedical Instrumentation, Tata McGraw Hill, 2016

WEB SITES:

   1. https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/

COURSES OFFERED TO OTHER DEPARTMENTS

BY

BIOTECHNOLOGY

SEMESTER VII

22BTBTOE01   **BIOREACTOR DESIGN** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
- Impart basic knowledge in bioprocess Engineering
- Design the bioreactors for various operations.
- Discuss the principle and working of heat transfer equipments.
- Extend the knowledge in principle of heat transfer inside a bioreactor
- Construct the equipments used in mass transfer operations.
- Illustrate the equipments used in separation process.

COURSE OUTCOMES:

After completing the course, the students will be able to
- Summarize the basic concepts in bioprocess Engineering.
- Design the bioreactors for various operations.
- Develop the heat transfer equipments for Bioprocess Engineering.
- Construct the equipments used in mass transfer operations.
- Categorize the equipments used in separation process.
- Describe the applications of bioreactors.

UNIT I INRODUCTION TO BIOPROCESS ENGINEERING **9**

Introduction – Biotechnology and Bioprocess Engineering- Biologists and Engineers Differ in their approach to research-How Biologists and Engineers work Together- Bioprocesses: Regulatory constraints.

UNIT II REACTOR DESIGN **9**

Design of Airlift fermentor, Bubble column reactor and Continuous stirred tank reactor.

UNIT III HEAT TRANSFER EQUIPMENTS **9**

Design of Shell and tube Heat exchanger, Double pipe heat exchanger, Long tube vertical evaporator and Forced circulation evaporator.

UNIT IV MASS TRANSFER EQUIPMENTS **9**

Design of Bollmann extractor, Fractionating column, Packed tower and Spray tray absorber.

UNIT V SEPARATION EQUIPMENTS 9

Design of Plate and frame filter press, Leaf filter, Rotary drum filter, Disc bowl centrifuge, Rotarydrum drier and Swenson –walker crystallizer.

REFERENCE BOOKS:

1. James Edwin Bailey, David F. Ollis (2015) Biochemical Engineering Fundamentals, SecondEdition. McGraw-Hill Education (India) private limited.
2. Don W. Green, Robert H.Perry (2008). Chemical Engineer Hand book. The McGraw-HillCompanies, Inc.
3. Pauline. M. Doran (2015). Bioprocess Engineering Principles Second Edition. AcademicPress.

SEMESTER VII

22BTBTOE02   **FOOD PROCESSING AND PRESERVATION**   **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:

- Discuss the scope and importance of food processing.
- Impart basic knowledge in different food processing methods carried out in the food techcompanies.
- Explain the methods of food preservation by cooling.
- Tell the concepts of preservation methods for fruits.
- Create deeper understanding on preservation methods for vegetables.
- Extend the brief knowledge in food conservation operations and packaging methodologies

COURSE OUTCOMES:

After completing the course, the students will be able to
- Describe the scope and importance of food processing.
- Outline the various processing methods for foods.
- Describe the methods of food preservation by cooling.
- Summarize the preservation methods for fruits and vegetables.
- Extend the knowledge in food conservation operations.
- Understand the types and materials used for packaging.

UNIT I SCOPE AND IMPORTANCE OF FOOD PROCESSING   9

Properties of food - Physical, thermal, mechanical, sensory. Raw material Preparation - Cleaning, sorting, grading, peeling.

UNIT II PROCESSING METHODS   9

Heating- Blanching and Pasteurization. Freezing- Dehydration- canning-additives- fermentation- extrusion cooking- hydrostatic pressure cooking- dielectric heating- micro wave processing and aseptic processing – Infra red radiation processing-Concepts and equipment used.

UNIT III FOOD CONVERSION OPERATIONS AND FOOD PACKAGING   9

Size reduction – Fibrous foods, dry foods and liquid theory and foods – equipments - membrane separation- filtration- equipment and application. Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

UNIT IV FOOD PRESERVATION BY COOLING   **9**

Refrigeration, Freezing-Theory, freezing time calculation, methods freezing of freezing equipments, freeze drying, freeze concentration, thawing, effect of low temperature on food. Water activity, methods to control water activity.

UNIT V   PRESERVATION METHODS FOR FRUITS AND VEGETABLES   **9**

Preprocessing operations - preservation by reduction of water content: drying / dehydration and concentration – chemical preservation – preservation of vegetables by acidification, preservation with sugar - Heat preservation– Food irradiation- Combined preservation techniques.

REFERENCE BOOKS:

1. R. Paul Singh, Dennis R.Heldman (2014).Introduction to food engineering. Academic press.
2. P.Fellows. (2017). Food processing technology principles and practice, Fourth Edition. Woodhead publishing Ltd.
3. M.A. Rao, Syed S.H.Rizvi, Ashim K. Datta. (2014). Engineering properties of foods. CRCpress.
4. B. Sivasankar. (2002). Food processing and preservation.PHI learning Pvt.Ltd.
5. Ranganna, S. (2000). Handbook of canning and aseptic packaging. Tata McGraw-Hill Publishing Company..
6. Sharma, M., Goyal, M. R., & Birwal, P. (Eds.). (2021). Handbook of Research on Food Processing and Preservation Technologies: Volume 5: Emerging Techniques for Food Processing, Quality, and Safety Assurance. CRC Press.

22BTBTOE03   BASIC BIOINFORMATICS

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- Elaborate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Discuss the 3D structure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.
- Extend the brief knowledge in Micro array data analysis.

COURSE OUTCOMES:

After completing the course, the students will be able to
- Summarize the basic concepts and importance of Bioinformatics in various sectors.
- Demonstrate the sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Analyze the three dimensional protein structure and classification using various tools.
- Illustrate the protein secondary structure prediction by comparative modeling.
- Extend the knowledge in micro array technology and applications of bioinformatics invarious sectors.

UNIT I: OVERVIEW OF BIOINFORMATICS   9

Aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities. The scope of bioinformatics; bioinformatics & the internet; useful bioinformatics sites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene & protein expression data; protein interaction data. Databases – contents, structure & annotation: file formats; annotated sequence databases; miscellaneous databases.

UNIT II: RETRIEVAL OF BIOLOGICAL DATA   9

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple- sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III: PHYLOGENETICS   9

Introduction to Phylogenetics, Molecular Evolution and Molecular Phylogenetics, Phylogenetic tree, Forms of Tree Representation, Rooted and un-rooted trees, Phylogenetic Tree Construction Methods: Distance based methods- NJ, UPGMA PGMA , cladistics & ontology; building phylogenetic trees; evolution of macromolecular sequences. Sequence annotation: principles of genome annotation; annotation tools & resources.

UNIT IV: STRUCTURAL BIOINFORMATICS   9

Protein sequence data-bases- SwissProt/ TrEMBL, PIR, Sequence motif databases -Pfam, PROSITE, Protein structure databases, Protein Data Bank-SCOP, CATH, KEGG, Chembank, Sequence, structure and function relationship. Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing & analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; introduction to protein structure prediction; structure prediction by comparative modeling; secondary structure prediction; advanced protein structure prediction & prediction strategies.

UNIT V: MICROARRAY DATA ANALYSIS   9

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling & SAGE. Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharma informatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems; software downloading & installation; database management.

REFERENCE BOOKS:

1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. PearsonEducation.
2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide tothe analysis of genes and proteins. Wiley-Interscience.
3. David W. Mount. (2004). Sequence and Genome Analysis. Cold Spring Harbor Laboratory.
4. Jonathan Pevsner.(2015). Bioinformatics and functional genomics. wiley-Liss.
5. Michael J Koernberg. (2016).Microarray Data Analysis: Methods and applications. HumanaPress
6. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta(2013). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt. Ltd.,

SEMESTER VII

22BTBTOE04   FUNDAMENTALS OF NANOBIOTECHNOLOGY   3H-3C

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

COURSE OBJECTIVES:
- Impart the skills in the field of nano biotechnology and its applications.
- Acquire knowledge in the nano particles and its significance in various fields.
- Extend the knowledge in types and application of nano particles in sensors.
- Define the concepts of biomaterials through molecular self assembly.
- Equip students with clinical applications of nano devices.
- Describe deeper understanding of the socio-economic issues in nanobiotechnology.

COURSE OUTCOMES:
After completing the course, the students will be able to
- Develop skills in the field of nano biotechnology and its applications.
- Summarize the nanoparticles and its significance in various fields.
- Extend the knowledge in types and application of nano particles in sensors.
- Define the concepts of biomaterials through molecular self assembly.
- Outline the clinical applications of nano devices.
- Describe the socio-economic issues in nanobiotechnology.

UNIT I INTRODUCTION   9
Introduction to Nanotechnology and nanobiotechnology: Properties at nanoscale, Scope and Overview, Length scales , Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution, ; General synthesis methods of nanoscale materials; top down and bottom up approaches; Silicon based Technology, Benefits and challenges in Molecular manufacturing: The Molecular assembler concept, Controversies and confusions, Understanding advanced capabilities, Nanotechnology in Different, Fields: Nanobiotechnology, Materials, Medicine, Dental care.

UNIT II NANO PARTICLES   9
Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles, Applications, Toxic effects of Nanomaterials, Significance of Nanoparticles Nanofabrications- MEMS/NEMS, Atomic Force Microscopy, Self assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes. X-ray diffraction technique; Scanning Electron Microscopy with EDX; Transmission Electron Microscopy including high-resolution imaging;

UNIT III MEDICAL NANOTECHNOLOGY   9

Nanomedicine, Nanobiosensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine. Case study on drug delivery of gold nanoparticles against breast cancer

UNIT IV NANOBIOTECHNOLOGY   9

Nanoscale devices for drug delivery: micelles for drug delivery; targeting; bioimaging; microarray and genome chips; Clinical applications of nanodevices.   Artificial neurons. Real-time nanosensors- Applications in cancer biology. Nanomedicine. Synthetic retinyl chips based on bacteriorhodopsins. High throughput DNA sequencing with nano carbontubules. Nanosurgical devices.

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY   9

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

REFERENCE BOOKS:

1. Niemeyer, C.M. and Mirkin, C.A (2005). Nanobiotechnology: Concepts, Applications andPerspectives. Wiley-VCH.
2. Goodsell, D.S. (2004). Bionanotechnology. John Wiley and Sons, Inc.
3. Shoseyov, O. and Levy, I (2008).Nanobiotechnology: Bioinspired Devices and Materials of theFuture. Humana Press.
4. Bhushan, B. (2017). Springer Handbook of Nanotechnology. Springer-Verlag BerlinHeidelberg.
5. FreitasJr R.A (2006) Nanomedicine. Landes Biosciences.
6. Kohler, M. and Fritzsche, W. (2008). Nanotechnology – An Introduction to NanostructuringTechniques. Wiley-VCH.
7. Niemeyer, C. M., and CA Mirkin, C. A., (2010); NanoBiotechnology II – More concepts, and applications. First edition, Wiley –VCH publications

COURSES OFFERED TO OTHER DEPARTMENTS

BY

MECHANICAL ENGINEERING

22BEMEOE01   COMPUTER AIDED DESIGN   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
- To apply basic concepts to develop construction (drawing)techniques.
- To ability to manipulate drawings through editing and plotting techniques.
- To understand geometric construction and Produce template drawings.
- To understand and demonstrate dimensioning concepts and techniques.
- To understand Section and Auxiliary Views.
- To become familiar with Solid Modelling concepts and techniques.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
- Apply basic concepts to develop construction(drawing)techniques.
- Ability to manipulate drawings through editing and plotting techniques.
- Understand geometric construction and Produce template drawings.
- Understand and demonstrate dimensioning concepts and techniques
- Understand Section and Auxiliary Views
- Become familiar with Solid Modelling concepts and techniques.

UNIT I OVERVIEW OF CAD SYSTEMS   9

Conventional and computer aided design processes- advantages and disadvantages. Subsystems of CAD-CAD hardware and software, analytical and graphics packages, CAD workstations. Networking of CADsystems.

UNIT II   INTERACTIVE COMPUTER GRAPHICS AND GRAPHICS TRANSFORMATIONS   9

Generative, cognitive and image processing graphics. Static and dynamic data graphics. Transport of graphics data. Graphic standards. Generation of graphic primitives- display transformation in Two- and Three –Dimensional graphics concepts, Graphical input technique, Geometric transformations, Visual Realism, Computer animation, customizing graphics software.

UNIT III GEOMETRIC MODELING   9

Wireframe, surface, NURBS and solid modeling-applications and advantages. Creating primitive solids, sweeping solids, Boolean operations. Extracting entities from a solid. Filleting of edges of solids. Boundary representation(B-rep)Constructive Solid Geometry(CSG) and Analytical Solid Modeling (ASM)

UNIT IV PARAMETRIC DESIGN AND OBJECT REPRESENTATION   9

Types of co-ordinate systems. Parametric design - definition and advantages. Parametric

representation of analytic and synthetic curves. Parametric representation of surfaces and solids-manipulations.

UNIT V PRODUCT DESIGN AND DEVELOPMENT   9

Automated 2D drafting - basics, mating conditions – Types of translators (IGES, STEP, ACIS and DXF). Mass property calculations.

REFERENCE BOOKS:

1. Vera B Anand, Computer Graphics and Geometric Modeling for Engineers,1st edition, John Wiley & Sons, NewYork, 2000

2. Radhakrishnan P and Subramanyan S,CAD/CAM/CIM,2nd edition,New Age InternationalPvt.Ltd,2008

3. Ibrahim Zeid, CAD/CAMTheoryand Practice,2nd edition,McGrawHill Inc.,NewYork,2009

4. Barry Hawhes,The CAD/CAM Process,1st edition,PitmanPublishing,London,2007(digital)

5. William M Newman and Robert Sproul, Principles of Interactive Computer Graphics,1st edition,McGrawHill Inc., New York,2001

6. RaoSS,OptimizationTechniques,1st edition,WileyEastern,NewDelhi,2006

22BEMEOE02	INDUSTRIAL SAFETY AND ENVIRONMENT	3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To recognize and evaluate occupational safety and heal hazards in the workplace.
- To determine appropriate hazard controls following the hierarchy of controls.
- To analyses the effects of workplace exposures, injuries and illnesses, fatalities.
- To prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- To teach student the concept of Industrial Safety & provide useful practical knowledge for work place safety.
- To prevent or mitigate harm or damage to people, property, or the environment.

COURSE OUTCOMES:

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

- Recognize and evaluate occupational safety and health hazards in the workplace.
- Determine appropriate hazard controls following the hierarchy of controls.
- Analyze the effects of workplace exposures, injuries and illnesses, fatalities.
- Prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.
- Underst and the concept of Industrial Safety & provide useful practical knowledge for work place safety.
- Prevent or mitigate harm or damage to people, property, or the environment.

UNIT I CONCEPTS   9

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety-Safety Committee-budgeting for safety.

UNIT II TECHNIQUES   9

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENTINVESTIGATIONANDREPORTING   9

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process –Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports

UNIT IV   SAFETYPERFORMANCEMONITORING   9

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incidentrate, accident rate, safety "t" score, safety activity rate– problems.

UNIT V SAFETYEDUCATIONANDTRAINING   9

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme ,safety campaign–Domestic Safety and Training.

REFERENCE BOOKS:

1. Accident Prevention Manual for Industrial Operations,3rdedition,N.S.C.Chicago,2010(digital).
2. Heinrich H.W. "Industrial Accident Prevention", 2ndedition, Tata McGraw-Hill Company, NewYork, 1941.
3. Krishnan N.V, Safety Management in Industry, 1stedition,Jaico Publishing House, Bombay,1997.
4. John R Ridley,Safety at Work, 3rdedition, Elsevier,2014
5. Rol and P.Blake,Industrial Safety,2ndedition, PrenticeHall, Inc.,NewJersey,1973
6. L M Deshmukh,Industrial safety management,1stedition,TATA McGrawHill,2005.

22BEMEOE03   NON-DESTRUCTIVE TESTING   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- The main objectives of this course are to introduce the concept of non-destructive testing among the students and make them understand various types of non-traditional practices available for manufacturing industry.
- To provide in-depth knowledge on various techniques of non-destructive testing.
- To provide an overview of destructive and non-destructive tests and state their applications
- To study the features of NDT techniques for various products and to understand the established NDE techniques and basic familiarity of emerging NDE techniques.
- To expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs.
- To facilitate the understanding of standard application area of NDET

COURSE OUTCOMES:

Student will be able to

- Understand the codes, standards and specifications related to NDT.
- Classify the destructive and non-destructive tests and state their applications.
- Develop NDT techniques for various products.
- Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
- Acquire sound knowledge of established NDE techniques and basic familiarity of emerging NDE techniques.
- Make use of standards application area of NDET

UNIT I   INTRODUCTION   9

Properties of Engineering Materials – Types of Defects – Surface and Sub-Surface of a component – Characteristics of Ferrous, Non-ferrous and Alloys. Classification of Destructive testing and Non-Destructive testing – Uses and applications. Codes, Standards and Specifications of NDT (ASME, ASTM, AWS etc.). Importance and Scope of NDT, Non-destructive testing methods

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION   9

Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - Apparatus required for LPT - An Illustration of Penetrant Testing, Application, Advantages and Disadvantages of Penetrants Testing.
Introduction to Magnetic Particle Inspection – MPT equipments and devices - An Illustration of Magnetic Particle Inspection, Application, Advantages and Disadvantages of Magnetic Particle Crack Detection.

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION   9

Introduction to Ultrasonic Flaw Detection, UT equipments and devices, An Illustration of Ultrasonic Flaw Detection, Application, Advantages and Disadvantages of Ultrasonic Flaw Detection.

Principle of Radiography Inspection, RT equipments and devices Radiation sources, uses of x-rays and gamma rays Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety from Radiation.

UNIT IV EDDY CURRENT TESTING AND VISUAL TESTING METHODS   9

Introduction to Eddy Current Testing. ECT equipments and devices, An Illustration of Eddy Current Testing Equipment, Application, Advantages and Disadvantages of Eddy Current Testing.

Introduction to visual testing method, Equipments required for VT - An Illustration of visual testing method, Application, Advantages and Disadvantages of visual testing method.

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS   9

Inspection of Raw Products, Inspection for In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Automobile component Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

REFERENCE BOOKS:
1. Sadashiva.M – Non - Destructive Testing Paperback – 15 July 2021.
2. Ramachandran.S and Anderson.A - Non-Destructive Testing – Kindle Edition - 2018
3. J. Prasad and C. G. Krishnadas Nair - Non-Destructive Test and Evaluation of Materials Hardcover – 1 July 2017.
4. Lari and Kumar - Basics of Non - Destructive Testing Paperback – 1 January 2013.
5. Ravi Prakash – Non - Destructive Testing Techniques Hardcover – 1 January 2010.
6. Louis Cartz - Non - destructive Testing - 1st Edition, ASM International, Almere, Netherland, 2007(digital).

COURSES OFFERED TO OTHER DEPARTMENTS

BY

CIVIL ENGINEERING

22BECEOE01   HOUSING PLAN AND MANAGEMENT   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
- To examine the role and tasks of basic housing policies and building bye laws
- Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
- Analyze the Innovative construction methods and Materials
- Analyze city management strategies and strengthen the urban governance through a problem solving approach
- To know the Importance of basic housing policies and building bye laws
- To use Housing Programmes and Schemes

COURSE OUTCOMES:

After completing the course, the students will be able to
- Know the Importance of basic housing policies and building bye laws
- Use Housing Programmes and Schemes
- Plan and Design of Housing projects
- Examine Innovative construction methods and Materials
- Know Housing finance and loan approval procedures
- Understand Construction as well as managing techniques

UNIT I INTRODUCTION TO HOUSING   9

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES   9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS   9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS   **9**

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL   **9**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis,Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

TEXT BOOKS:

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd.,New Delhi, 2002.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House,Bombay, 2001.

REFERENCES BOOKS:

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS(Habitat), Nairobi, 2000.

22BECEOE02   BUILDING SERVICES   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
- Defining and identifying of engineering services systems in buildings.
- The role of engineering services systems in providing comfort and facilitating life of users of the building.
- The basic principles of asset management in a building & facilities maintenance environment
- Importance of Fire safety and its installation techniques.
- To understand Electrical system and its selection criteria
- To use the Principles of illumination & design

COURSE OUTCOMES:

After completing the course, the students will be able to

- Machineries involved in building construction
- Understand Electrical system and its selection criteria
- Use the Principles of illumination & design
- Know the principle of Refrigeration and application
- Importance of Fire safety and its installation techniques
- Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES   9

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators –Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS   9

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiringsystems and their choice – Planning electrical wiring for building – Main and distribution boards –Transformers and switch gears – Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN   9

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux –

Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP –Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS   9

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION   9

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

TEXT BOOKS:

1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 2002.

2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

REFERENCE BOOKS:

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
2. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press,London, 2005.
3. National Building Code.

22BECEOE03   REPAIR AND REHABILITATION OF STRUCTURES   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
1. To learn various distress and damages to concrete and masonry structures
2. To know the influence of corrosion in durability of structures
3. To understand the importance of maintenance of structures
4. To study the various types and properties of repair materials
5. To learn various techniques involved in demolition of structures
6. To Assessing damage of structures and various repair techniques

COURSE OUTCOMES:
   After completing the course, the students will be able to
1. Various distress and damages to concrete and masonry structures
2. Durability of structures and corrosion mechanism
3. The importance of maintenance of structures, types and properties of repair materials etc
4. Assessing damage of structures and various repair techniques
5. the various types and properties of repair materials
6. Modern technique and equipment being adopted for the demolition of structures

UNIT I INTRODUCTION   9
Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors.

UNIT II DURABILITY OF STRUCTURES   9
Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III MAINTENANCE AND REPAIR STRATEGIES   9
Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS FOR REPAIR   9
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre

reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES   9

Non-destructive Testing Techniques, Corrosion protection techniques ,Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies.

TEXT BOOKS:

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials,Maintenance andRepair", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
3. Shetty M.S., "Concrete Technology – Theory and Practice", S.Chand and Company, 2008.

REFERENCE BOOKS:

1. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and
2. Rehabilitation of Concrete Structures", Allied Publishers, 2004.
3. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013
4. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
5. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
6. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.
7. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011

| **22BECEOE04** | **COMPUTER-AIDED CIVIL ENGINEERING DRAWING** | **3H-3C** |

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact.
- To Communicate a design idea/concept graphically/ visually

COURSE OUTCOMES:
After completing the course, the students will be able to
- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact
- Planning and designing of structures

UNIT I: INTRODUCTION   9

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT II: SYMBOLS AND SIGN CONVENTIONS   9

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards.

UNIT III: MASONRY BONDS   9

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV: BUILDING DRAWING   9

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.

UNIT V: PICTORIAL VIEW   9

Principles of isometrics and perspective drawing. Perspective view of building, Software's

TEXT BOOKS:
1. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New AgeInternational Pvt.Ltd.,
2. Subhash C Sharma & Gurucharan Singh (2005), " CivilEngineering Drawing" ,StandardPublishers

REFERENCE BOOKS:
1. (Corresponding set of) CAD Software Theory and UserManuals.
2. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication LtdNewAsian.
3. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria&Sons.
4. Ajeet Singh (2002), " Workingwith AUTOCAD 2000 with updates on AUTOCAD200I", Tata- Mc Graw-Hill Company Limited, NewDelhi

22BECEOE05	CONTRACTS MANAGEMENT	3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To have developed a more detailed appreciation for construction planning and scheduling
- To apply their learned knowledge as it pertains to upper level construction management skills and procedures.
- To evaluate the best practices associated with the development of contract parameters.
- To understand the legal aspects of acts governing the contracts
- To discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- To understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

COURSE OUTCOMES:

After completing the course, the students will be able to

- Apply project Procurement management concepts in a project environment.
- Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
- Evaluate the best practices associated with the development of contract parameters.
- Understand the legal aspects of acts governing the contracts
- Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

UNIT I CONTRACT MANAGEMENT   9

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.

UNIT II CONTRACT PARAMETERS   9

Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

UNIT III VARIOUS ACTS GOVERNING CONTRACTS   9

Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy,

UNIT IV BID PROCESS AND BID EVALUATION   9

Bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types of proposals Design Conditions and Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

UNIT V MANAGING RISKS AND CHANGE   9

Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post- Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance- Introduction, Monitoring and Measurement.

TEXT BOOKS:
1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.

REFERENCE BOOKS:
1. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011.
2. Varghese, P.C., "Building Construction", Prentice Hall India,2007.
3. National Building Code, Bureau of Indian Standards, New Delhi,2017.
4. Chudley, R., Construction Technology, ELBS Publishers,2007.
5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
6. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
7. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson EducationIndia, 2015
8. Punmia, B.C., Khandelwal, K.K., Project Planning withPERTandCPM,LaxmiPublications,2016.

| **22BECEOE06** | **AIR AND NOISE POLLUTION AND CONTROL** | **3H-3C** |

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

- To impart knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends
- To induce operational considerations under the processing and control monitoring.
- To apply sampling techniques of gaseous contaminants.
- To control noise pollution by specific measurements, standard and preventive measures.
- To enable to evaluate the behavior of air pollutants.
- To have knowledge about appropriate control measures of air pollution

COURSE OUTCOMES:

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

- Have knowledge about appropriate control measures of air pollution.
- To apply sampling techniques and suggest suitable air pollution prevention equipment's and techniques for various gaseous and particulate pollutants.
- Have knowledge about the air pollution monitoring and modeling.
- Understand causes of air pollution and Analyze different types of air pollutants.
- Evaluate air pollutant behavior in the atmosphere.
- Enable to evaluate the behavior of air pollutants.

UNIT I: INTRODUCTION   9

Structure and composition of Atmosphere – Sources and classification of air pollutants -Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices Emission Inventories.

UNIT II: AIR POLLUTION MONITORING AND MODELLIN   9

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques – Air PollutionClimatology.

UNIT III: CONTROL OF PARTICULATE CONTAMINANTS   9

Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working

principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, ParticulateScrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring –Costing of APC equipment – Case studies for stationary and mobile sources.

UNIT IV: CONTROL OF GASEOUS CONTAMINANTS   9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT V: AUTOMOBILE AND NOISE POLLUTION   9

Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control.

TEXT BOOKS:

1. Anjaneyulu D, "Air pollution and control technologies", Allied Publishers, Mumbai, 2002.
2. Khitoliya R K, "Environmental Pollution", 2/e, S. Chand Publishing, 2012.

REFERENCE BOOKS:

1. Rao C.S, "Environmental pollution control engineering", Wiley Eastern Ltd., New Delhi,1996.
2. Rao M.N, and Rao H.V.N, "Air Pollution Control" Tata-McGraw-Hill, New Delhi, 1996.
3. David H.F Liu, Bela G.Liptak, "Air Pollution", Lewis Publishers, 2000.
4. Mudakavi, J R, "Principles and Practices of Air Pollution Control and Analysis" IKInternational, 2010.
5. Air Pollution act, India, 1998.

COURSES OFFERED TO OTHER DEPARTMENTS

BY

FOOD TECHNOLOGY

| 22BTFTOE01 | PROCESSING OF FOOD MATERIALS | 3H-3C |

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for students to,
- Explain the milling, extraction and manufacture of tremendous products from cereals,pulses and oilseeds
- Summarize the production and processing methods of fruits andvegetables
- Discuss the chemical composition, processing, production, spoilage and quality of milk and milkproducts
- Outline the overall processes involved in the production of meat, poultry and fishproducts
- Review the production and processing methods of plantation and spiceproducts

COURSE OUTCOMES:
Upon completion of this course, students will be able to,
- Discuss the basics of foodprocessing.
- Demonstrate the various processing technologies involved in fruits and vegetables,dairy, cereals, meat, fish, egg and plantationproducts.
- Infer the basics on microbiology of foodproducts.
- Describe the process of manufacture of various foodproducts.
- Recognize various methods of preservation offood.
- Express the possible arena of entrepreneurial activity related to foodproducts.

UNIT I CEREAL, PULSES AND OIL SEEDS TECHNOLOGY   9

Rice milling, Pulse milling, Wheat milling – Recent trends in milling process- Oil extraction – different methods in oil extraction - Methods of manufacture ofBread - differentprocessesofmanufacture-typesofbreads-buns,biscuits,cakesandcookies-Pastaproducts - Tortilla - Method of manufacture.

UNIT II FRUITS AND VEGETABLE PROCESSING   9

Production of Fruits and vegetables in India, Maturity standards, Cause for heavy losses, preservation treatments - Basics of Canning, Minimal processing and Hurdle technology as applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing- Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates.

UNIT III DAIRY PROCESSING   9

Basicdairyterminology,composition,Generaltestsatreception,DairyProcessing-Methodof manufacture of Standardized, toned and double toned milk, milk powder - Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Icecream, Cheese, Paneer, Yoghurt - Pasteurization and microorganisms involved in spoilage ofmilk – Major pathogens, Plant construction, Sanitation management, Cleaning equipment.

UNIT IV MEAT, POULTRY AND FISH PROCESSING   9

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Common pathogens, Sanitation management, Sanitizers for meat & poultry plants, Fish and other Marine Products Processing, Sources of sea food contamination.

UNIT V PLANTATION PRODUCT TECHNOLOGY   9

Processing of Tea, Coffee and Cocoa - Outline of the methods of manufacture of - green tea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric. By products from plantation crops and spices.

REFERENCE BOOKS:
1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles andPractices. International Book Distributing Co. Lucknow. 3rd Edition.2010.
2. Chakraverty A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. Handbook of Post- harvest Technology: Marcel Dekker Press. USA. 1st Edition.2003.
3. Sukumar De. Outlines of Dairy Technology. Oxford University Press. New Delhi.23rd impression.2016.
4. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.

22BTFTOE02   **NUTRITION AND DIETETICS**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for students,
- To explain the basic concepts of food and nutrition.
- To define the overall classification, function, and source of carbohydrates, lipids and proteins.
- To recite the availability, source, deficiency and physiological role of fat- and water-soluble vitamins.
- To outline the role of health and nutritional importance of micro and macrominerals.
- To discuss the recent trends and developments in nutrition.

COURSE OUTCOMES:
Upon successful completion of this, students will be able to
1. Recognize the basics in the area of nutritional assessment in health and disease
2. Evaluate the biological functions of various macromolecules in terms of food and health.
3. Select the balanced diet for healthy life to avoid or prevent the deficiency disorders.
4. Choose an appropriate diet, products that prevent vitamin deficiency disorders.
5. Identify the proper foods rich in minerals to live a healthy life.
6. Design the diet with the recent concepts of human nutrition to prevent / treat the dreadful diseases.

UNIT I HUMAN NUTRITION   9

Six classes of nutrients - Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality - Malnutrition and related disorders – Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health andwellbeing.

UNIT II BIOMOLECULES   9

Carbohydrates- Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Properties of fats and oils, Refined & Hydrogenated fats process. Proteins - Definitions, Classification, Function, Amino Acids, Sources ofProteins, Texturized proteins.

UNIT III VITAMINS   9

Physiological role, bio-availability, requirements, sources and deficiency of Fat-Soluble Vitamins:VitaminA,VitaminD,E&K. ƒWatersoluble vitamins:VitaminC,Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12,VitaminB6. Stability under different food processing conditions.

UNIT IV MINERALS AND WATER   9

Physiological role, bio-availability, requirements, sources and deficiency of Macro minerals: Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Micro minerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride - Chemistry and physical properties of free, bounded and entrapped water, water activity, quality parameters of drinking and mineral water.

UNIT V RECENT TRENDS IN NUTRITION   9

Principles of dietary management in gout, rheumatism, AIDS/HIV - Cancer-risk factors, symptoms, dietary management, role of food in prevention of Cancer. Role of functional foods Health foods and novel foods, organically grown foods, personalized nutrition, recent concepts in human nutrition like nutrigenomics, nutraceuticals etc.

REFERENCE BOOKS:

1. SunetraRoday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rd edition 2018. (ISBN-13:9780199489084)
2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1st Edition, 2017. (ISBN:9780128052570)
3. Ashley Martin. Nutrition and Dietetics. Syrawood Publishing House. 1st Edition, 2016. (ISBN:9781682860588)
4. Robert E. C. Wildman. Handbook of Nutraceuticals and Functional Foods. CRC Press, 2nd Edition, 2016. (ISBN-10:9781498770637)
5. Srilakshmi.B.NutritionScience.NewAgeInternationalPvt.Ltd,Publishers.6thEdition.2 017. (ISBN-13:9789386418883)

22BTFTOE03 **READY TO EAT FOODS** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for students to,
- Outline the current status of snack foodIndustry
- Describe the production, processing and marketing trends of potato and tortillachips
- Outline the overall processing ofpopcorn
- Explain the production and processing of fruits involved in snack foodpreparation
- Summarize the sensory analysis methods and packaging techniques of snackfoods

COURSE OUTCOMES:
Upon completion of this course, students will be able to,
- List the various manufacturing process in snack foodindustries
- Acquire knowledge about current production and marketing status of Snackfoods
- Elucidate the advantages of SensoryEvaluation
- Packaging technologies in Snack FoodIndustries
- Demonstrate the *equipments involved in the snack productionprocesses
- Use flavorings in the popcornindustries

UNIT I INTRODUCTION TO SNACK FOODS **9**
Introduction- Types – processing methods - Nutrition- Quality and standards for snack foods - GHP and GMP for snack food industries - Outline of snack food industry - Domestic Snack Food Market-Global Market.

UNIT II POTATO AND TORTILLA CHIPS PROCESSING **9**
Potato Production- selection and grading of potato - Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials- Processing steps-Equipment involved- Reconstitution of Dry Maize Flour-Unit operations - Nutritional properties of potato and tortilla chips.

UNIT III POPCORN PROCESSING **9**
Introduction- Raw popcorn selection and preparation-Popping Methods-Home preparation of Popcorn-Equipments-Industrial manufacturing process- Flavorings and Applicators-Popcorn Packaging- Relative Nutrition- Marketing.

UNIT IV FRUIT BASED SNACKS   **9**

Introduction-production and processing of fruit crops – fruit purees – fruit powders – canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars – exotic fruits – Nutritions and health benefits of fruit snacks.

UNIT V SENSORY EVALUATION AND PACKAGING   **9**

Introduction- importance of sensory evaluation – Analytical methods-Sensory methods-Sensory Aspect of Processing- Limitations of sensory evaluation- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing-Labelling requirements - Current Issues in Snack Foods Packaging

REFERENCE BOOKS:

1. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Instituteof Industrial Research, Delhi. 2nd Edition 2013.
3. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys BooksLtd. 2008.
4. Lusas, E. W and Rooney, L. W. Snack Foods Processing. CRC Press,1st Edition2001.
5. Panda, H. The Complete Technology Book on Snack Foods, National Instituteof Industrial Research, Delhi. 2nd Edition 2013.
6. Sergio O Serna-Saldivar, Industrial Manufacture of Snack Foods, Kennedys BooksLtd. 2008.

2BTFTOE05	**DESIGN OF FOOD PROCESS EQUIPMENT**	3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to,
- Emphasis the types of materials used in the food processingequipments.
- Discuss about the materials and designing of different storagevessel.
- Explain the importance of reaction vessel and their deskiningtechniques.
- Explain the materials and designing of heat exchanger andevaporators.
- Discuss the importance of dryers in food processingindustries.

COURSE OUTCOMES:

Upon completion of this course, students will be able to,
- Point out the materials suitable for the construction ofequipments.
- List out the vessels used for the foodstorage.
- Categorize the different types of reaction vessel used for differentpurposes.
- Understand the importance of heat exchanger in the designing of food processingequipments.
- Understand the significance of dryers in foodprocessing.
- Understand the basic for design and develop equipments used in food Processing operations.
- To gain technical know-how about the material requirements and design of various equipments needed in Food industries.

UNIT I MATERIALS   9
Metals and non-metals, design of pressure vessels – cylindrical shell –internal and external pressure - under continued loadings. Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes Numerical problem and design of pressure vessel.

UNIT II STORAGE VESSELS   9
Design of storage vessels – Rectangular Tank without stiffeners –with stiffeners – shell design – Numerical problem and design. Design of agitators and baffles. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;

UNIT III REACTION VESSELS   9

Design of Reaction vessels – materials -classification – jackets-Design of vessel shell with half coil – Design of vessel shell with jacket – Numerical problem and design. Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

UNIT IV HEAT EXCHANGERS   9

Design of Heat exchangers – types – materials – Design pressure and temperature- shell design – tubes - Numerical problem. -Design of Equipment. Evaporator: Materials of concentration – types –design- consideration – Design of agitators – power requirements – Design based on Torque – criticalspeed.

UNIT V DRYERS   9

Types - General considerations – Design of Tray dryer, Rotary Dryer, fluidized bed dryer, spray dryer, vacuum dryer, microwave dryer – Material Balance, Thermal energy Requirements , electrical energy Requirements, Performance Indices

REFERENCE BOOKS:

1. Maroulis Z.B. and Saravacos G.D. Food Process Design, Marcel Dekker Inc. ISBN-0824743113,2003.
2. Joshi M.V, "Process Equipment Design", Macmillan IndiaLtd.,1985
3. Coulson ,J.M. and Richardson, J. F,"Chemical Engineering " Butterworth-Heinemnn Elsevier, ISBN-0750644451,2002

22BTFTOE04 AGRICULTURAL WASTE AND BYPRODUCTS UTILIZATION   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students,

- To categorize the types of agriculturalwastes
- To outline the production and utilization ofbiomass
- To explain the various parameters considered to be important in the designing of biogasunits
- To discuss the methods employed in the production of alcohol from agricultural wastes/ byproducts
- To summarize the overall aspects involved in the production of paperboards and particleboards from agriculturalwastes

COURSE OUTCOMES:

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

- List and classify the types of agriculturalwastes
- Collect and generate number of value added products from agriculturalwastes
- Recall the techniques involved in the production and utilization ofbiomass
- Assess the various parameters considered to be important in the designing of biogasunits
- Illustrate the various methods employed in the production of alcohol from the byproductsof agriculturalwastes
- Choose the appropriate materials to produce paperboards and particleboards from agricultural wastes

UNIT I TYPES OF AGRICULTURAL WASTES   9

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, properties of agricultural waste- storage and handling - rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II BIOMASS PRODUCTION AND UTILIZATION   9

Biomass – types – production and utilization Technology used for the utilization of agricultural wastes:Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk Based Gasifier, Heat andSteam from Sugarcane Leaf andBagasse.

UNIT III BIOGAS DESIGN AND PRODUCTION   **9**

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogasplant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogasplant.

UNIT IV PRODUCTION OF ALCOHOL FROM WASTE MATERIALS   **9**

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT V PRODUCTION OF PAPERBOARD AND PARTICLEBOARDS FROM AGRICULTURALWASTE   **9**

Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps-Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

REFERENCE BOOKS:

1. EfthymiaAlexopoulou. Bioenergy and Biomass from Industrial Crops on Marginal Lands. Elsevier, 1st Edition, 2020. (ISBN:9780128188644)
2. NavaniethaKrishnarajRathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1st Edition, 2019. (ISBN:9780128179529)
3. SimonaCiuta,DemetraTsiamis,MarcoJ.Castaldi.GasificationofWasteMaterials.Academic Press, 1st Edition, 2017. (ISBN:9780128127162)
4. Nicholas E. Korres, Padraig O'Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1st Edition, 2013. (ISBN-13:9780415698405)
5. Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1st Edition, 2011. (ISBN-13:9781849025

COURSES OFFERED TO OTHER DEPARTMENTS

BY

SCIENCE AND HUMANITIES

| 22BTSHOE01 | SOLID WASTE MANAGEMENT | 3H-3C |

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course for students is :
- To Make the students conversant with basics of Solid wastes and its classification.
- To Make the student acquire sound knowledge of different treatments of solid wastes.
- To Acquaint the student with concepts of waste disposals.
- To Develop an understanding of the basic concepts of Hazardous waste managements.
- To Acquaint the students with the basics of energy generation from waste materials.
- To understand the chemical principles in the projects undertaken in field of engineering and technology

COURSE OUTCOMES:
Upon completion of this course, the student will be able to:
- Outline the basic principles of Solid waste and separation of wastes
- Identify the concepts of treatment of solid wastes
- Identify the methods of wastes disposals.
- Examine the level of Hazardousness and its management.
- Examine the possible of the energy production using waste materials.
- Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I SOLID WASTE   9
Definitions – Sources, Types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste

UNIT II WASTE TREATMENT   9
Size Reduction – Aerobic Composting – Incineration – batch type and continuous flow type, Medical/ Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT III-WASTE DISPOSAL   9
Sanitary Land Fill Method of Solid Waste Disposal – Land Fill Classficaition, Types, Methods &Siting Consideration – Layout & Preliminary Design of Land Fills – Composition Characteristics generation, Movement and Control of Landfill Leachate & Gases – Environmental Monitoring System for Land Fill Gases, Waste landfill Remediation

UNIT IV-HAZARDOUS WASTE MANAGEMENT   **9**

Definition & Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling - Assessment of Hazardous Waste Sites – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure, Remediaiton, risk assessment.

UNIT V-ENERGY GENERATION FROM WASTE   **9**

Thermal conversion Technologies – Pyrolysis systems, Combustion systems, Gasification systems, Environment control systems, Energy recovery systems. Biological & Chemical conversion technologies – Aerobic composting, low solids. Anaerobic digestion, high solids anaerobic digestion, Energy production from biological conversion products, other biological transformation processes. Chemical transformation processes.

                                        TOTAL : 45

REFERENCE BOOKS:

1. Dara.S.S,Mishra.D.D (2011) A Text book of Environmental Chemistry and Pollution ControlS.Chand and Company Ltd., New Delhi
2. Naomi B. Klinghoffer and Marco J. Castaldi (2013) Waste to Energy Conversion Technology (Woodhead Publishing Series in Energy) Woodhead Publishing Ltd., Cambridge, UK
3. Frank Kreith, George Tchobanoglous (2002) Hand Book of Solid Waste Management-2ndedition McGraw Hill Publishing Ltd., Newyork
4. Shah, L Kanti (Basics of Solid & Hazardous Waste Management Technology Prentice Hall (P) Ltd.,New Delhi
5. Salvatore Caccavale (2016)A Basic Guide to RCRA: Understanding Solid and Hazardous Waste Management 2 edition American Society of Safety Professionals
6. www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.
7. http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/
8. www.alternative-energy-news.info/technology/garbage-energy/
9. nzic.org.nz/ChemProcesses/environment/

22BTSHOE02 **GREEN CHEMISTRY** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course for students is :
- To make the students conversant about the green chemistry
- To make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- To acquaint the student with concepts of green technology.
- To develop an understanding of the basic concepts of renewable energy resources.
- To acquaint the students with the basics information on catalysis.
- To apply the concepts of green catalysts in the synthesis.

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

UNIT I INTRODUCTION TO GREEN CHEMICAL PRINCIPLES   9
Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II ATOM EFFICIENT PROCESSES   9
Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNIT III BIOTECHNOLOGY AND GREEN CHEMISTRY   9
Bio technology and its applications in environmental protection - Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology- Significance of green chemistry-Basic components of green chemistry, Industrial applications of green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV RENEWABLE RESOURCES **9**

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V CATALYSIS IN GREEN CHEMISTRY **9**

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

TOTAL: 45

REFERENCE BOOKS:

1. Sanjay K. Sharma, Ackmez Mudhoo (2010)Green Chemistry for Environmental Sustainability CRC Press , London
2. Ahluwalia V. K. and M.Kidwai (2007) New Trends in Green Chemistry 2nd edition Anamaya publishers., New Delhi.
3. Dr. Sunita Ratan (2012) A Textbook of Engineering Chemistry S.K. Kataria and Sons., New Delhi
4. Mukesh Doble. Ken Rollins, Anil Kumar (2007) Green Chemistry and Engineering, 1st edition Academic Press, Elesevier., New Delhi.
5. Desai K. R. (2005) Green Chemistry Himalaya Publishing House, Mumbai.
6. Matlack A. S. (2001) Introduction to Green Chemistry Marcel Dekker: New York
7. http://www.organic-chemistry.org/topics/green-chemistry.shtm
8. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
9. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.htm
10. http://www.epa.gov/research/greenchemistry/
11. http://www.amazon.in/Green-Chemistry-Catalysis

22BTSHOE03   **APPLIED ELECTROCHEMISRY**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course for students is :
- To make the students conversant with the information on electrochemical material.
- To make the student acquire sound knowledge of conducting polymers.
- To acquaint the student with concepts of Energy storage devices.
- To develop energy storage devices.
- To impart knowledge on basic principles of solar cells and its applications
- To understand the chemical principles in the projects undertaken in field of engineering

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:
- Outline the basic principles of chemistry in **electrochemical material**
- Examine the properties of conducting polymers
- Apply the concepts of electrochemistry in storage devices.
- Identify the concepts of storage devices and its applications.
- Apply the suitable materials for the manufacturing of storage devices.
- Integrate the chemical principles in the projects undertaken in field of engineering and technology

UNIT I METAL FINISHING   9
Fundamental principles, surface preparation-Electroplating of copper, nickel, chromium, zinc and precious metals (gold & silver)- Electroplating for electronic industry- Alloy plating, brass plating- Electro less plating of nickel- anodizing – Electroforming – Electro winning.

UNIT II CONDUCTING POLYMERS AND ELECTROCHEMICALS   9
Lectro-polymerisation- anodic and cathodic polymerization-effect of reaction parameters on the course of the reaction- Electrochemical preparation of conducting polymers- poly acetylene- Electrolytic production of perchlorates and manganese dioxide- Electro organic chemicals- constant current electrolysis.

UNIT III BATTERIES AND POWER SOURCES-I   9
Principles of energy conservation- electrochemical energy conservation- thermodynamic reversibility, Gibbs equation. EMF- battery terminology, energy and power density- Properties of anodes, cathodes, electrolytes and separators- Types of electrolytes.

UNIT IV BATTERIES AND POWER SOURCES-II   **9**

Primary batteries- Dry Leclanche cells, alkaline primary batteries, Lithium batteries, Lithium ion batteries- construction, characteristics, problems associated with system- Secondary batteries- Lead acid, nickel cadmium- Fuel cells- Introduction, types of fuel cells, advantages.

UNIT V ELECTROCHEMICAL MATERIAL   **9**

Solar cells- Preparation of CdS/Cu_2S solar cells by screen printing techniques and their characteristics - Amorphous silicon solar cells - Photo electrochemical cells(PEC) for conversion of light energy to electrical energy - PEC cells based on Cd/Se and Ga/As characteristics.

Total hours: 45

REFERENCE BOOKS:

1. Cynthia G. Zoski (2007) Hand Book of Electrochemistry, Academic Press, Elesevier., UK
2. D.Pletcher and F.C.Walsh, (2012) Industrial Electrochemistry, Chapman and Hall, London
3. Vladimir S. Bagotsky , Alexander M. Skundin , Yurij M. Volfkovich, (2015) Electrochemical Power Sources: Batteries, Fuel Cells, and Supercapacitors, Wiley India Pvt. Ltd
4. Bruno Scrosati (2012) Applications of Electroactive Polymers Chapman & Hall, London
5. K.L. Chopra (2011) Thin Film Devices Application Plenum Press, New York
6. M.M.Baizer (2011) Organic electrochemistry: An introduction and a guide Dekker Inc. New York
7. http://www.anoplate.com/finishes/
8. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/battery.html
9. http://inventors.about.com/od/sstartinventions/a/solar_cell.htm

COURSES OFFERED TO OTHER DEPARTMENTS

BY

COMPUTER SCIENCE AND ENGINEERING

22BECSOE01 **INTERNET OF THINGS** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIES:

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.
  - Analyze different connectivity technologies for IoT.
  - Demonstrate simple applications using Arduino / Raspberry Pi.
  - Analyze different models for network dynamics.
  - Apply data analytics techniques to IoT.
  - Identify 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.

REFERENCE BOOKS:

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/

22BECSOE02   **MACHINE LEARNING**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the students
- To introduce the basic concepts and techniques of Machine Learning.
- To 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
- Identify supervised, unsupervised or semi-supervised learning algorithms for any given problem
- Explain appropriate graph models for solving problem using machine learning
- Identify existing machine learning algorithms to improve classification accuracy / efficiency
- Analyze 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 :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",Second Edition, 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.

REFERENCE BOOKS:
1. Ethem Alpaydin,"Introduction to Machine Learning",3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press,2014
2. Tom M Mitchell,"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/

22BECSOE03	**BLOCKCHAIN TECHNOLOGIES**	3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- 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:

- Explain the design principles of Bitcoin and Ethereum.
- Discuss about Nakamoto consensus.
- Explain the Simplified Payment Verification protocol.
- List the differences between proof-of-work and proof-of-stake consensus.
- Demonstrate blockchain system by sending and reading transactions.
- Explain about Crypto currency Exchange in a distributed application.
- Explain about 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, 2016.
2. 2.Andreas M.Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain" O'Reilly, Media;2 edition, 2017.

REFERENCE BOOKS :

1. Andreas M. Antonopoulos,Gavin Wood "Mastering Ethereum: Building Smart Contracts and DApps" O'Reilly Media; 1 edition, 2018.
2. Don Tapscott, Alex Tapscott "Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies" Penguin; 01 edition, 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.

COURSES OFFERED TO OTHER DEPARTMENTS

BY

B.TECH ARTIFICIAL INTELLIGENCE
AND DATA SCIENCE

22BTADOE01   FUNDAMENTALS OF ARTIFICIAL INTELLIGENGE   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the students
- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

COURSE OUTCOME:
Upon completion of the course, the students will be able to:
- Choose appropriate search algorithms for any solving AI related problems.
- Explain about the different methods of knlowdge representation.
- Discuss about Description logic and conceptional dependencies.
- Compare different Game playing techniques.
- Describe applications using fuzzy logic.
- Demonstrate the basic principles, techniques, and applications of Artificial Intelligence.

UNIT I   9
Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II   9
Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, in ferencing, monotonic and non monotonic reasoning. Introduction to prolog.

UNIT III   9
Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.

UNIT IV 9

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alpha-beta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning.

UNIT V 9

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models.

TOTAL: 45

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

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

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

22BTADOE02   **FUNDAMENTALS OF DATA SCIENCE**   **3H-3C**

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

COURSE OBJECTIVES:
The goal of this course is for the students
- To study the basic concepts of Data Science and data life cycle
- To understand the theoretical and mathematical aspects of Data Science models
- To learn common random variables and their uses, and with the use of empirical distributions
- To obtain the knowledge in data management tools
- To explore the major techniques for data science

COURSE OUTCOMES:
Upon completion of this course the students will be able to:
- Explain the key concepts in data science and data processing.
- Describe about sampling and probabilistic models
- Discuss about data normalization and data management tools.
- Identify the difference between supervised and unsupervised machine learning techniques.
- Explain about the different analytics used in business intelligence.
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

UNIT I   **9**
The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre-processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT II   **9**
Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

UNIT III   **9**
Data Normalization (z-values, transforms) –Random processes –Data Management: Tools for Data Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

UNIT IV   **9**
Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse–Machine Learning- Supervised Learning, Unsupervised Learning.

UNIT V **9**

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non commercial cloud service providers.

TOTAL: 45

TEXT BOOKS:
1. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.
2. Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.

REFERENCE BOOKS:
1. Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition, 2015.
2. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly Publication, First Edition, 2017.
3. Dawn Griffiths, Head First Statistics, O'Reilly Publication, First Edition, 2008.

WEBSITES:
6. https://www.inferentialthinking.com/chapters/intro
7. https://www.openintro.org/stat/
8. https://swayam.gov.in/nd1_noc20_cs36/preview
9. https://swayam.gov.in/nd1_noc19_cs60/preview
10. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/

22BTADOE03   **INTERNET PROGRAMMING**   **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course 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:

- Explain the advanced concepts& techniques of the Internet and Java.
- Analyze the requirements for and create and implement the principles of web page development
- Explain the concepts of PERL
- Demonstrate client side programming using java applets
- Describe internet telephony based upon advanced concepts
- Apply knowedge of java applets and java scripts fr developing application

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 PERL   9

Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling- JavaScript- Basics, Statements, comments,

variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies- Definition of cookies, Create and Store a cookie, 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:

3. Robert W. Sebesta, "Programming the World Wide Web", Pearson Education, 2016
4. Paul Deitel, Harvey Deitel and Abby Deitel, "Internet and World Wide Web-How to Program", 5th Edition, 2018.

REFERENCE BOOKS:

3. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2018.
4. Rahul Banerjee, Internetworking Technologies, An Engineering Perspective, PHI Learning, Delhi, 2019.

WEBSITES:

4. https://nptel.ac.in/courses/106/105/106105084/
5. https://supportline.microfocus.com/Documentation/books/sx22sp1/piover.htm
6. https://www.geeksforgeeks.org/internet-and-web-programming/

| 22BTADOE04 | ROBOTICS AND AUTOMATION | 3H-3C |

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the students
- To introduce the functional elements of Robotics
- To impart knowledge on the forward and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce about hydraulics system
- To introduce the concept of automation

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Explain the basic concept of robotics and automation in robotics industries.
- Identify planning and control process in mobile robots..
- Discuss about vision based controls and their applications.
- Demonstarte the working of a hydraulic system.
- Explain about Pneumatic logic circuits and choose suitable circuits.
- Apply advanced robotics principles to solve real time problems.

UNIT I   **9**
Introduction – Actuators – Sensors – Rigid body – coordinate systems – Kinematics – Forward Kinematics & Inverse Kinematics – Velocity Kinematics – Angular velocity – Linear velocity –Singularity – Force and torque

UNIT II   **9**
Dynamics – Mobile Robots – Planning and Control – Path & Trajectory planning – Probabilistic Roadmaps – Localization.

UNIT III   **9**
Basics of probability – Kalman Filtering – Extended Kalman – Particle filter – Localization – Computer Vision – Vision Based Controls.

UNIT IV   **9**
Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors – Fluid accessories

UNIT V   **9**
Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders

TOTAL: 45

TEXT BOOKS:
1. **"**Robot Modeling and Control**",** Mark W. Spong, Seth Hutchinson and Vidyasagar. M, Wiley Publishers, Second Edition, 2020.
2. **"**Robot Building for Beginners**",** David Cook, Apress Publishers, Third Edition, 2015.

REFERENCE BOOKS:
1. **"**Industrial Automation and Robotics**",** Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
2. **"**Industrial Robotics**",** Groover. M.P, Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017
3. **"**Embedded Systems & Robotics**",** Ghoshal. S, Cengage Learning, First Edition, 2009.
4. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

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

COURSES OFFERED TO OTHER DEPARTMENTS

BY

BE COMPUTER SCIENCE AND DESIGN

22BECDOE01   INTRODUCTION TO 3D MODELLING AND ANIMATION   3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:
The goal of this course is for the students
- To provide skills in 3D Modelling
- To gain knowledge in creating animation
- To practice with Max tool to design objects
- To understand the key features of design 3D models
- To understand the computer animation
- To understand the setting up of key frames and object properties.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
- Describe the Computer-based 2D, 3D Animation & Getting Started with Max
- Illustrate the animationed objects with simulation and effects
- Perform moving and scaling the keyframes on timelines
- Identify the Computer-based objects spline
- Use the animationed objects with modeling with patches
- Apply and understand the basic animation technique

UNIT I   **9**

Computer-based Animation-Definition of Computer-based Animation-Basic Types of Animation: Real Time - Non-real time -Definition of Modeling - Creation of 3D objects - 2D Splines & Shapes& compound object- Understanding 2D Splines & shape - Extrude & Bevel 2D object to 3D- Understanding Loft & terrain - Modeling simple 4 objects with splines.

UNIT II   **9**

Modelling- Understanding morph- scatter- conform- connect compound objects- blobmesh- Boolean – Proboolean&procutter compound object. 3DModelling -Modeling with Polygons- using the graphite- working with XRefs- Building simple scenes- Building complex scenes with XRefs- using assets tracking- deforming surfaces & using the mesh modifiers- modeling with patches & NURBS

UNIT III   **9**

Keyframe Animation -Creating Keyframes- Auto Keyframes- Move & Scale Keyframe on the timeline- Animating with constraints & simple controllers- animation Modifiers & complex controllers- function curves in the track view- motion mixer etc.

UNIT IV   **9**

Simulation & Effects -Bind to Space Warp object- Gravity- wind- displace force object- deflectors- FFD space warp- wave- ripple- bomb- Creating particle system through parray- understanding particle flow user interface- how to particle flow works- hair & fur modifier- cloth & garment maker modifiers etc. Getting Started with Max-Exploring the Max Interface- Controlling & Configuring the Viewports-

UNIT V   **9**

Customizing the Max Interface & Setting Preferences-Working with Files- Importing & Exporting- Selecting Objects & Setting Object Properties- Duplicating Objects- Creating & Editing Standard Primitive & extended Primitives objects- Transforming objects- Pivoting- aligning etc.

                                                          TOTAL:45

TEXT BOOKS:
1. Lance Flavell Beginning Blender: Open Source 3D Modeling, Animation, and Game Design Apress 2010
2. Michael E. Mortenson 3D Modeling, Animation, and Rendering Create space 2010

REFERENCE BOOKS:
1. Oliver Villa Learning Blender: A Hands- On Guide to Creating 3D Animated Characters"Addition Wesley Learning Second Edition 2014
2. Michael G.3D Modelling and Animation Igi Publishing 2011

WEBSITES:
1. www.web.iit.edu/sites/web/files/departments/academic-affairs/academic-resource- center /pdfs/3dsmax_interface.pdf
2. 2.www.dl.softgozar.com/Files/Ebook/3D_Animation_Essentials_Softgozar.com.pdfw ww.nptel.ac.in/courses/106/102/106102065/
3. www.tutorialspoint.com/3ds_max_for_beginners_3d_modeling_fundamentals/index.asp

22BECDOE02 **DIGITAL PHOTOGRAPHY** **3H-3C**

Instruction Hours/week: L:3 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 understand the basics of film and photography techniques.
- To familiarize the concepts of image transportation in digital platforms.
- To impart knowledge in digital capture and digital camera.
- To enhance skills in scanning and image editing.
- To enhance capturing and scanning skills
- To describe the concepts of digital manipulation and digital output.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
- Explain the general function of digital photography, digital camera and imageediting.
- Apply the functional knowledge of photographic history and theory
- Identify the relationship of photography to the visual disciplines, and itsinfluence on culture.
- Apply the functional knowledge of representation of images.
- Use experimental and manipulative techniques, candid and contrivedimagery
- Use experimental technique for documentary photography, archival processing, and interpretive studies.

UNITI 9
Introduction to Digital Photography: Understanding film and paper photography - Learning about the digital revolution – Digital photography over film photography - Computers as photographic tools. Digital Basics: Raster and Vector method - Representation of digital image.

UNIT II 9
Digital Platform: Hardware and System Software - Windows Operating System - Concept of Internet - Image transportation. Digital Capture: Digital Image formation - Capturing Method: Digital camera – Scanner – Frame grabber.

UNIT III 9
Digital camera: Understanding how digital cameras work – Digital camera types: Floppy Disc type, Flash Card type, Hard Disc type – Overview of current digital cameras.

UNIT IV   **9**

Scanning: Scanners as input devices- Working of a Scanner– Scanning procedure – Scanning resolution. Image editing: Image editing through image editing softwares like Adobe Photoshop – Adjustment of Brightness, Contrast, Tonal and Colour Values.

UNITV   **9**

Experimenting with Level and Curve. Image size – Resolution – Selection tools and techniques – History – Retouching tools – Layers – Photo mounting techniques – Incorporation of text into picture. Digital Manipulation - Digital Output.

         TOTAL:45

TEXT BOOKS:
1. Scott Kelby The Digital Photography Book Pearson Education,Second Edition,2020
2. Tom Ang Digital Photography MasterclassDorling Kindersley Limited,First Edition 2013

REFERENCE BOOKS:
1. Ken Browar The Art of Movement Running Press,First Edition 2016
2. Michelle BogrePhotography as Activism Images for Social Change Focal Press,First Edition 2012

WEBSITES:
1. www.photography.tutsplus.com/
2. www.cs.princeton.edu/courses/archive/fall13/cos429/lectures/02-imaging.pdf
3. www.format.com/magazine/resources/photography/still-life-photography-ideas-and-tips
4. www.deepmlblog.wordpress.com/2016/01/03/how-to-break-a-captcha-system/

22BECDOE03   **MOBILE APPLICATION DEVELOPMENT**   **3H-3C**

Instruction Hours/week: L:3 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 develop knowledge about mobile application development.
- To understand the building blocks of mobile apps.
- To gain knowledge about graphics and animations in mobile apps.
- To know about testing of mobile apps.
- To learn the advantages and limitations of development frameworks.
- To understand more about how to distribute apps on mobile market place.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, understand and explain the overview of android with its states and lifecycle.
- Apply the mobile applications for e-marketing in Android and iPhone.
- Explain mobile databases and various types of testing.
- Model simple android applications.
- Discuss alternative mobile frameworks, and different programming platforms.
- Apply modern tools to create android applications in different field

UNIT I   **9**

Mobility landscape – Mobile platforms – Mobile apps development – Overview of android platform – Setting up the mobile app development environment along with an emulator – A case study on mobile app development.

UNIT II   **9**

App user interface designing – Mobile UI resources (Layout, UI elements, Draw- able, Menu) – Activity – States and life cycle – Interaction amongst activities – App functionality beyond user interface – Threads, async task, services – States and lifecycle, Notifications, Broadcast receivers.

UNIT III   **9**

Telephony and SMS APIs – Native data handling – On-device file I/O – Shared preferences – Mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). Graphics and animation – Custom views – Canvas – Animation APIs – Multimedia – Audio/video playback and record – Location awareness and native hardware access (sensors such as accelerometer and gyroscope).

UNIT IV   **9**

Debugging mobile apps – White box testing – Black box testing and test automation of mobile apps – JUnit for android, robotium and monkey talk. Versioning – Signing and packaging mobile apps – Distributing apps on mobile market place. Introduction to objective C – iOS features

UNIT V   **9**

UI implementation – Touch frameworks – Location aware applications using core location and map kit – Integrating calendar and address book with social media application – Using WIFI – iPhone market place – Drawbacks on iOS over Android – Various stores available in online market – Configuration of mobile app – Online ecommerce transaction – E-booking transaction.

TOTAL : 45

TEXT BOOK:
   1. Anubhav Pradhan and Anil V Deshpande, Composing Mobile Apps Wiley,First Edition 2020.

REFERENCE BOOK:
   1. Barry Burd,Android Application Development All-in-one for Dummies, John Wiley, First Edition 2012

WEBSITES:
   1. www.impetus.com/mobility
   2. www.cise.ufl.edu/~helal/classes/f10/notes/intro_to_mobile.ppt
   3. www.diva– portal.org/smash/get/diva2:626531/FULLTEXT01.pdf
   4. www.law.fsu.edu/library/databases/ppt/Androidapps.ppt
   5.www.infosys.com/flypp/resources/Documents/mobile-application-testing.pdf

LIST OF MANDATORY COURSES

22BECS351   PC HARDWARE ASSEMBLY AND TROUBLE SHOOTING   3H

Instruction Hours/week: L:0 T:0 P:3   **Marks: :100**

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 OUTCOMES:

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
- Explain various concepts of hardware and its interface and control
- Demonstrate about basic installation of PC.
- Explain Various faults and failures are identified and troubleshooting in detail
- Illustrate hardware, interfacing, maintenance and troubleshooting of PC

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.

REFERENCE BOOKS:
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

22BTAD551 **WEB SCRIPTING** **3H**

Instruction Hours/week: L:0 T:0 P:3 **Marks: 100**

PRE-REQUISITES: None

COURSE OBJECTIVES:
The goal of this course is for the students

- To understand HTML tags, attributes, URL encoding.
- To know about CSS tags and text styles.
- To study the designed form validation by java script.
- To understand the behavior of the web pages.
- To have the knowledge of AJAX and JSON.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Create web pages.
- Describe the presentation of attractive web page.
- Apply validation of form data in javascript.
- Define arrays and functions in javascript.
- Ilustrate working with AJAX and JSON.
- Create XML documents and Schemas.

UNIT I   9

Introduction: Internet – HTTP – http-server – HTML – HTML versions – Unicode Transformation Format (UTF) – HTML5 Resources – Doctype in html – html5 tags. Web Page: Design consideration – Tag structure – Tags(html, head, title, body, meta). Listing Values: Unordered – Ordered and definition list. Images: Web page background – resizing – alternate text. Hyperlink: Text link – Image link – Link with in document – Target – Email link – Tel link. Table: Table – Header – Footer – Body – Caption – Row – Cells and properties of table. iFrame: Insert iframe – Adjusting height and width. Form and input controls: About forms – Textbox – Password – Textarea – Radio button – Checkbox – Menu list – Submit – Reset – Changing tab order. Multimedia: Embed audio – Video.

UNIT II   9

Cascading Style Sheets(CSS): Introduction – Syntax for creating style – Comments –Inline style – Internal and external style sheet. Text styling: Bold – Italic – Decoration – Font-family – Font-size – Letter space – Line-space – Text transformation – Alignment – Fore color – Sizing element and text wrapping. Backgrounds: Colors and images Element Control: Visibility – Display – Grouping – Positioning – Floating – Psuedo classes and elements. Box-model: Border – Margin – Padding – Outline – Grid system(960px, 1200px).

Table styling: Border – Collapse border – Table width – Cell height, padding. Transformation, Transition and animation, Font-face.

UNIT III   9

Responsive design javascript: Introduction – Need of javascript – Javascript vs Java – ECMAScript. Console: Log – Error – Warn. Grammer and types: Syntax and comment – Declaration – Scope of variable – Constant – Literals. Operators and expressions: Assignment – Comparisions – Arithmetic – Bitwise –Logical – Ternary and misc. Numbers, Date, String. Control flow and iteration: If..else – Switch – For – While – Do-while – For in – For of – Break/continue.

UNIT IV   9

Javascript arrays: Indexing – Types – Sorting – Slicing and other functions. Objects: Defining object and its properties – Defining methods – Prototype-based OOP – Creating object hierarchies and inheritance. Functions: Defining function – Invoking functions – Parameters (arguments object) – Call – Apply – Closures – IIFE. JSON: Raw JSON – Syntax – Parse – Stringify. BOM: Window – Screen – Location – History – Navigator – Popup alert – Timing – Clock cookie and local Storage.

UNIT V   9

DOM: document selector – Changing HTML (html, text, attribute, style) – Adding and deleting elements – Form validation. DOM Events: Mouse – Key board – Form – Drag – Print and touch Events. AJAX: Introduction – Work flow – XML http request object (for cross browser) – XML http request properties and methods.

TOTAL: 45

LIST OF EXPERIMENTS:
1. Programs using HTML formatting tags.
2. Programs using HTML Table and Form tags.
3. Programs using HTML iFrame and Multimedia tags.
4. Programs based on the different ways of stylesheet insertion.
5. Programs using CSS2.
6. Programs using CSS3.
7. Programs using Grid System.
8. Programs using JavaScript Arrays, Strings, Objects, and Functions.
9. Programs using OOPs and Prototype.
10. Programs using JavaScript Browser Object Model.
11. Programs using JavaScript Form Validation.
12. Programs using AJAX (XML Http Request).

TEXT BOOKS:
1. Thomas A Powell, HTML and CSS: The Complete Reference, Tata McGraw-Hill, Fifth Edition, 2010
2. Mike McGrath, JavaScript: Create functions for the web, Tata McGraw-Hill, Fifth Edition, 2012

REFERENCE BOOKS:

1. Jeremy McPeak and Paul Wilton, Beginning JavaScript, Wiley-India, Fifth Edition, 2015
2. Larry Ullman, Modern JavaScript: Develop and Design, Pearson Education Inc., First Edition, 2012
3. Zak Ruvalcaba and Anne Boehm, Murach's: HTML5 and CSS3, Training and Reference, 2012

WEBSITES:

1. www.nptel.ac.in /courses/106105084/25.
2. www.w3.org/TR/2000.
3. www.tutorialspoint.com/Css.
4. www.build-your-website.co.uk/starting-scripting/
5. www.github.com/processing/p5.js.

SEMESTER IV

22BTAD451   **INTERNSHIP - I**   **2H-1C**

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

PRE- REQUISITES: None
COURSE OBJECTIVES:

The goal of this course is for the students
- To self motivated and diligent professional
- To involve new learning, expanded growth or improvement on the job
- To enable the students to develop their engineering skills

COURSE OUTCOMES:

Upon completion , the students will be able to:
- Develop written and oral communication skills in both technical and non-technical environment and use ICT for effective presentation of the study/internship
- Identify the mathematical concepts, science concepts, Engineering concepts and modern engineering tools necessary to communicate the identified Study /internship
- Explain modern engineering trends in the identified study and engage in research literature
- Apply the knowledge of engineering concepts to effectively communicate the Results from various publications
- Demonstrate the need and abide by professional ethics
- Identify the role of engineering concepts on environmental, cultural and social concepts

22BTAD651	INTERNSHIP - II	**SEMESTER IV** **2H-IC**

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

PRE- REQUISITES: None
COURSE OBJECTIVES:
The goal of this course is for the students

- To self motivated and diligent professional
- To involve new learning, expanded growth or improvement on the job
- To enable the students to develop their engineering skills

COURSE OUTCOMES:
Upon completion , the students will be able to:

- Develop written and oral communication skills in both technical and non-technical environment and use ICT for effective presentation of the study/internship
- Identify the mathematical concepts, science concepts, Engineering concepts and modern engineering tools necessary to communicate the identified Study /internship
- Explain modern engineering trends in the identified study and engage in research literature
- Apply the knowledge of engineering concepts to effectively communicate the Results from various publications
- Demonstrate the need and abide by professional ethics
- Identify the role of engineering concepts on environmental, cultural and social concepts

PROJECT WORK

	SEMESTER IV
22BTAD691 **MINI PROJECT**	**2H-1C**

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

PRE- REQUISITES: None
COURSE OBJECTIVES:
- To provide an opportunity to transform theoretical knowledge acquired into practice.
- Sufficient confidence to carry out final year projects.
- An opportunity to conceptualize an idea into a system or product based on the theoretical knowledge gained in the specific domain.
- Knowledge and practice in writing project report and its presentation to the expert committee.

COURSE OUTCOMES:

Upon completion , the students will be able to:
- Apply and analyze the engineering concepts to solve the identified research work through literature survey and function effectively as an individual to engage in independent learning.
- Identify the list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and societal need and validate the results of the identified work leading to publications
- Explain about professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team, Communicate effectively through presentation and demonstration of the project and preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project

Guidelines
- Maximum of 4 students per group will do the project.
- Each batch will select and carry out their project under the guidance of a teaching
  faculty.
- The project will be evaluated by the guide and coordinator nominated by the HOD as per the following details:

Category	Marks	Evaluated by
Project Selection and Design	20	Guide
Implementation and Validation	40	Guide and Coordinator
Project Report	20	
Viva-Voce	20	

SEMESTER IV

22BTAD791   **PROJECT WORK – PHASE I**   **8H-4C**

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

PRE- REQUISITES: None

COURSE OBJECTIVES:
- Identification of a real life problem in thrust areas
- Proposing different solutions for the problems based on literature survey
- Developing a mathematical model for solving the above problem
- Finalization of system requirements and specification
- Future trends in providing alternate solutions
- Consolidated report preparation of the above

COURSE OUTCOMES:

Upon completion , the students will be able to:
- Apply and analyze the engineering concepts to solve the identified research work through literature survey and function effectively as an individual to engage in independent learning.
- Identify the list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and societal need and validate the results of the identified work leading to publications
- Explain about professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team, Communicate effectively through presentation and demonstration of the project and preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project

SEMESTER IV

22BTAD891   **PROJECT WORK & VIVA VOCE – PHASE II**   **16H-8C**

Instruction Hours/week: L:0 T:0 P:20   **Marks:100**

COURSE OBJECTIVES:

- The objective of the project work is to enable the students in convenient groups of not more than members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Twelve periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

COURSE OUTCOMES:

Upon completion , the students will be able to:

- Apply and analyze the engineering concepts to solve the identified research work through literature survey and function effectively as an individual to engage in independent learning.
- Identify the list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and societal need and validate the results of the identified work leading to publications
- Explain about professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team, Communicate effectively through presentation and demonstration of the project and preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project