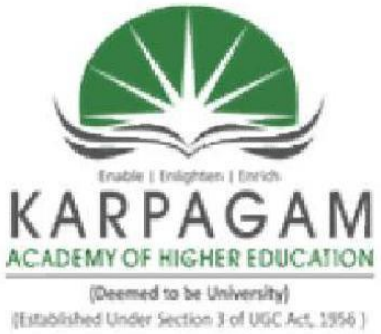
B.Tech. ARTIFICAL INTELLIGENCE AND DATA SCIENCE

SYLLABI 2024-2025

(CHOICE BASED CREDIT SYSTEM)

Department of Artificial Intelligence and Data Science

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.

KARPAGAM ACADEMY OF HIGHER EDUCATION

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

Eachanari, Coimbatore-641 021. INDIA

FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

REGULAR PROGRAMME

REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

These regulations are effective from the academic year 2024 – 2025 and applicable to the candidates admitted to B. E. / B. Tech programmes. during 2024 - 2025 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 have 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 University 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.

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 University 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 in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology. **OR** Passed B.Sc. Degree from a recognizedUniversity as defined by UGC, with at least 45%marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject. **OR** Passed D.Voc. Stream in the same or allied sector. (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)
2	B. E. Civil Engineering	
3.	B. E. Computer Science and Engineering	
4.	B. E. Computer Science and Engineering (Cyber security)	
5.	B. E. Electrical and Electronics Engineering	
6.	B. E. Electronics and Communications Engineering	
7.	B. E. Mechanical Engineering	
8.	B. Tech. Artificial Intelligence and Data Science	
9.	B. Tech Bio - Technology	
10.	B. Tech Food Technology	

1.3 Migration from other University

Candidates who are willing to migrate to Karpagam Academy of Higher Education for admission to their next semester of B. E./B. Tech programme may get admitted from 2nd semester onwards upto 7th semester. 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 Competent authority, he/she has undergone. Equivalence Certificate shall be provided by the respective Head of the Department of Karpagam Academy of Higher Education.

2 . PROGRAMMES OFFERED

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

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

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

3. MODE OF STUDY

3.1 Full-Time:

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

3.2 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, internship, 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.
- 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 core, Professional Electives, Open Electives, Value added courses, Humanity Sciences, Basic sciences & Engineering sciences). A course designated as hard core for a particular programme of study must invariably be completed by

the student to receive the degree in the programme. The Hardcore courses cannot be substituted by another courses. Students can exercise their choice among a set of soft-core courses from the list of Soft core courses specified for each Programme of study. The student should meet the criteria for prerequisites to become eligible to register for that course. The student should request for the course for every semester within the first week of semester. Maximum no of students to be registered in each course shall depend on availability of physical facilities, classroom availability and lab capacity. Registration of already requested courses by students in previous semester is not allowed.

4.2 Each course is normally assigned certain number of credits.

No. of credits per lecture period per week	1
No. of credits per tutorial period per week	1
No. of credits for 3 periods of laboratory course per week	2
No. of credits for 3 periods of project work per week	2
No. of credits for 2 weeks of field project/internship training during semester vacations	1

4.3 In every semester, the curriculum shall normally have a blend of theory courses not exceeding 6 and practical courses not exceeding 4.

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 except Tamil/French.

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 interested students would be trained, for the holistic development to enhance employment opportunity.

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

5. DURATION OF THE PROGRAMME

5.1 The prescribed duration of the programme shall be

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

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

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

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

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

6.2 A candidate who has secured attendance between 65% and 74% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) shall be given exemption from prescribed minimum 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 concerned. However, the candidate has to execute a one-time bond (Stamp paper) with an undertaking from the parent and the student that this situation never arises in the future.

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

7. CLASS ADVISOR

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

8. CLASS COMMITTEE

8.1. Every class shall have a class committee consisting of teachers of the class concerned, Maximum of six student representatives [boys and girls] and the concerned Head of the Department. It is like the ‘Quality Circle’ with the overall goal of improving the teaching-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 weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar, etc.) the breakup of marks for each experiment / exercise /module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Solving problems experienced by students in the class room and in the laboratories.
- Informing the student representatives, the academic schedule, including the dates of assessments and the syllabus coverage for each assessment.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any and requesting the teachers concerned to provide some additional academic support.

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

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

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

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

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

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

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a “Course Committee” comprising all the teachers handling the common course with one of the nominatedas 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 course will be continuously assessed by the respective teachers as per the guidelines given below:

a. THEORY COURSES

S. No.	CATEGORY	MAXIMUM MARKS
1.	Assignment	5
2.	Seminar *	5
3.	Attendance	5
4.	Test – I	12.5
5.	Test – II	12.5
Continuous Internal Assessment: TOTAL		40

*Evaluation shall be made by a committee.

PATTERN OF TEST QUESTION PAPER (Test I & II)

INSTRUCTION	REMARKS
Maximum Marks	100
Duration	3 Hours
Part – A	Question no. 1 to 10 Two Mark Questions, covering 2.5 units of the syllabus. **(10 x 2= 20 Marks)**
Part- B	Question 11 to 15 will be of either-or type, covering 2.5 units of the syllabus. Each Question may have subdivision. **(5 x 16=80 Marks).**

b. PRACTICAL COURSES:

S. No	CATEGORY	MAXIMUM MARKS
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Internal Practical Assessment	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.

c. INTEGRATED THEORY AND PRACTICAL COURSES:

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

S.No.	CATEGORY	MAXIMUM MARKS
1.	Observation	5
2.	Record	5
3.	Attendance	5
4.	Test –I	12.5
5.	Test –II	12.5
Continuous Internal Assessment: TOTAL		40

The external evaluation of integrated practical component from End semester Examination is conducted 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 andpractical 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 normally in-house. However, as a special case, if a student is able toget a project from a government organization or private or public sector company, the student may be permitted to do his/her project work in that institution/research organization/industry.

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 course in a semester and passed the Examination is not entitled to reappear in the same course of the semester for improvement of grade.

12. END SEMESTER EXAMINATION

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

PATTERN OF ESE QUESTION PAPER:

INSTRUCTION	REMARKS
Maximum Marks	100
Duration	3 Hours
Part – A	Question no. 1 to 10 Two Mark Questions, covering all the 5 units. **(10 x 2= 20 Marks)**
Part- B	Question 11 to 15 will be of either or type, covering Five units of the syllabus. Each Question may have subdivision. **(5 x 16=80 Marks).**

13. PASSING REQUIREMENTS

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

13.1.1 The minimum marks to pass for Value Added Course /Skill Development 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 ESE of a particular course, 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 were nhe/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 CIA of a particular course, 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 /Skill Development course, he/she has to appear for the tests when course is conducted subsequently.

13.4 CREDIT TRANSFER THROUGH MOOC

The MOOC coordinator shall assist the students for the online courses offered by the SWAYAM platform periodically and also monitor their course.

Open Elective Courses shall be considered for the credit transfer. Only courses available in SWAYAM platform (which are totally beyond the scope of the programme under consideration) shall be considered as open elective courses and get completed at any time within the duration of the Programme before the last semester. This is a mandatory requirement for completion of the programme. At least 2 Open Electives (3 credits each) to be completed for the credit transfer.

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.

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

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

14.3 REVALUATION

Revaluation and Re-totaling are allowed on representation. A candidate can apply for revaluation of his/her semester Examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Department and Dean. A candidate can applyfor 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.
- The award of the degree must be approved by the Board of Management of Karpagam Academy of Higher Education.

16. CLASSIFICATION OF THE DEGREE AWARDED

16.1 A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses in his/her first appearance within the specified minimum number of semesters (vide Clause 5.1) securing a CGPA of not less than **7.5** 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 forBE(Honors), B.Tech.(Honors). If, he / she has passed all the courses in the first appearance and holds / maintains a CGPA of 7.5 upto VIII 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(Honors), B.Tech.(Honors). However, if he / she fails in securing 20 additional credits but maintains CGPA of 8 and above is not eligible for Honors degree but eligible for First class with Distinction.

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

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

17. 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.

18. 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 in to 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.

19. ADVANCED LEARNERS, ON-DEMAND EXAMINATION

Students
1. Who secure 7.5 CGPA and maintain an attendance of 75% in every semester
2. Clear all the courses in their first appearance itself are referred to as advanced learners. When a student fails to maintain any of the above conditions at any given time, he cannot be an advanced learner further.

When a student fails to maintain any of the above conditions at any given time, he cannot be an advanced learner further. These students can request for an on-demand examination for the courses in their forthcoming semester(s). These students on prior permission can appear for such examinations well in advance and complete the entire courses well before the prescribed period of study and can progress for a full time Research Project/Internship/Minor Project during the remaining prescribed period of study. The Internal and External examinations will be conducted for these courses as like the other courses. One or more faculty mentors will be allocated based on the number of students/courses enrolled for the on-demand examination.

Also, these advanced learners can also register for online courses from NPTEL/SWAYAM/SWAYAM Plus portals on prior and proper approval from the department. The credits earned from those courses will be transferred to the mark statement of the students.

20. REVISION OF REGULATION AND CURRICULUM

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

21. CREDIT TRANSFER THROUGH ONLINE / INTERNATIONAL STUDIES

Students are encouraged to enroll in courses offered by MOOC platforms and international institutions of higher learning, either virtually or in person. The equivalent credits for these courses will be determined by a committee named Subject Equivalency Committee comprising the Dean, Head of Department (HoD), and one faculty member nominated by the Vice Chancellor. The committee's decision will be submitted for ratification/approval by the Board of Studies (BoS) and the Academic Council. Additionally, the equivalent grade points for marks/grades/grade points awarded by various MOOC platforms and international institutions of higher learning will be determined by a committee named Grade Equivalency Committee duly constituted by the Vice-Chancellor. The decisions of this committee will also be submitted for ratification/approval by the Academic Council. This shall be approved to be implemented from the even semester of the academic year 2024-25.

22.KARPAGAM INNOVATION AND INCUBATION COUNCIL (KIIC)
(A Section 8 Company)

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

22.1 Norms to Student Start-Ups

a) Any (UG/PG /(Ph.D.) Research scholars, student, right from the first year of their programme is allowed to set a startup (or) work part time/ full time in a startup or work as intern in a startup
b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their programme is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation(case to case basis). Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC
c) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.
d) Students engaged in startups affiliated with the KIIC or those who work for them may be exempted from KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies Potential Students who have been incubated at KIIC may be permitted to take their University semester exams even if their attendance is below the minimum acceptable percentage, with the proper authorization from the head of the institution.

    (On case-to-case basis depends upon the applicability strength, societal benefits and quality of the Innovation and Subsequent engagement of the students with the/ her business)
e) Any Students Innovators/entrepreneurs are allowed to opt their startup in place mini project /major project, /seminar and summer training etc. (In plant training, Internship, value added Course.). The area in which the student wishes to launch a Startup may be interdisciplinary or multidisciplinary.
f) Student's startups are to be evaluated by Expert committee, formed by KIIC and KAHE.

22.2 Guide lines to award Credits/ Marks to a Student startup

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

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

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

List of PEOs, POs and PSOs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. To establish as professionals by acquiring technological advancements and innovations in AI, data science, and related fields.

II. To demonstrate leadership and teamwork skills, effectively working in multidisciplinary teams to solve complex problems.

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

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

2) **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.

3) **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.

4) **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.

5) **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.

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

7) **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.

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

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

10) **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.

11) **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.

12) **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: Apply principles of artificial intelligence, machine learning, and data science to design and develop solutions for real-world problems across various industries.

2: Demonstrate proficiency in handling large datasets and applying techniques for data analysis and interpretation using statistical tools and programming languages.

MAPPING:

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

Credit Distribution:

S.No.	Course Category	Credit Distribution	Percentage
1	Basic Science	28	17.2
2	Engineering Science	23	14.1
3	Humanities and Science	14	8.6
4	Professional Core	52	32.0
5	Professional Elective	18	11.0
6	Mandatory Course	2	1.2
7	Open Elective	6	3.7
8	Skill Development	2	1.2
9	Project Work	18	11.0
	Total	163	100

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

FACULTY OF ENGINEERING

UG PROGRAM (CBCS) – B.Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(2024-2025 Batch and Onwards)

SEMESTER I												
COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PO	PSO	L	T	P		CIA	ESE	TOTAL	
24BTCC101	Technical English I	HS	5,8,9,10 12	2	3	0	0	3	40	60	100	1
24BTCC102	Matrices and Calculus	BS	1,2,3,12	2	3	1	0	4	40	60	100	4
24BTCC141	Environmental Chemistry(EC)	BS	1,2,3 4,6,7 8,9,12	2	3	0	2	4	40	60	100	6
24BTAD142	Physics for Computing Engineers	BS	1,2,3 9,12	2	3	0	2	4	40	60	100	9
24BTAD143	Python Programming	ES	1,2,3,4 9,10,12	2	3	0	2	4	40	60	100	12
24BTCC111	Communication Skills Laboratory	HS	5,8,9 10,12	2	0	0	2	1	40	60	100	15
24BTMC151	Women Safety and Security*	MC			1	0	0	0	100	-	100	217
24BTMC152	தமிழர் மரபும் பண்பாடும்*	MC			1	0	0	0	100	-	100	219
SEMESTER TOTAL					**17**	**1**	**8**	**20**	**440**	**360**	**800**	

SEMESTER II												
COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PO	PSO	L	T	P		CIA	ESE	TOTAL	
24BTCC201	Technical English II	HS	8,9 10,12	2	3	0	0	3	40	60	100	**17**
24BTCC202A/ 24BTCC202B/ 24BTCC202C	Graph Theory/ Computational Methods for Engineers/ Transforms and its Applications	BS	1,2,3 12	2/2/2	3	1	0	4	40	60	100	20,23,25
24BTAD203	Fundamental of Data Science	ES	1,2,3,9 10,12	2	3	0	0	3	40	60	100	28

24BTAD241	Digital Logic Circuits	**ES**	1,2,3,8 9,10 11,12	1	3	0	2	4	40	60	100	30
24BTCC242	Web Technology	**ES**	1,2,3,5 9,10,12	1	3	0	2	4	40	60	100	33
24BTCC243	Data Structures and Algorithms	**ES**	1,2,3,9 10,12	1	3	0	2	4	40	60	100	36
24BTMC251	Yoga *	**MC**			0	0	4	2	100	-	100	221
24BTAD291	Application Development I *	**PW**			0	0	2	1	100	-	100	229
SEMESTER TOTAL					**18**	**1**	**12**	**25**	**440**	**360**	**800**	

SEMESTER III

COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	P		**CIA**	**ESE**	**TOTAL**	
24BTAD301A/ 24BTAD301B	Discrete Mathematics and Stochastic Process/Numerical Methods	**BS**	1,2,12/ 1,2,3,12	2/2	3	1	0	4	40	60	100	39,42
24BTAD302	Numerical Linear Algebra	**BS**	1,2,3,12	2	3	1	0	4	40	60	100	45
24BTAD341	Database Management Systems	**PC**	1,2,3,9 10,11,12	2	3	0	2	4	40	60	100	47
24BTAD342	Design and Analysis of Algorithms	**ES**	1,2,3,4,9 10,12	1	3	0	2	4	40	60	100	50
24BTAD343	Java Programming	**PC**	1,2,3,9 10,12	2	3	0	2	4	40	60	100	53
24BTAD344	Artificial Intelligence	**PC**	1,2,3,4,9 10,12	1	3	0	2	4	40	60	100	56
24BTMC351	Aptitude and Reasoning*	**MC**			1	0	0	0	100	-	100	223
24BTAD391	Application Development II*	**PW**	1-12	1,2	0	0	2	1	100	-	100	230
24BTAD392	Field project / Internship I*	**PW**	1-12	1,2	0	0	2	1	100	-	100	231

SEMESTER TOTAL					19	2	12	26	540	360	900	
SEMESTER IV												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	P		**CIA**	**ESE**	**TOTAL**	
24BTAD401A/ 24BTAD401B	Probability and Statistics /Statistics and Optimization Techniques	**BS**	1,2,3,12 / 1,2,3,12	2/2	3	1	0	4	40	60	100	59,62
24BTAD441	Operating Systems	**PC**	1,2,3,4 9,10,12	2	3	0	2	4	40	60	100	65
24BTAD442	Web Application Development	**PC**	1,2,3,5 9,10 11,12	2	3	0	2	4	40	60	100	68
24BTAD443	Machine Learning Techniques	**PC**	1,2,3,4 5,9 10,12	2	3	0	2	4	40	60	100	71
24BTAD444	Computer Networks	**PC**	1,2,3,4 9,10	2	3	0	2	4	40	60	100	74
24BTAD4E4X	Professional Elective-I	**PE**	-	-	2	0	2	3	40	60	100	103-120
24BTSD411	Skill Development I	**SD**	1-12	1,2	0	0	2	1	100	-	100	238
24BTMC451	Foundation of Entrepreneurship*	**MC**	-	-	1	0	0	0	100	-	100	225
24BTMC452	Essence of Traditional Indian knowledge and Heritage*	**MC**	-	-	1	0	0	0	100	-	100	227
24BTAD491	Application Development III	**PW**	1-12	1,2	0	0	2	1	100	-	100	232
SEMESTER TOTAL					**19**	**1**	**14**	**25**	**640**	**360**	**1000**	
SEMESTER V												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	P		**CIA**	**ESE**	**TOTAL**	
24BTAD541	Deep Learning	**PC**	1,2,3,9 10,12	2	3	0	2	4	40	60	100	77
24BTAD542	Data Visualization	**PC**	1,2,3,5 9,10,12	2	3	0	2	4	40	60	100	80

24BTAD543	Big Data Analytics	**PC**	1,2,3,4 9,10,12	1	3	0	2	4	40	60	100	83
24BTAD5E4X	Professional Elective-II	**PE**	-	-	2	0	2	3	40	60	100	122-139
24BTAD5E4X	Professional Elective-III	**PE**	-	-	2	0	2	3	40	60	100	141-158
24BTSD511	Skill Development II	**SD**	1-12	1,2	0	0	2	1	100	-	100	239
24BTAD512	Community Engagement and Social Responsibility	**HS**	6,8,12	-	0	0	4	2	100	-	100	86
24BTAD591	Field project / Internship II	**PW**	1-12	1,2	0	0	2	1	100	-	100	233
SEMESTER TOTAL					**13**	**0**	**18**	**22**	**500**	**300**	**800**	

SEMESTER VI

COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	P		**CIA**	**ESE**	**TOTAL**	
24BTCC601	Universal Human Values	**HS**	6,8,9,12	2	2	0	0	2	40	60	100	88
24BTAD641	Computer Vision	**PC**	1,2,3,4 9,10,12	2	3	0	2	4	40	60	100	91
24BTAD642	Natural Language Processing	**PC**	1,2,3,9 10,12	1	3	0	2	4	40	60	100	94
24BTAD643	Distributed and Cloud Computing	**PC**	1,2,3,9 10,12	1	3	0	2	4	40	60	100	97
24BTAD6E4X	Professional Elective-IV	**PE**	-	-	2	0	2	3	40	60	100	160-177
24BTAD6E4X	Professional Elective-V	**PE**	-	-	2	0	2	3	40	60	100	179-196
24BTAD691	Mini Project	**PW**	1-12	1,2	0	0	2	1	100	-	100	234
SEMESTER TOTAL					**15**	**0**	**12**	**21**	**340**	**360**	**700**	

SEMESTER VII

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

24BTAD701	Principles of Management and Engineering Ethics	**HS**	1,2,3 4,10,12	1,2	3	0	0	3	40	60	100	100
24BTAD7E4X	Professional Elective-VI	**PE**	-	-	2	0	2	3	40	60	100	198-215
24BTAD791	Project Work Phase I/Field Project/ Internship III	**PW**	1-12	1,2	0	0	8	4	40	60	100	235
SEMESTER TOTAL					**5**	**0**	**10**	**10**	**120**	**180**	**300**	

SEMESTER VIII

COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	P		**CIA**	**ESE**	**TOTAL**	
24BTAD891	Project Work Phase II	**PW**	1-12	2	0	0	16	8	80	120	200	236
24BTADXE0X	Open Elective -I	**OE**	-	-	3	0	0	3	40	60	100	-
24BTADXE0X	Open Elective -I	**OE**	-	-	3	0	0	3	40	60	100	-
SEMESTER TOTAL					6	0	16	14	200	300	500	
PROGRAM TOTAL					**112**	**5**	**102**	**163**	**3180**	**2520**	**5700**	

***Internal evaluation only**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**PageNo.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
24BTAD4E41	UX/UI design	**PE**	1,2,3,5 9,10,12	2	2	0	2	3	40	60	100	103
24BTAD4E42	Cryptography and Network Security	**PE**	1,2,3 9,10	2	2	0	2	3	40	60	100	106
24BTAD4E43	Digital Marketing	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	109
24BTAD4E44	Augmented Reality and Virtual Reality	**PE**	1,2,3,9 10,12	2	2	0	2	3	40	60	100	112
24BTAD4E45	Image and video Analytics	**PE**	1,2,3 9,10	2	2	0	2	3	40	60	100	115
24BTAD4E46	Recommender Systems	**PE**	1,2,3,4 9,10	1	2	0	2	3	40	60	100	118
PROFESSIONAL ELECTIVE II												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
24BTAD5E41	Devops	**PE**	1,2,3,4 5,9, 10,12	1	2	0	2	3	40	60	100	122
24BTAD5E42	Ethical Hacking	**PE**	1,2,3,4 9,10,12	2	2	0	2	3	40	60	100	125
24BTAD5E43	Industrial Psychology	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	128
24BTAD5E44	Quantum Computing	**PE**	1,2,3,9 10,12	2	2	0	2	3	40	60	100	131
24BTAD5E45	Health Care Analytics	**PE**	1,2,3 9,10	2	2	0	2	3	40	60	100	134
24BTAD5E46	Soft computing	**PE**	1,2,3,4 9,10	1	2	0	2	3	40	60	100	137

PROFESSIONAL ELECTIVE III												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
24BTAD5E47	Low Code Application Development	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	141
24BTAD5E48	AI in Cyber Security	**PE**	1,2,3,9 10,12	2	2	0	2	3	40	60	100	144
24BTAD5E49	Market Risk and Supply Chain Analytics	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	147
24BTAD5E410	Game Theory	**PE**	1,2,3,4, 9,10,12	2	2	0	2	3	40	60	100	150
24BTAD5E411	AI for Sustainability	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	153
24BTAD5E412	Cognitive Science	**PE**	1,2,3,4 9,10,12	1	2	0	2	3	40	60	100	156
PROFESSIONAL ELECTIVE IV												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
24BTAD6E41	Mobile Application Development	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	160
24BTAD6E42	Data Security and Access control	**PE**	1,2,3,4 9,10,12	2	2	0	2	3	40	60	100	163
24BTAD6E43	Investment Analysis with AI	**PE**	1,2,3 9,10	2	2	0	2	3	40	60	100	166
24BTAD6E44	Industrial IoT	**PE**	1,2,3,4 9,10	1	2	0	2	3	40	60	100	169
24BTAD6E45	AI in Edge Computing	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	172
24BTAD6E46	Generative AI	**PE**	1,2,3,4 5,9 10,12	1	2	0	2	3	40	60	100	175

PROFESSIONAL ELECTIVE V												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
24BTAD6E47	Mern Stack Development	**PE**	1,2,3,9 10,11,12	2	2	0	2	3	40	60	100	179
24BTAD6E48	Digital and Mobile Forensics	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	182
24BTAD6E49	Business Analytics for Management Decision	**PE**	1,2,3,4 9,10	2	2	0	2	3	40	60	100	185
24BTAD6E410	Blockchain Technology	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	188
24BTAD6E411	Social Network Analytics	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	191
24BTAD6E412	Pattern Recognition	**PE**	1,2,3,4 9,10	1	2	0	2	3	40	60	100	194
PROFESSIONAL ELECTIVE VI												
COURSE CODE	**NAME OF THE COURSE**	**CATEGORY**	**Objectives and Outcomes**		**Instruction hours/week**			**CREDIT(S)**	**Maximum Marks**			**Page No.**
			POs	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
24BTAD7E41	NoSQL Databases	**PE**	1,2,3,5 9,10,12	1	2	0	2	3	40	60	100	198
24BTAD7E42	Security and Privacy in Cloud	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	201
24BTAD7E43	Robotics Process Automation	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	204
24BTAD7E44	3D Printing and Design	**PE**	1,2,3,4 9,10,12	2	2	0	2	3	40	60	100	207
24BTAD7E45	Robotic and Intelligent Systems	**PE**	1,2,3,4 5,9,10	1	2	0	2	3	40	60	100	210
24BTAD7E46	Reinforcement Learning	**PE**	1,2,3 9,10,12	2	2	0	2	3	40	60	100	213

SEMESTER-I

24BTCC101 **TECHNICAL ENGLISH I** **3H-3C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to

- Acquire the fundamental reading and writing skills, proper grammar usage, listening, and speaking
- Understand and improve skills in listening and speaking, in expressing oneself formally in writing, and in deducing meaning from what one reads
- Apply one's receptive (reading and listening) and productive (writing and speaking) language skills

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Replicate grammar usage in reading, speaking, and writing skills. (P2)
- Describe precise transitions while reading, writing, and speaking to enhance communication coherence and clarity. (A2)
- Report the interpretation of linguistic parameters in day-to-day reading, listening, and speaking interactions. (A2)
- Point out errors to restructure paragraphs, compose, compile, and synthesize d ocuments for presentations. (P2)
- Demonstrate proficiency in reading, writing, and critical listening and the ability to interpret and articulate complex ideas persuasively in written and oral forms. (A3)

UNIT I **9**

Grammar **:** Parts of Speech – Gerunds and infinitives – Sentence Pattern
Reading **:** Reading comprehension: (vocabulary, referents, and inferences/conclusions)
Writing **:** Business letter – e-mail Writing
Listening **:** Listening to different short recordings – Listen to a longer recording
Speaking **:** Introduction to Phonetics, Diphthongs

UNIT II **9**

Grammar **:** Tenses: Simple Tenses – Concord – Types of Sentences
Reading **:** Identifying main and secondary information
Writing **:** Check lists – Building Itineraries
Listening **:** Listening Comprehension – Job Description

Speaking **:** Pronunciation – Describing people, places, jobs and things – Asking and answering questions

UNIT III **9**

Grammar **:** Tenses: Progressive Tenses – Direct and Indirect speech – Concord
Reading **:** Identifying, organizing, comparing and Interpreting information
Writing **:** Writing Articles – Paragraph Writing
Listening **:** Telephonic conversation
Speaking **:** Stress, Intonation – Self Introduction

UNIT IV **9**

Grammar **:** Tenses: Perfect Tenses – Active and Passive voice
Reading **:** Reading Comprehension (Reconstruction, Rewording)
Writing **:** Memo – Notice – Agenda
Listening **:** Critical Listening
Speaking **:** Oral presentation

UNIT V **9**

Grammar **:** Tenses: Perfect Continuous Tenses – Reported Speech
Reading **:** Reading Comprehension (Cause and Effect identification)
Writing **:** Creative writing – Copy Writing
Listening **:** Listening and Interpretation of ideas
Speaking **:** Group Discussion

TOTAL: 45

TEXT BOOKS:

1. Richards J C, Hull J, et al., "Interchange 2 Student's Book", 5th Edition, Cambridge University Press, 2022.
2. Kumar Sanjay and Pushp Latha, "English Language and Communication Skills for Engineers", 1st Edition, Oxford University Press, 2018.

REFERENCE BOOKS:

1. Swan Michael and Walter Catherine, "Oxford English Grammar Course", 1st Edition, Oxford University Press, 2019.
2. Sudharshana N P and Savitha C, "English for Engineers", 1st Edition, Cambridge University Press, 2018.
3. Brook-Hart G, "Business Benchmark: Upper intermediate: Business Vantage: Student's Book", 2nd Edition, Cambridge University Press, 2021.

WEBSITES:

1. www.onestopenglish.com
2. www.britishcouncil.org
3. www.cambridgeenglish.org/learning-english/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-I

24BTCC102 MATRICES AND CALCULUS 4H-4C

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

End Semester Exam:3 Hours

PREREQUISITE: Nil

COURSE OBJECTIVES:

The goal of this course is for students is to

- Provide sufficient knowledge in calculus and matrix algebra in the respective fields
- Find an extremum value for a function of several variables subject to a given constraint.
- Provide knowledge in evaluating double and triple integrals
- Apply mathematical tools to solve second and higher order ODE and PDE with constant coefficients.

COURSE OUTCOMES:

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

- Make use of orthogonal transformation to reduce the quadratic form to canonical form (K3)
- Utilize differential calculus of multivariable to optimization problems. (K3)
- Apply multiple integrals for finding area and volume. (K3)
- Solve the n^{th} order Ordinary Differential Equations (ODE) and Homogeneous equation of Euler's type. (K3)
- Solve the n^{th} order Partial Differential Equations. (K3)

UNIT – I MATRICES 12

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

UNIT – II DIFFERENTIAL CALCULUS OF MULTIVARIABLE FUNCTIONS 12

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

UNIT – III MULTIPLE INTEGRALS **12**

Definite and Indefinite Integrals – Double integrals – Change of order of integration – Double integrals in polar coordinates – Area using double integrals – Evaluation of Triple Integrals- Volume of Solids.

UNIT – IV ORDINARY DIFFERENTIAL EQUATIONS **12**

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

UNIT – V PARTIAL DIFFERENTIAL EQUATIONS **12**

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

TOTAL : 45+15

TEXT BOOKS:

1. Hass, Heil and Weir, "Thomas Calculus", 14th Edition, Pearson Education, 2018.
2. Dennis G. Zill, "Advanced Engineering Mathematics", 7th Edition, Jones & Bartlett Learning, 2022.

REFERENCE BOOKS:

1. Rogawski, Adams and Franzosa, "Calculus", 4th Edition, W. H. Freeman, 2019.
2. Boyce, DiPrima and Meade, "Elementary Differential Equations and Boundary Value Problems", 12th Edition, John Wiley & Sons, 2021.
3. Alexander Graham, "Matrix Theory and Applications for Scientists and Engineers", 1st Edition, Dover Publications Inc.,2018.

WEBSITES:

1. www.classcentral.com/course/matrix-methods-13644
2. www.classcentral.com/course/brilliant-calculus-ii-59290
3. www.classcentral.com/course/differential-equations-engineers-13258

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-I

24BTCC141 ENVIRONMENTAL CHEMISTRY(EC) 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

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Summarize the importance of water and its treatment processes.
- Create a basic understanding of energy resources, storage devices and pollution eradication.
- Clarify the concepts of corrosion and analytical techniques.

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Outline the importance of water resources and water quality parameters. (K3)
- Infer the alternate energy sources and storage devices. (K2)
- Summarize the problems of environmental pollution and its control measures. (K2)
- Illustrate the types of corrosion and its prevention methods. (K2)
- Demonstrate the principle and working of analytical techniques. (K3)

UNIT I – WATER AND ITS TREATMENT 9

Sources -surface and ground water – problems of over-exploitation - Surface water treatment -Water quality parameters -Alkalinity- Types of alkalinities and determination - Hardness - Types and estimation by EDTA method - Boiler feed water - Requirements - Disadvantages of using hard water in boilers - Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) - External conditioning - Demineralization process - Desalination - Reverse osmosis.

UNIT II- ENERGY SOURCES AND STORAGE DEVICES 9

Renewable and Non - Renewable resources -Nuclear energy (Fission and fusion)- light water nuclear power plant- Wind energy-Hydroelectric power-Geothermal energy- solar energy conversion - solar cells-Batteries, Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell

UNIT III-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 IV -CORROSION AND ITS CONTROL **9**

Chemical corrosion and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion- Factors influencing the rate of corrosion -Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings - Organic coatings(Paints - Constituents and functions) - Metallic coatings (Inorganic coatings) - Electroplating (Au) and Electro less plating (Ni).

UNIT V – ANALYTICAL TECHNIQUES AND APPLICATIONS **9**

Introduction-Instrumentation and applications of Colorimetry, Flame Photometry, Potentiometry, Conductometry (Strong acid with strong base, Mixture of acids with strong base, precipitation titrations)-Electronic spectroscopy- Vibrational spectroscopy-Atomic Absorption spectroscopy.

TOTAL : 45

ii) LABORATORY

LIST OF EXPERIMENTS (Any 8 Experiments):

1. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixture using volumetric titration
2. Determination of Ca / Mg using complexometric titration
3. Determination of chloride content of water
4. Determination of the rate of corrosion by weight loss method
5. Conductometry - Determination of conductance of solutions (strong acid Vs strong base)
6. pH Metry - Determination of Acid/Base
7. Potentiometry - Estimation of iron content in a water sample.

TOTAL : 30

TEXT BOOKS:

8. Anubha Kaushik., and Kaushik, C.P. 7Th Edition, 2021. Perspectives in Environmental Studies. NewAge International Pvt. Ltd. Publications, New Delhi.
9. Erach Bharucha, “A Textbook of Environmental Studies for UG Courses” 3rd Edition, University Press India ltd, 2021.
10. P C Jain & Monica Jain, (2022). Engineering Chemistry, 18th edition, Dhanpat Rai Publishing Company
11. Prabhakar S Mithra, “Methodologies for environmental studies”, 1st Edition, Academic Apirations, 2021.
12. B. H. Mahan, (2010). University chemistry, Pearson Education.

REFERENCE BOOKS:

1. C. N. Banwell, (2001) Fundamentals of Molecular Spectroscopy, McGraw-Hill.
2. G.Tyler Miller and Scott Spoolman, "Living in the Environment", 20th Edition, Cengage Learning, 2021.
3. M. J. Sienko and R. A. Plane,(1976) Chemistry: Principles and Applications. 5th edition, McGraw-Hill Higher Education.
4. Sing, J.S., Sing. S.P. and Gupta, S.R. 2022. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
5. Linda D Williams, "Environmental Science" 1st Edition, Tata McGraw Hill, 2017.

WEBSITES:

1. https://www.insightsonindia.com/2013/09/06/environment-biodiversity
2. https://www.nptelvideos.in/2012/11/energy-resources-and-technology.html
3. https://www.bspublications.net/downloads/0523ff2e4a5331_chemistry_ch_01_JNTUK.pdf

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	1	1	1	1	-	-	1	-	1
CO2	2	2	1	1	-	1	1	1	1	-	-	1	-	1
CO3	2	1	-	-	-	2	2	2	1	-	-	1	-	1
CO4	2	1	-	-	-	1	1	1	1	-	-	1	-	1
CO5	2	1	-	-	-	1	1	1	1	-	-	1	-	1
Avg	**2.2**	**1.4**	**1**	**1**		**1.2**	**1.2**	**1.2**	**1**	**-**	**-**	**1**	**-**	**1**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-I

24BTAD142 **PHYSICS FOR COMPUTING ENGINEERS (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Instil knowledge on physics of semiconductors, determination of charge carriers and device applications
- Establish a sound grasp of knowledge on different properties of materials such as magnetic and super conducting
- Make the students to understand the nano materials and its applications

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Relate the quantum concepts in quantum computing (K2)
- Identify the types of semiconductors and its carrier concentration using Hall effect (K3)
- Examine the performance of light, laser and optical fibres (K3)
- Utilize magnetic properties for finding B - H Curve (K3)
- Illustrate the properties of nano materials and its fabrication methods (K2)

UNIT I – QUANTUM COMPUTING **9**

Black body radiation - Energy Distribution laws (Qualitative): Stefan Boltzmann's law, Wein's Displacement law-Rayleigh Jeans Law – De Broglie hypothesis - uncertainty principle – Heisenberg uncertainty principle – physical significance of wave function - Schrödinger's Time dependent wave equation - Schrödinger's Time independent wave equation – Particle in one dimensional box – Introduction to quantum computing – History of quantum computation and quantum information – Quantum bits – Global perspectives – Future directions.

UNIT II SEMICONDUCTORS **9**

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

UNIT III LASER AND FIBER OPTICS **9**

LASER: Introduction - characteristics - Einstein's co-efficients derivation Principle of laser action- population inversion- pumping methods - Nd: YAG - Applications of LASER in industry and medicine.

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

UNIT IV MAGNETIC AND SUPER CONDUCTING MATERIALS **9**

Magnetic moment, magnetic dipoles - magnetic permeability and susceptibility, types of magnetic materials - Ferromagnetism, Domain Theory, Hysteresis on the basis of domains, hysteresis loss, soft and Hard magnetic materials - Superconductivity – Properties – Meissner effect – Effect of magnetic field – Types of superconductors – BCS theory of superconductivity — Applications of superconductors, cryotron and magnetic levitation.

UNIT V NANOMATERIALS **9**

Low-dimensional systems such as quantum wells, wires, and dots – Nanostructures: Synthesis of nanomaterials- top-down approach (Ball milling, Pulsed laser deposition and bottom-up approach (Chemical Vapour Deposition, Physical Vapour Deposition) – Carbon nanotubes: Properties and applications.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS – PHYSICS (Any 8 Experiments):

1. Determination of Band gap of a semiconductor.
2. Characteristics of photo diode.
3. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
4. Laser- Determination of the wave length of the laser using grating
5. Laser – Determination of Particle size
6. Optical Fiber – Determination of Numerical Aperture and Acceptance angle of the optical fiber
7. Air wedge – Determination of thickness of a thin sheet/wire.

TOTAL: 30

TEXT BOOKS:

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, (2015).
2. B.K. Pandey, S. Chaturvedi, Engineering Physics, Cengage Learning India Pvt. Ltd. 2 nd Edition, (2022).
3. S.O. Pillai, "Solid State Physics", 9th Edition. New Age International Publishers, 2020.
4. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, wiley Publishers, (2006).
5. William T Silfvast, Laser Fundamentals, Cambridge Univ Press. 2012.

REFERENCES BOOKS:

1. Halliday.D. Resnick R. & Walker. J, Principles of Physics, Wiley, 2015.
2. Charles Kittel, Kittel's, Introduction to Solid State Physics, Wiley India Edition, 2019.
3. Donald A. Neamen, Semiconductor Physics and Devices, McGraw Hill Education private limited; 4 edition, (2021).
4. LeszekMalkinski, Advanced Magnetic Materials, Published by InTech, (2012).
5. Michael Shur, Physics of Semiconductor Devices, Published by Pearson Education; First edition, (2019).
6. Kulkarni, Sulabha K, Nanotechnology: Principles and Practices, Springer International Publishing, (2015).
7. R P Khare, Fiber Optics and Optoelectronics, Oxford, 2012

WEBSITES:

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

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	-	-	1	-	1
CO2	3	2	1	-	-	-	-	-	2	-	-	1	-	1
CO3	3	2	1	-	-	-	-	-	2	-	-	1	-	1
CO4	3	2	1	-	-	-	-	-	2	-	-	1	-	1
CO5	2	1	-	-	-	-	-	-	2	-	-	1	-	1
Avg	2.6	1.8	1.0	-	-	-	-	-	2.0	-	-	1.0	-	1.0

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-I

24BTAD143 **PYTHON PROGRAMMING (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Nil

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Learn about basic python syntax and semantics like control structures and functions.
- Develop logical thinking abilities and to propose novel solutions for real world problems through object-oriented programming concepts.
- Model the empirical knowledge on applying programming on business domains.

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Interpret the basic representation of the data structures and sequential programming (K2)
- Solve the problems using list, dictionaries, tuples, and sets core data structures (K3)
- Build applications using functions, modules and packages (K3)
- Examine the error-handling constructs for unanticipated states/inputs. (K4)
- Analyze the applications on real-world problems using object-oriented concepts (K4)

UNIT I INTRODUCTION TO PYTHON BASICS **9**

Fundamentals of Computing - Building blocks of algorithms - Introduction to Programming - Elements of python - Variables - Data Types - Operators - Operator Precedence - Expressions - Conditional statement - Loops - Break, Continue and Pass - Illustrative problems: square root, GCD, LCM, Sum an array of numbers, Linear search, Binary search.

UNIT II PYTHON DATA STRUCTURES **9**

Mutable vs immutable data types - String - Indexing and slicing - String functions - List - List slices - List methods - Iterate over a list - Mutability - Aliasing - Cloning lists - List parameters - List comprehension- Tuples- Tuple assignment - Tuple as return value - Dictionaries - Operations and methods - Set - Set operations - Illustrative programs: Simple sorting, pattern matching, Fibonacci, Factorial, Prime numbers.

UNIT III FUNCTIONS, MODULES AND PACKAGES 9

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 - Python libraries NumPy, pandas, Matplotlib - Flask/Django

UNIT IV FILE HANDLING, CLASS AND OBJECT 9

Introduction to files - File path - Opening and closing files - Reading and writing files - File position - Decorators - Introduction to 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. Illustrative programs: File operations on TEXT and CSV, Scientific calculator using class and objects.

UNIT V ERROR HANDLING, TESTING 9

Exception handling with try, except, finally - Exception handling: Errors vs exceptions - Handling exceptions - Raising exception - Creating user defined exception - Debugging techniques- Unit testing with unit test - Writing test cases - web scraping - Data analysis project - Automation script

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Write conditional and looping statements in Python.
2. Create and manipulate strings using indexing, slicing,and various string functions.
3. Create and manipulate lists using operations, slices, methods, list comprehension, and looping.
4. Create and manipulate tuples, dictionaries, and sets, and understand the differences between mutable and immutable types.
5. Implement user-defined functions and understand the different types of function arguments, such as positional, keyword, and default arguments.
6. Implement inheritance and understand the different types of inheritance.
7. Implement polymorphism through method overloading, overriding, and operator overloading.

TOTAL: 30

TEXT BOOKS:

1. Allen B Downey,Jeffrey Elkne, Chris Meyers ,"How to Think Like a Computer Scientist: Learning with Python 3 Documentation",3rd Edition, Green Tea Press,2020.
2. Steven F. Lott ,Dusty Phillips,"Python Object-Oriented Programming: Build robust and maintainable object-oriented Python applications and libraries"4th Edition , Packt Publishing Limited ,2021.

REFERENCE BOOKS:

1. R. Nageswara Rao," Core Python Programming", 3rd Edition, Dream tech Press,2022.
2. Mark Lutz , "Learning Python" ,5th Edition , O'Reilly Publication , 2018.
3. Mark and Summerfield , "Programming in Python 3",2ndEdition ,Dorling Kindersley India Pvt. Ltd, 2019.

WEBSITES:

1. https://realpython.com/
2. www.programiz.com/python-programming
3. https://www.geeksforgeeks.org/python-programming-language/
4. https://www.pythonspot.com/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	3	-	3
CO2	3	2	1	-	-	-	-	-	2	2	-	3	-	3
CO3	3	2	1	-	-	-	-	-	2	2	-	3	-	3
CO4	3	3	2	1	-	-	-	-	2	2	-	3	-	3
CO5	3	3	2	1	-	-	-	-	2	2	-	3	-	3
Avg	**2.8**	**2.4**	**1.4**	**1**	-	-	-	-	**2**	**2**	-	3	-	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-I

24BTCC111 COMMUNICATION SKILLS LABORATORY 2H-1C

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

End Semester Exam:3 Hours

PREREQUISITE: None

COURSE OBJECTIVES:

The goal of this course is for students to

- Acquire different listening techniques for understanding different kinds of audio content, including lectures, conversations, videos, etc. and to effectively communicate their ideas using a variety of media

- Understand the "English language skills" by engaging them in listening and reading activities that are relevant to authentic contexts and to help learners use language effectively in academic /work contexts
- Apply the communicative competence of learners in listening, speaking, reading and writing

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Organize the context, topic, and pieces of specific information of English through all four skills. (P1)
- Identify the purpose and clarity of facts and reflect their thoughts, opinions, and knowledge through all the language skills. (A1)
- Put together skimming, scanning, and listening techniques effectively to acquire the gist from the context. (P2)
- Demonstrate in communication more effectively with their peers, instructors and colleagues. (A2)
  Master public speaking techniques, business writing, and listening with professional speaking techniques. (P3)

***P-Psychomotor Skills, A- Affective Domain Skills**

LIST OF EXPERIMENTS:

S.No.	SKILLS	TOPICS
1	Listening	Dialogues from TV/radio/Ted talk/Podcast
2	Listening	Listening for gist

3	Reading	Reading for detail, global understanding
4	Speaking	Presentations and interactive communication – Pair presentations
5	Listening	Listen and respond appropriately
6	Reading	Reading different genres
7	Writing	Documentary and Movie review
8	Writing	Informational or Analytical Reports
9	Speaking	Mock Interview
10	Speaking	Group Discussion

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	2	3	3	-	2	1	-
CO2	-	-	-	-	2	-	-	2	3	3	-	2	1	-
CO3	-	-	-	-	1	-	-	2	3	3	-	2	1	-
CO4	-	-	-	-	1	-	-	1	2	3	-	2	1	-
CO5	-	-	-	-	1	-	-	1	2	3	-	2	1	-
Avg	-	-	-	-	1.4	-	-	1.6	2.6	3	-	**2**	**1**	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTCC201 TECHNICAL ENGLISH II 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to

- Acquire the context of grammar and the importance of Listening, Speaking, Reading and Writing
- Understand and develop critical Listening, Speaking, Reading, and Writing skills
- Apply students' capability to listen vigilantly, read proficiently, innovative writing, and speak fluently

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Demonstrate the aspects of writing, speaking, reading, and listening with grammar. (P2)
- Refine speaking, listening, reading, and writing skills in the social milieu. (P3)
- Justify the text critically in reading, writing, speaking, and listening. (A3)
- Differentiate grammatical structures in reading and listening and apply the structure in speaking and writing. (A3)
- Adapt writing, reading, listening, and speaking rules in formal and informal situations. (P3)

UNIT I **9**

Grammar : Prepositions – Adjectives – Adverbs
Reading : Reading comprehension: Skimming and Scanning
Writing : Letter writing (Formal and Informal) – Letter to Editor
Listening : Listening to Business talks – TED Talks

UNIT II **9**

Grammar : Use of sequence words – Modal Verbs
Reading : Mind Mapping (Structured thinking and related ideas)
Writing : Interpreting visual materials – Note Making – Recommendations
Listening : Listening to specific tasks – Focused Listening – Note Taking.
Speaking : Making presentations on given topics – Speaking in formal Situations

UNIT III **9**

Grammar : Contextual usage of Tenses – Connectives
Reading : Cohesion and Coherence in Reading
Writing : Paragraph writing: Compare and Contrast – Cause and Effect – Jumbled Sentences
Listening : Listening and responding to video lectures
Speaking : Role-play – Group Interaction

UNIT IV **9**

Grammar : WH Questions – Identifying Common Errors
Reading : Critical Reading Shifting facts from opinions
Writing : Resume writing with cover letter – Free writing
Listening : Watching videos or documentaries and answering
Speaking : Responding to questions – Mock Interviews

UNIT V **9**

Grammar : Use of Imperatives – Confusing words in English
Reading : Reading and making inference
Writing : Essay writing – Report – Proposals
Listening : Listening to different accents – Listening to Speeches
Speaking : Impromptu Speeches – Describing a process

TOTAL: 45

TEXT BOOKS:

1. Richards J C, Hull J, et al. "Interchange 3 Student's Book", 5th Edition, Cambridge University Press, 2022.
2. Harding, Keith, and Appleby, Rachel, "International Express: Pre-Intermediate: Student's Book", 3rd Edition, Oxford University Press, 2019.

REFERENCE BOOKS:

1. Swan, Michael and Walter Catherine, "Oxford English Grammar Course", 1st Edition, Oxford University Press, 2019.
2. Sudharshana N P and Savitha C, "English for Engineers", 1st Edition, Cambridge University Press, 2018.
3. Brook-Hart G, "Business benchmark: Upper intermediate: Business vantage: Student's book", 2nd Edition, Cambridge University Press, 2021.

WEBSITES:

1. www.myenglishpages.com
2. www.cambridgeenglish.org/learning-english/
3. www.eslvideo.com/index.php

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTCC202A GRAPH THEORY 4H-4C

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

End Semester Exam:3 Hours

PREREQUISITE: Matrices And Calculus

COURSE OBJECTIVES:

The goal of this course for the students is to

- Provide the basic concepts of graphs
- Impart the knowledge of trees and its properties.
- Afford the adequate knowledge on matrix representation of graphs, coloring and dominating sets.
- Understand the concepts and significance of lattices

COURSE OUTCOMES:

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

- Infer the basic terminologies of directed and undirected graphs. (K2)
- Illustrate the properties of trees, connectivity, fundamentals of circuits, cutset through algorithms. (K2)
- Apply matrix representation of graphs to explore spectra and energy of graphs. (K3)
- Interpret the coloring and domination of a given graph. (K2)
- Explain Lattice theory and its operations on discrete structural areas of computing.(K2)

UNIT I GRAPHS **12**

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

UNIT II TREES **12**

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

UNIT III MATRIX REPRESENTATION OF GRAPHS **12**

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

UNIT IV COLORING, COVERING AND PARTITIONING **12**

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

UNIT V LATTICE THEORY **12**

Partial ordering – Posets – Lattices as Partial Ordering-Posets – Properties of lattices – Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices.

TOTAL : 45+15

TEXT BOOKS:

1. Narsingh Deo., "Graph Theory with applications to Engineering and Computer Science", 1st Edition, Prentice Hall Series, 2021.
2. Karin R Saoub., "Graph Theory – An Introduction to Proofs, Algorithms and Applications", 1st Edition, CRC Press, 2021.
3. Kenneth H. Rosen., "Discrete Mathematics and Applications", 7thEdition, Tata McGraw Hill, 2012.

REFERENCE BOOKS:

1. Allan Bickle, "Fundamentals of Graph Theory", American Mathematical Society,2020.
2. LonathanI, Gross, Jay Yellen and Mark Anderson, "Graph Theory and Its Applications", 3rd Edition, CRC press, 2019.
3. Madhumangal Pal, SovanSamanta and Anita Pal, "Advanced Applications of Graph Theory in Modern Society", IGI Global, 2021.

WEBSITES:

1. www.classcentral.com/subject/graph-theory
2. www.nitttrc.edu.in/nptel/courses/video/106106183/lec292.pdf
3. www.digimat.in/nptel/courses/video/106108054/L17.html

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTCC202B COMPUTATIONAL METHODS FOR ENGINEERS 4H-4C

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

End Semester Exam:3 Hours

PREREQUISITE: Matrices And Calculus

COURSE OBJECTIVES:

The goal of this course for the students is to

- Provide the knowledge of Vector differentiation and Integration.
- Inculcate the concepts of Number Theory.
- Introduce the concepts of graphs and algorithm on spanning trees.
- Afford adequate knowledge of Linear Programming Problems.

COURSE OUTCOMES:

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

- Make use of vector calculus for finding area and volume. (K3)
- Interpret the concepts of divisibility, prime number, congruence and number theorems.(K2)
- Explain the terminology of basic graphs and its matrix representation. (K2)
- Illustrate the properties of trees, connectivity, fundamentals of circuits, cut set through algorithms. (K2)
- Solve linear programming models by Graphical method, Simplex method and Dual simplex method. (K3)

UNIT I VECTOR CALCULUS 12

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

UNIT II NUMBER THEORY 12

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

UNIT III GRAPH THEORY 12

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

UNIT IV TREES **12**

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

UNIT V LINEAR PROGRAMMING PROBLEM **12**

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

TOTAL : 45+15

TEXT BOOKS:

1. Jonathan L. Gross, Jay Yellen, Mark Anderson, "Graph Theory and Its Applications", 3rd Edition, Chapman and Hall, 2023.
2. Satyabrota Kundu, Supriyo Mazumder, "Number Theory and Its Applications", 1st Edition, CRC Press, London, 2022.

REFERENCE BOOKS:

1. Colley, Susan Jane, "Vector Calculus", 4th Edition, Pearson Education, 2019.
2. Pio J Arias, "Elementary Number Theory", 1st Edition, Toronto Academic Press, 2024.
3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall Series, 2021.
4. Hamdy A. Taha, "Operations Research: An Introduction", 10th Edition, Pearson Education, 2019.

WEBSITES:

1. www.khanacademy.org/computing/computer-science/cryptography/random-algorithms-probability/fermat-s-little-theorem-visualization
2. www.udemy.com/course/linear-programming-basics/
3. www.udemy.com/course/graph-theory

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTCC202C TRANSFORMS AND ITS APPLICATIONS 4H-4C

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

End Semester Exam:3 Hours

Pre-Requisites: Matrices and Calculus

COURSE OBJECTIVES:

The goal of this course is for students:

- Understand the concept of periodic functions and represent it as Fourier series.
- Provide knowledge of Fourier series techniques in solving heat flow problems and wave equations.
- Acquaint Fourier transforms techniques used in various applications.
- Impart the knowledge of Laplace Transforms and Inverse Laplace Transforms techniques and its applications.

COURSE OUTCOMES:

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

- Illustrate Fourier series representation of periodic functions (K2)
- Apply Fourier series in one dimensional heat flow and wave equation (K3)
- Make use of Fourier transform for converting elementary functions into
- frequency domain (K3)
- Utilize Laplace Transform to convert time-domain systems into frequency-domain
- systems (K3)
- Apply Inverse Laplace Transform in linear differential equations (K3)

UNIT I FOURIER SERIES 12

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

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

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

UNIT III FOURIER TRANSFORMS **12**

Integral Theorem – Fourier transform pair –Fourier sine and cosine transforms –Properties – Convolution theorem – Parseval's identity of Fourier transform.

UNIT IV LAPLACE TRANSFORM **12**

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

UNIT V INVERSE LAPLACE TRANSFORM **12**

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

Total Hours: 45+15

TEXT BOOKS:

1. Boyce, Diprima and Meade, "Elementary Differential Equations and Boundary Value Problems", 12th Edition, John Wiley & Sons, 2021.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons, 2017

REFERENCE BOOKS:

1. T. Hillen, "Partial Differential Equations", 2nd Edition, Friesen Press, 2019.
2. Dennis G. Zill, "Advanced Engineering Mathematics", 7th Edition, Jones and Bartlett Publishers, 2020.
3. Richard Haberman, "Applied Partial Differential Equations with Fourier Series and Boundary Value Problems", 5th Edition, Pearson, 2021.
4. Grewal B.S., "Higher Engineering Mathematics", 44thEdition, Khanna Publishers, New Delhi, 2018.

WEBSITES:

1. www.infocobuild.com/education/audio-video-courses/mathematics/Transform TechniquesForEngineers-IIT-Madras/lecture-01.html
2. www.infocobuild.com/education/audio-video-courses/mathematics/ordinary-and-partial-differential-equations-iit-roorkee.html
3. www.electrical4u.com/laplace-transformation/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24BTAD203 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

PRE-REQUISITES: Python Programming

COURSE OBJECTIVES:

The goal of this course for the students is to

- Study the basic concepts of data science and data life cycle.
- Understand the theoretical and mathematical aspects of data science models.
- Gain knowledge of common random variables and their uses and with the use of empirical distributions.

COURSE OUTCOMES:

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

- Intepret the various aspects of data science and skill sets necessary for data scientist (K2)
- Illustrate the concepts of data storage and Big Data (K2)
- Outline the different types of process and tools used in data science (K2)
- Identify the principles of Data Science for analysis using Google Sheets and Excel (K3)
- Apply major techniques in data science, including data mining, data warehousing and machine learning. (K3)

UNIT I BASICS OF DATA SCIENCE 9

Data Science: Steps in doing Data Science - Data Science relation to other fields- Data Science and Information Science- Computational Thinking - Skills and tools needed to do Data Science - Storing data - Combining bytes into larger structures - Creating data sets - Identifying data problem - Understanding data sources - Exploring data models- Introduction to Big Data

UNIT II DATA HANDLING 9

Structured and unstructured data - Challenges with unstructured data - Data collection: Open data - multimodal data - Data Preprocessing: Data Cleaning - Data Integration, Data Transformation - Data Reduction - Data Discretization

UNIT III SAMPLING 9

Sampling – Probability models for statistical methods: Discrete and continuous probability distributions – Density functions – Random variables – Expected values – Variance – Correlation – Data normalization (z-values, transforms) – Random processes – Data management: Tools for data analysis. Case Study: Data analysis using python – Arrays – Visualization.

UNIT IV EXCEL FOR DATA SCIENCE 9

Elementary data handling: Types - Data Transformation - Filtering -Pivot tables - Graphical Methods - Descriptive statistics - Random sampling - Probability distributions using functions- Binomial - poisson - Normal - Geometric - Negative binomial - exponential - gamma - beta- lognormal - pmf and cmd- Hypothesis testing using Data Analysis Pack - Z test and t-test

UNIT V MAJOR TECHNIQUES IN DATA SCIENCE 9

Data mining – Data warehousing – Data mining vs Data warehouse – Machine learning – Supervised learning – Unsupervised learning – Business Intelligence – Cloud computing.

TOTAL: 45

TEXT BOOKS:

1. Myatt, G. J., & Johnson, W. P, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining", John Wiley and Son Publication, 2nd Edition, 2014.
2. Saltz Jeffrey S, "An Introduction to Data Science", Sage Publications, 2nd Edition, 2019.

REFERENCE BOOKS:

1. Murtaza Haider, "Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press First Edition 2015.
2. Samuel Burns, "Fundamentals of Data Science: Take the first Step to Become a Data Scientist", Second Edition ,2016.
3. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists 1st Edition 2017.

WEBSITES:

1. www.inferentialthinking.com/chapters/intro
2. www.openintro.org/stat/
3. https://onlinecourses.swayam2.ac.in/imb23_mg64/preview

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTAD241 DIGITAL LOGIC CIRCUITS 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

PREREQUISITE: Nil

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Understand the digital fundamentals and minimization of logic.
- Be familiar with different Combinational and Sequential logic circuits.
- Be exposed to memory and programmable logic.

COURSE OUTCOMES:

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

- Explain the fundamental concepts of various number systems. (K2)
- Make use of the postulates of Boolean algebra for optimization and \ implementation of digital circuits. (K3)
- Build different combinational digital circuits using logic gates. (K3)
- Build different synchronous circuits using flip-flops. (K3)
- Construct digital circuits using semiconductor memories and related technology. (K2)

UNIT – I DIGITAL FUNDAMENTALS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, number base conversions, 1‘s and 2‘s complements, Arithmetic Operations, Binary codes–Binary, BCD, Excess 3, Gray, Alphanumeric codes. Boolean Algebra: Basic definitions, basic theorems and properties of Boolean algebra, Boolean functions, Sum of products and product of sums, Min terms and Max terms, Canonical form, Conversion between canonical forms, Digital logic gates, Universal gates.

UNIT – II GATE LEVEL MINIMIZATION 9

The K-map method- two-variable map, three-variable map and four-variable map, Sum of products and product of sums, simplification, don’t-care conditions, determination and selection of Prime Implicants, Essential and Non-essential prime Implicants, Implementation of logic functions using gates, Multilevel gate implementation, NAND and NOR implementation.

UNIT – III COMBINATIONAL LOGIC CIRCUITS 9

Design procedure, Design of Half and Full Adders, Half and Full Subtractors, 4-bit Binary Parallel Adder, 4-bit Binary Parallel Adder/subtractor, 2 bit Magnitude Comparator, 3-to-8-line Decoders, 8-to-3-line conventional Encoders, 4-to-2-line Priority Encoder,8x1 Multiplexer, and 1x8 De-multiplexers.

UNIT – IV SYNCHRONOUS LOGICCIRCUITS 9

Sequential circuits, latches, Flip flops – SR, JK, T, D, Flip Flop conversions, analysis of clocked sequential circuits- Moore/Mealy models, state minimization, state assignment, state diagram. Registers, shift registers, Universal Shift Register, ripple counters, synchronous counters - Modulo counters.

UNIT – V MEMORY AND PROGRAMMABLE LOGIC 9

Classification of memories- Random access memory – Static and dynamic RAM, memory decoding, Read only memory- PROM - EPROM – EEPROM, programmable logic array, programmable array logic, Field Programmable Gate Arrays, Implementation of combinational logic circuits using PLA, PAL.

TOTAL :45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Verification of Boolean theorems using logic gates.
2. Realization of Universal gates.
3. Implementation of full adder and full subtractor.
4. Implementation of encoder and decoder circuits.
5. Implementation of Synchronous Decade counter using T flip-flops.
6. Implementation of a Shift left register and shift right register.

TOTAL :30

TEXT BOOK:

1. M. Morris Mano, Michael D. Ciletti (2008), Digital Design, 4th edition, Pearson Education Inc, India.

REFERENCE BOOKS:

1. Zvi. Kohavi (2004), Switching and Finite Automata Theory, Tata McGraw Hill, India.
2. C. V. S. Rao (2009), Switching and Logic Design, 3rd Edition, Pearson Education, India.
3. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India
4. Roth (2004), Fundamentals of Logic Design, 5th Edition, Thomson, India.

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTCC242	WEB TECHNOLOGY (THEORY & LAB)	5H-4C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Nil

i) THOERY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the principles of web design
- Acquire basic knowledge of HTML elements, CSS and various layouts for styling a web page
- Understand designing interactive web pages using JavaScript and Bootstrap

COURSE OUTCOMES:

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

- Outline the components for web development (K2)
- Demonstrate structural aspects of HTML, CSS and JavaScript for interactive web pages (K2)
- Apply CSS and layouts for styling web pages (K3)
- Build dynamic web pages using JavaScript (K3)
- Develop responsive web pages by using Bootstrap framework (K3)

UNIT I ESSENTIALS OF WEB DESIGN AND HTML 9

Web design – Internet versus the web – Web browsers – Design process – Design principles – HTML – Document structure – Paragraphs – Headings – Lists – iFrame – div – span – Hyperlinks – Adding images – Table markup – Forms – HTML5 Advanced Elements – Embedded media.

UNIT II CASCADING STYLE SHEETS 9

CSS – Units of measurement – Formatting text with css3 – Colors and backgrounds – Padding – Borders – Margins – Floating and positioning – CSS layout with flexbox and grid - CSS Animations and Transitions – Responsive Design with Media Queries.

UNIT III DYNAMIC WEB PAGES USING JAVA SCRIPT 9

JavaScript – JavaScript Fundamentals – Variables – Data types – Operators – Control Structures – Functions – Function expressions – Arrow functions – Objects – Object methods – Constructor – Strings – Arrays – Array methods – Destructuring – JSON – Error handling – Closures

UNIT IV ADVANCED JAVASCRIPT CONCEPTS 9

Browser object – Events – DOM – Promises – Callbacks – Promises chaining – Promise API – Fetch API – Async/await – Modules – Export and Import – Polyfills – JavaScript libraries : jQUERY.

UNIT V RESPONSIVE WEB DESIGN USING BOOTSTRAP 9

Bootstrap – Setting up bootstrap – Structuring web page using bootstrap – Grid system – Typography – Tables – Forms – Images – Effects – Icons – Components

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Develop static web pages using HTML.
2. Create an HTML-based web page to demonstrate the use of inline, internal, and external CSS.
3. Develop web pages using HTML and CSS Flexbox.
4. Create dynamic web pages using JavaScript.
5. Implement a web page that includes JavaScript code to demonstrate arrays, strings, and JSON.
6. Write JavaScript code to work with Promises, Async/Await, and Modules.
7. Develop a responsive website using Bootstrap components.

TOTAL :30

TEXT BOOKS:

1. Jennifer Niederst Robbins, "Learning Web Design", 5th Edition, O'Reilly Media, Inc, 2018.
2. Jorg Krause, "Introducing Bootstrap 4", 2nd Edition, A press Media LLC, 2020.

REFERENCE BOOKS:

1. Jason Beaird, James George and Alex Walker, "The Principles of Beautiful Web Design", 4th Edition, Site Point Pty. Ltd., 2020.
2. Ben Frain, "Responsive Web Design with HTML5 and CSS", 3rd Edition, Packt Publishing, 2020.
3. Sufyan bin Uzayr, "Mastering Bootstrap A Beginner's Guide", 1st Edition, CRC Press, 2022.

WEBSITES:

1. www.w3schools.com/html/
2. www.udacity.com/course/responsive-web-design-fundamentals--ud893
3. www.getbootstrap.com/docs/4.6/getting-started/introduction/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-II

24BTCC243 **DATA STRUCTURES AND ALGORITHMS (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Python Programming

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the concepts of abstract data types
- Learn linear and non-linear data structures
- Understand sorting, searching and hashing algorithms

COURSE OUTCOMES:

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

- Interpret the concepts of linear and non-linear data structures (K2)
- Identify appropriate linear/non–linear data structure operations for solving a given problem (K3)
- Experiment with linear and non-linear data structure operations to understand their implementation, performance, and practical applications (K3)
- Apply searching and sorting algorithms for solving a problem (K3)
- Develop the application using suitable data structures (K3)

UNIT I LISTS **9**

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

UNIT II STACKS AND QUEUES **9**

Stack ADT – Operations – Applications – Balancing symbols – Evaluating arithmetic expressions – Infix to Postfix conversion – Function calls – Queue ADT – Operations – Circular queue – Deque – Applications of queues.

UNIT III TREES **9**

Tree ADT – Tree traversals – Binary tree ADT – Expression trees – Binary search tree ADT– AVL Trees – Red-Black trees – Priority queue (Heaps) – Binary heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS 9

B-Tree – B+ Tree – Tries – Graph definition – Representation of graphs – Types of graphs – Breadth-first traversal – Depth-first traversal – Bi-connectivity – Euler circuits – Topological sort – Dijkstra's algorithm – Minimum spanning tree – Prim's algorithm – Kruskal's algorithm

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching – Linear search – Binary search – Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Quick sort – Merge sort – Heap sort – Radix sort – Hashing – Hash functions – Separate chaining – Open addressing – Rehashing – Extendible hashing.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement array implementation of Stack, Queue, and Circular Queue ADTs.
2. Develop the implementation of a singly linked list.
3. Create linked list implementation of stack and linear queue ADTs.
4. Implement the evaluation of postfix expressions and infix to postfix conversion.
5. Develop the implementation of binary search trees and AVL Trees.
6. Implement insertion sort, merge sort and quick sort.
7. Create open addressing (Linear probing and Quadratic probing).

TOTAL: 30

TEXT BOOKS:

1. John Canning, Alan Broder, Robert Lafore, "Data Structures & Algorithms in Python", 1st Edition, Addison-Wesley Professional, 2022.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2019.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", 4th Edition, MIT Press, 2022.

REFERENCE BOOKS:

1. Bradley N. Miller and David L. Ranum, "Problem Solving with Algorithms and Data Structures using Python" 2nd edition, Franklin, Beedle & Associates Inc., 2005.
2. Benjamin Baka, "Python Data Structures and Algorithms" 1st Edition, Packt Publishing, 2017.

3. Narasimha Karumanchi, “Data Structures and Algorithms Made Easy”, 1st Edition, Career monk Publications, 2019.
4. Langsam, Augenstein and Tanenbaum, “Data Structures Using C and C++”, 2nd Edition, Pearson Education, 2020.
5. Jan Wengrow, “A Common–Sense Guide to Data Structures and Algorithm”, 2nd Edition, O’Reilly Publications, 2020.
6. Yashavant Kanetkar, “Data Structures Through C”, 4th Edition, BPB publications, 2022.

WEBSITES:

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

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

SEMESTER-III

24BTAD301A DISCRETE MATHEMATICS AND STOCHASTIC PROCESS 4H-4C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Graph Theory

COURSE OBJECTIVES:

The goal of this course for students is to

- Inculcate the concepts of Number theory.
- Eextend student's logical and mathematical maturity and ability to deal with abstraction.
- Synthesize methods of solving problems in summation of series and recurrence relations.
- Introduce the concept of Theoretical Distributions and interpret the importance of correlation function and spectral studies.

COURSE OUTCOMES:

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

- Interpret the concepts of divisibility, prime number, congruence and number theorem. **(K2)**
- Solve a given problem using propositional logic. **(K3)**
- Explain the concept of Mathematical induction and the fundamentals of Probability **(K2)**
- Infer standard distributions of random variables. **(K2)**
- Explain the perceptions of correlation and spectral densities. **(K2)**

UNIT I NUMBER THEORY **12**

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

UNIT II PROPOSITIONAL CALCULUS **12**

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

UNIT III COMBINATORICS **12**

Mathematical Induction – Permutations and combinations - Recurrence Relation – Formation of Recurrence relation – Solution of recurrence relation by Generating Functions.

UNIT IV THEORETICAL DISTRIBUTIONS **12**

Concept of Probability – Conditional– Theorem of Total Probability – Baye's theorem –One dimensional Random Variables – Discrete and Continuous Random variables – Probability distribution function – Probability density function - Mathematical Expectations – Moments –. Mean and Variance – Moment generating function of Binomial, Poisson and Normal distributions

UNIT V STOCHASTIC PROCESS **12**

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

TOTAL : 45+15

TEXT BOOKS:

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction,5th Edition, Pearson New International Edition,2019.
2. Kenneth H. Rosen and Dr. Kamala Krithivasan, "Discrete Mathematics and Applications",8th Edition, Tata Mcgraw Hill, Education,2021.
3. Roy D Yates and David J Goodman, "Probability and Stochastic processes",3rd Edition, Wiley India Pvt Ltd,2021

REFERENCE BOOKS:

1. Kenneth H Rosen, "Discrete Mathematics and its Applications with Combinatorics and Graph Theory",7th Revised Edition, Tata McGraw – HillPub Co Ltd,2017.
2. Randolph Nelson, "A Brief Journey in Discrete Mathematics", Springer Nature Switzerland AG; 1st Edition, 2020.
3. Oscar Levin, "Discrete Mathematics: An Open introduction",3rd Edition, Createspace Independent Pub,2019.

WEBSITES:

1. www.geeksforgeeks.org/proposition-logic/
2. www.classcentral.com/subject/number-theory
3. www.mathworld.wolfram.com

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24BTAD301B NUMERICAL METHODS **4H-4C**

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

End Semester Exam:3 Hours

Pre-Requisites: Computational methods for Engineers/Transforms and Its Applications

COURSE OBJECTIVES:

The goal of this course is for students:

- Inculcate the basic concepts of solving algebraic and transcendental equations.
- Understand the numerical techniques of interpolation in various intervals
- Provide the knowledge of numerical differentiation and integration
- rovide the knowledge of solving ordinary differential equations and partial differential equations numerically

COURSE OUTCOMES:

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

- Solve the systems of linear and nonlinear equations by iterative methods (K3)
- Make use of interpolation methods for finding the missing terms (K3)
- Apply numerical methods for finding differentiation and integration of a given function (K3)
- Solve ordinary differential equations using Euler's, Taylor's, Runge Kutta and Milne Thomson's method (K3)
- Utilize implicit and explicit methods in heat and wave equations (K3)

UNITI SOLUTION OF EQUATIONS **12**

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

UNIT II INTERPOLATION **12**

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

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

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

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

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

UNIT V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

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

TOTAL :45+15

TEXT BOOKS:

1. Steven C.Chapra, Raymond P.Canale, Numerical Methods for Engineers,8thEdition , Tata McGraw Hill Education,2021.
2. Curtis F. Gerald and Patrick O. Wheatley,Applied Numerical Analysis,Addison Wesley, Thirteenth Edition,2004.

REFERENCE BOOKS:

1. Richard L. Burden and J. Douglas Faires, Numerical Methods, 4th Edition, Brooks/Cole 2012
2. Boyce, Di Prima and Meade, "Elementary Differential Equations and Boundary value problem", 12th Edition, John Wiley & Sons, 2021.
3. Steven Chapra, "Applied Numerical Methods with MATLAB", 5th Edition, Mcgraw-Hill Education, 2022.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition, 2011

WEBSITES:

1. www.classcentral.com/course/numerical-methods-engineers-32822
2. http://www.infocobuild.com/education/audio-video-courses/mathematics/numerical-analysis-iit-madras.html
3. http://www.infocobuild.com/education/audio-video-courses/mathematics/NumericalMethods-FiniteDifference-IIT-Roorkee/lecture-06.html

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTAD302 NUMERICAL LINEAR ALGEBRA 4H-4C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Graph Theory

COURSE OBJECTIVES:

The goal of this course for students is to

- Import the knowledge of solving system of algebraic equations.
- Provide the concept of Algebraic Structures such as Groups, Ring, Field,Vector spaces and its matrix representations.
- Apply the concept of inner product spaces in orthogonalization.
- Afford the adequate knowledge of least square approximation, Singular Value Decomposition and Principal Component Analysis.

COURSE OUTCOMES:

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

- Solve algebraic equations using direct and indirect methods. (K3)
- Infer the basics of vector spaces, subspaces and its properties. (K2)
- Explain the properties and matrix representation of a linear transformation. (K2)
- Interpret the inner product spaces in Gram Schmidt orthogonalization process and orthogonal projection. (K2)
- Apply Least Square Approximation, Singular Value Decomposition and Principal Component Analysis in vector spaces. (K3)

UNIT I NUMERICAL SOLUTION OF SYSTEM OF ALGEBRAIC EQUATION 12

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

UNIT II VECTOR SPACES 12

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

UNIT III LINEAR TRANSFORMATION 12

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

UNIT IV INNER PRODUCT SPACE **12**

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

UNIT V POSITIVE DEFINITE MATRICES **12**

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

TOTAL : 45+15

TEXT BOOKS:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, "Linear Algebra", Pearson Education, 5th Edition,2018
2. Gilbert Strang, "Linear Algebra and Learning from Data", Cambridge University press, 1st Edition, 2019.

REFERENCE BOOKS:

1. Kenneth Hoffman, Ray Kunze, "Linear Algebra", Pearson In, 2nd Edition, 2018.
2. G. Williams, "Linear Algebra with Applications" ,Jones & Bartlett Learning, 1st Edition, 2019.
3. Sheldon Axler, "Linear Algebra Done Right", Springer Cham, 3rdEdition, 2015.

WEBSITES:

1. www.classcentral.com/courses/swayam-numerical-linear-algebra-9904
2. www.coursera.org/learn/pca-machine-learning
3. www.udemy.com/course/linear-algebra-theory-and-implementation/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTAD341 DATABASE MANAGEMENT SYSTEMS (THEORY & LAB) 5H-4C

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

End Semester Exam:3 Hours

PREREQUISITES: Computer Fundamentals and Communication

i) THEORY

COURSE OBJECTIVES:

The Goal of this course for the students is to

- Understand the data models, conceptualize and Design a database system using E-R diagrams
- Acquire the knowledge on the design principles of a relational database system, SQL and Indexing
- Impart knowledge in transaction processing, concurrency control and recovery techniques

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Illustrate the fundamental principles of database management systems and sketch an ER model for a real-world context (K2)
- Interpret the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes and security schemes (K2)
- Construct queries in SQL or Relational algebra, relational calculus for providing query-based solutions (K3)
- Design databases with designed structures and enforce normalization principles in relational databases to eliminate anomalies (K3)
- Build database storage and access techniques for file organization, indexing methods and query processing (K3)

UNIT I INTRODUCTION 9

Introduction: Database Architecture – Database design and ER model: Overview of the design process–The ER Model – Constraints – Removing redundant attributes in Entity Sets–ER Diagram – Reduction to Relational Schemas – ER Design Issues. Introduction to Relational Model – Formal Relational Query Languages: Relational Algebra, Relational Calculus: Tuple and Domain Relational Calculus.

UNIT II DATABASE DESIGN & NORMAL FORMS 9

Introduction to SQL: DDL, DML, TCL, DCL– Basic structure of SQL Queries – Set operations – Aggregate functions Nested subqueries – Intermediate SQL: Joins–Views – Integrity Constraints –

Functional dependencies – Normal forms based on primary keys – General Definition of Second and Third Normal Form – Boyce Codd Normal Form – Multi valued dependencies and Fourth Normal Form.

UNIT III DATA STORAGE AND INDEXING 9

Data Storage & Indexing: File Organizations Organization of Records in Files Indexing Structures Primary & Secondary Indexes Tree – structured Indexes – Multidimensional Indexes –Hashing – Static hashing – Dynamic hashing – Query Processing and Optimization: Heuristic optimization – Cost based optimization.

UNIT IV TRANSACTION AND RECOVERY 9

Transactions: Transaction concept –Transaction Atomicity and Durability – Transaction Isolation– Serializability –Transaction Isolation and Atomicity– Transaction Isolation levels –Implementation of Isolation Levels –Concurrency Control: Lock based protocols – Deadlock handling –Timestamp based protocols – Recovery system: Failure classification – Storage - Recovery and atomicity.

UNIT V DATABASE SECURITY AND RECENT DBMS 9

Database Security: Common Threats and Challenges – Access Control – DAC, MAC and RBAC models – Intrusion Detection – SQL Injection – Recent DBMS: In-memory databases – Graph database – Open-source DBMS– Databases as a service.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Design E-R Diagram for the relational database.
2. Write a SQL Queries to implement Data Definition Language commands.
3. Write a SQL Queries to implement to implement Data Manipulation Language (DML).
4. Write a SQL Queries to implement to implement Data Control Language (DCL) and TCL commands.
5. Implement Nested Queries and Joins.
6. Querying using Aggregate Functions (COUNT, SUM, AVG, MAX and MIN)
7. Create and manage views and integrity constraints.

TEXT BOOKS:

1. Silberschatz A, Korth H F and Sudarshan S, "Database System Concepts", 6th edition, Tata Mc-Graw Hill, 2022.
2. Date C J, "Database Design and Relational Theory", 2nd Edition, Apress Berkeley, CA, 2019.

REFERENCES:

1. Ramakrishna R. & Gehrke J, "Database Management Systems", 3rd Edition, Mc-Graw Hill, 2022.
2. Ramez Elmasri and Shamkant B Navathe, "Fundamental Database Systems", 7th Edition, Pearson Education, 2021.
3. Robinson, I, Webber, J, & Eifrem E, "Graph Databases", 3rd Edition, O'Reilly, 2019.

WEBSITES:

1. www.geeksforgeeks.org/dbms/
2. www.guru99.com/dbms-tutorial.html
3. www.javatpoint.com/dbms-tutorial

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTAD342 DESIGN AND ANALYSIS OF ALGORITHMS (THEORY & LAB) 5H-4C

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

End Semester Exam:3 Hours

PREREQUISITES: Data Structures and Algorithms

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Understand and apply the algorithm analysis techniques on searching and sorting algorithms
- Recognize the various algorithm design techniques and analyze its efficiency
- Solve programming problems using state space tree and concepts behind NP Completeness, Approximation algorithms and randomized algorithms

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Utilize asymptotic notions and recurrence relations for assessment of time and space complexities of non-recursive and recursive algorithms (K3)
- Implement searching and pattern-matching algorithms for development of solutions to complex computational problems (K3)
- Construct optimal solutions for real-world applications using greedy techniques and dynamic programming. (K3)
- Develop solutions for combinatorial problems and travelling salesman problem by using state space search algorithms. (K3)
- Compute the complexity and feasibility of NP complete and approximation algorithms for computational contexts (K4)

UNIT I INTRODUCTION 9

Algorithm analysis: Time and space complexity – Asymptotic Notations and its properties – Best case – Worst case and average case analysis – Mathematical analysis of non-recursive and recursive algorithms – Recurrence relation: substitution method – Masters theorem Sorting – Analysis of Insertion sort and heap sort.

UNIT II BRUTE FORCE APPROACH AND DIVIDE AND CONQUER 9

Searching: linear search – binary search – interpolation Search – Pattern search: The naive string-matching algorithm – Rabin – Karp algorithm – Knuth–Morris – Pratt algorithm. Divide and Conquer methodology: Finding maximum and minimum – Merge sort – Quick sort – Strassen matrix multiplication.

UNIT III GREEDY AND DYNAMIC PROGRAMMING 9

Greedy Technique: Activity-selection problem – Fractional knapsack problem – Huffman Trees – Minimum spanning tree: Kruskal's and Prim's algorithm – Shortest path – Dijkstra's algorithm – Dynamic programming: Longest common subsequence – Matrix-chain multiplication – All pair shortest path – Floyd's algorithm – Optimal Binary Search Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n – Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem – Assignment problem – Knapsack Problem – Travelling Salesman Problem.

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation – NP algorithms – NP-hardness – NP-completeness –Bin Packing problem – Problem reduction: TSP – 3CNF problem – Approximation Algorithms: TSP – Randomized Algorithms: concept and application – primarily testing – randomized quick sort – Finding k^{th} smallest number.

TOTAL :45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Analyze Linear Search and Binary Search algorithms with Complexity Analysis.
2. Create implementations of Pattern Matching algorithms.
3. Develop Dijkstra's algorithm for shortest path.
4. Implement dynamic programming solution to find the length of longest common subsequence.
5. Create N Queens problem solution using Backtracking.
6. Implement backtracking solution for Subset Sum Problem.
7. Develop solution for Traveling Salesperson problem.

TOTAL :30

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", 4th Edition, Mcgraw Hill/ MIT Press, 2022.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2019.

REFERENCE BOOKS:

1. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, "Computer Algorithms /C++", 2nd Edition, Orient Blackswan, 2019.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures And Algorithmic Puzzles", 1st Edition, CareerMonk Publications, 2023.
3. S. Sridhar, "Design and Analysis of Algorithms", 2nd Edition, Oxford university Press, 2023.

WEBSITES:

1. www.https://nptel.ac.in/courses/106106131
2. www.https://geeksforgeeks.org/
3. www.javatpoint.com/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTAD343 JAVA PROGRAMMING (THEORY & LAB) 5H-4C

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

End Semester Exam:3 Hours

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

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Learn the fundamental concepts of Java programming
- Acquire the knowledge of inheritance, abstraction, exception and package in Java
- Obtain the knowledge of Java Collection API, Multithreading, JDBC and Lambda expression in Java

COURSE OUTCOMES:

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

- Infer the fundamental concepts, architecture, and features of Java Programming (K2)
- Solve programming challenges using object-oriented paradigms (K3)
- Build applications using multi-tasking mechanisms, and exception handling strategies (K3)
- Construct robust and efficient Java applications using JDBC, lambda expressions and interface (K3)
- Develop Java applications by amalgamating object-oriented design, collection usage and advanced data manipulation. (K3)

UNIT I INTRODUCTION TO JAVA 9

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

UNIT II INHERITANCE 9

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

UNIT III DATA ABSTRACTION **9**

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

UNIT IV COLLECTION API AND LAMBDA **9**

Introduction to wrapper classes – Predefined wrapper classes – Conversion of types – Concept of Auto boxing and unboxing – Java Collections API – Introduction to Collection – Generics – List implementations – Set implementations – Map implementations – Functional Interfaces – Lambda Expressions – Accessing local variables – Accessing class variables – Predicates – Functions – Suppliers – Consumers – Stream API – Filter – Sorted – Map – Reduce – Count – Parallel Streams.

UNIT V JDBC AND MULTITHREADING **9**

JDBC – Introduction to JDBC – Establishing connection – Executing query – Processing results – Prepared Statement – Callable Statement – Transactions – Meta Data objects – Multithreading: Introduction to Multithreading – Process Vs Thread –Thread life cycle – Thread class – Runnable Interface – Thread creation – Thread control and priorities – Thread synchronization.

Total: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Develop programs using flow control statements and arrays to manage execution flow and data organization effectively.
2. Implement programs using inheritance and polymorphism to promote code reusability and dynamic method binding.
3. Develop programs incorporating packages, abstract classes, and interfaces to structure code modularly and enforce abstraction.
4. Implement programs using exception handling mechanisms to ensure robust error detection and graceful recovery.
5. Create programs using the Collection API to manage groups of objects with flexibility and high performance.
6. Implement programs using JDBC to establish and manage database connections for data persistence and retrieval.
7. Develop programs using multithreading to achieve concurrent execution and improve application performance.

Total: 30

TEXT BOOKS:

1. Herbert Scheldt, " Java: The Complete Reference", 12th edition, Tata McGraw-Hill, 2022.
2. Cay S Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", 12th edition, Prentice Hall, 2021.

REFERENCE BOOKS:

1. David Flanagan and Benjamin Evans, "Java in Nutshell", 8th edition, O'Reilly Media, 2022.
2. Kathy Sierra, Bert Bates, Trisha Gee, "Head First Java ", 3rd edition, O'Reilly Media, Inc, 2022.
3. Joshua Bloch, "Effective Java", 3rd Edition, Addison-Wesley Professional, 2018.

WEBSITES:

1. www.https://docs.oracle.com/javase/tutorial/java/nutsandbolts
2. www. https://javabeginner.com/learn-java
3. www. https://dev.java/learn
4. https://www.w3schools.com/java/java_intro.asp

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTAD344 ARTIFICIAL INTELLIGENCE (THEORY & LAB) 5H-4C

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

End Semester Exam:3 Hours

PRE–REQUISITES: Fundamentals of Data Science, Python Programming

i) THEORY

COURSE OBJECTIVES:

The goal of this course for students is to

- Impart knowledge about Artificial Intelligence.
- Understand the main abstractions and reasoning for intelligent systems.
- Learn the basic principles of Artificial Intelligence in various applications

COURSE OUTCOMES:

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

- Interpret the structures of Learning concepts and use of PROLOG in AI. (K2)
- Apply the AI intelligent agents to a given real time dataset (K3)
- Analyze the search strategies and its types (K4)
- Examine the structures and algorithms selection in Artificial Intelligence techniques related to knowledge representation and reasoning. (K4)
- Compare AI with human intelligence and traditional information processing to complex and human-centered problems (K4)

UNIT I INTRODUCTION TO AI 9

Introduction - Definition - Characteristics of Intelligent Agents - Typical Intelligent Agents - Problem Solving Approach to Typical AI problems, History of Artificial Intelligence, The State of the Art, Future of Artificial Intelligence, Risks and Benefits of AI.

UNIT II INTELLIGENT AGENTS 9

Agents and Environment, The Concept of Rationality: Performance measures, Rationality, Omniscience, learning, and autonomy, Agent architectures (e.g., reactive, layered, cognitive), The Nature of Environments: Specifying the task environment, Properties of task environments, The Structure of Agents.

UNIT III PROBLEM-SOLVING 9

Solving Problems by Searching: Problem-Solving Agents, Search problems and solutions, formulating problems, Search Algorithms, Breadth-first search, Depth-first search, A* search, the effect of heuristic

accuracy on performance, Generating heuristics from relaxed problems. Local Search and Optimization Problem, Hill-climbing search, Constraint Satisfaction Problem, Variations on the CSP formalism.

UNIT IV KNOWLEDGE AND REASONING 9

Logical Agents: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Syntax, Semantics, A simple knowledge base, A simple inference procedure, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Conjunctive normal form, A resolution algorithm, Completeness of resolution, Forward and backward chaining.

UNIT V ADVERSARIAL SEARCH AND GAMES 9

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, Limitations of game search algorithms.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Installation and working on various AI tools viz Scikit Learn, Tensorflow, Keras, CNTK.
2. Data pre-processing and annotation and creation of datasets.
3. Implementation of Breadth First and Depth First searching techniques.
4. Implementation of Hill climbing algorithm.
5. Implementation of A* Algorithm.
6. Designing a Chat bot application.
7. Write a program for problem solving methods.

TOTAL: 30

TEXT BOOKS:

1. S.Russell and P.Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Fourth Edition, 2021.
2. I. Bratko, Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc, 2011

REFERENCE BOOKS:

1. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2023.
2. Deepak Khemani, Artificial Intelligence, Tata McGraw Hill Education 2013.
3. Mishra R B, Artificial Intelligence, PHI Learning Pvt. Ltd., New Delhi, 2013.

WEBSITES:

1. https://plato.stanford.edu/entries/artificial-intelligence/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/
3. https://oli.cmu.edu/learn-with-oli/see-all-oli-courses/
4. https://aitopics.org/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	3	3	-
CO2	3	2	1	-	-	-	-	-	2	2	-	3	3	-
CO3	3	3	2	1	-	-	-	-	2	2	-	3	3	-
CO4	3	3	2	1	-	-	-	-	2	2	-	3	3	-
CO5	3	3	2	1	-	-	-	-	2	2	-	3	3	-
Avg	**2.8**	**2.4**	**1.8**	**1**	-	-	-	-	**2**	**2**	**-**	**3**	**3**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24BTAD401A PROBABILITY AND STATISTICS 4H-4C

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

End Semester Exam:3 Hours

Pre-Requisites: Numerical Methods

COURSE OBJECTIVES:

The goal of this course is for students:

- Provide the required fundamental concepts of probability theory, Random variables and its distributions.
- Impart the knowledge of Measures of Central tendencies and Dispersions
- Impart the knowledge of correlation and Regression
- Inculcate the knowledge of testing of hypothesis using small and large sampling tests.

COURSE OUTCOMES:

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

- Infer the fundamentals of probability and random variables (K2)
- Explain standard distributions of random variables (K2)
- Make use of statistical data for finding the measures of central tendency and
- measures of dispersion (K3)
- Interpret the data using correlation and regression (K2)
- Apply small and large sample tests in testing of hypothesis**.** (K3)

UNIT I PROBABILITY AND RANDOM VARIABLES 12

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

UNIT II THEORETICAL DISTRIBUTIONS 12

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

UNIT III DESCRIPTIVESTATISTICS 12

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

UNIT IV CORRELATION AND REGRESSION **12**

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

UNIT V TESTING OF HYPOTHESIS **12**

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

TOTAL : 45+15

TEXT BOOKS:

1. Geoffrey Grimmett and David Stirzaker, "Probability and Random Processes", Oxford University Press, 4th Edition, 2020.
2. Allen Craig Rober V Hogg,JosephW Mckean, "Introduction to Mathematical Statistics",Pearson,8th Edition,2021**.**
3. Gupta, S.C and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 1999.

REFERENCE BOOKS:

1. Sheldon M Ross, "Introduction to Probability and statistics for Engineers and scientists", Elsevier, 6thEdition, 2021.
2. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", John Wiley, 7th Edition, 2019.
3. Freund John, E and Miller, Irvin, "Probability and Statistics for Engineering", 5th Edition, Prentice Hall, 1994.
4. Jay, L.Devore, "Probability and Statistics for Engineering and Sciences", Brooks Cole Publishing Company, Monterey, California, 1982.

WEB SITES:

1. www.britannica.com/science/probability
2. www.britannica.com/science/density-function
3. www.khanacademy.org/math/statistics-probability

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24BTAD401B STATISTICS AND OPTIMIZATION TECHNIQUES 4H-4C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Graph Theory/Transforms and Its Applications/Discrete Mathematics and Stochastic Process/Numerical Methods/Numerical Linear Algebra

COURSE OBJECTIVES:

The goal of this course for students is to

- Understand the concept of statistical tools and statistical techniques from both applied and theoretical points of view.
- Solve the linear programming problem using Graphical method, Simplex method and Dual simplex method.
- Impart the knowledge of transportation and assignment models.
- To afford the adequate knowledge on networking models and game theory.

COURSE OUTCOMES:

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

- Explain the concept of measures of central tendency and measures of dispersion. **(**K2)
- Apply small and large sample tests in testing of hypothesis. (K3)
- Make use of Graphical method, Simplex method and Dual simplex method in linear programming models. (K3)
- Interpret solutions for transportation and assignment problems (K2)
- Solve the network models, 2xn and mx2 games with and without saddle point. (K3)

UNIT I DESCRIPTIVE STATISTICS **12**

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

UNIT II TESTING OF HYPOTHESIS **12**

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

UNIT III LINEAR PROGRAMMING PROBLEM **12**

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

UNIT IV TRANSPORTATION AND ASSIGNMENT MODELS **12**

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

UNIT V NETWORK MODELS AND GAME THEORY **12**

CPM & PERT techniques - Critical path method - PERT approach - Expected length of a project - Probability of project completion by due date - Game theory – Pay-off matrix - Pure strategies: Games with saddle point - The rules of dominance - mixed strategies: Games without saddle point - Solution of 2xn and mx2 games.

TOTAL : 45+15

TEXT BOOKS:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, "Introduction to Mathematical Statistics",18th Edition, Pearson Education Limited, 2019
2. Geoffrey Grimmett and David Stirzaker, "Probability and Random Processes", Oxford UniversityPress,4th Edition, 2020.

REFERENCE BOOKS:

1. S.C. Gupta, V.K. Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, 2020.
2. Frederick S. Hillier Gerald J. Lieberman Bodhibrata Nag PreetamBasu, "Introduction to Operations Research", 10th Edition, Tata McGraw-Hill Education, 2017
3. Ronald L Rardin, "Optimization in Operations Research", 2nd Edition, Pearson, 2017

WEBSITES:

1. www.classcentral.com/course/udacity-intro-to-descriptive-statistics-2309
2. www.classcentral.com/course/open-edatpsu-stat-506-sampling-theory-and-methods-116656
3. www.classcentral.com/course/swayam-operations-research-14219

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-IV

24BTAD441 OPERATING SYSTEMS (THEORY & LAB) 5H-4C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Fundamentals and Communication

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Provide basic knowledge of computer operating system structures and functioning
- Compare different approaches to memory management, file management and process management
- Understand various problems related to concurrent operations and their solutions

COURSE OUTCOMES:

Upon Completion of this course the students will be able to

- Interpret the functionality of the Operating Systems to monitor, access and control the hardware for the user applications (K2)
- Solve the conflict of resource access by processes using process synchronization and deadlock handling techniques (K3)
- Apply Virtualization approach to achieve portability with appropriate File Syste (K3)
- Build scheduling algorithms to utilize the resources of the system efficiently (K3)
- Analyze the allocation and access strategy of memory for the processes to achieve high performance. (K4)

UNIT I BASICS OF OPERATING SYSTEMS AND PROCESS MANAGEMENT 9

Basics of operating systems: Generations – Types – Structure – Services - System Calls - System Boot - System Programs - Protection and Security - Process management: Process Concepts - Process States, Process Control Block –Operation on Process - Scheduling-Criteria - Scheduling Algorithms and their Evaluation – Threads - Threading Issues.

UNIT II PROCESS SYNCHRONIZATION AND DEADLOCK 9

Process synchronization: Background - Critical-Section Problem - Peterson's Solution - Synchronization Hardware – Semaphores - Classic Problems of Synchronization - Monitors. Deadlock: System Model - Deadlock Characterization - Deadlock Prevention - Detection and Avoidance - Recovery form Deadlock.

UNIT III MEMORY MANAGEMENT 9

Main Memory - Swapping - Contiguous Memory Allocation - Paging - Structure of Page Table - Segmentation - Virtual Memory - Demand Paging - Page Replacement Algorithms - Allocation of Frames - Thrashing.

UNIT IV STORAGE MANAGEMENT AND SYSTEM PROTECTION 9

Disk structure and attachment – Disk scheduling algorithms (seek time, rotational latency based)- System threats and security – Policy vs mechanism - Access vs authentication - System protection: Access matrix – Access Control - Capability based systems - OS: performance, scaling, future directions in mobile OS.

UNIT V VIRTUALIZATION AND FILE SYSTEM MANAGEMENT 9

Virtual Machines - Virtualization (Hardware/Software, Server, Service, Network - Hypervisors - Container virtualization - Cost of virtualization - File system interface (access methods, directory structures) - File system implementation (directory implementation, file allocation methods) - File system recovery - Journaling - Soft updates - Log-structured file system - Distributed file system.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Practice Unix and Shell commands, develop shell scripts and simulate a shell
2. Implement any two CPU scheduling algorithms, simulate and record the process state using SOsim
    a) FCFS
    b) SJF
    c) Priority
    d) Round Robin
3. Implement Bankers Algorithm for Dead Lock Avoidance
4. Implement Semaphore for Producer Consumer Problem
5. Implement any two of the following page replacement algorithms
    a) FIFO
    b) LRU
    c) LFU
6. Implement any two of the following file organization Techniques
    a) Single level directory structure
    b) Two level directory structure
    c) Tree structure
    d) Acyclic graph structure
7. Implement a few Disks Scheduling Algorithms

TOTAL: 30

TEXT BOOKS:

1. William Stallings, "Operating Systems: Internals and Design Principles", 10th Edition, Pearson Education, 2021.
2. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, Wiley, 2021.

REFERENCE BOOKS:

1. Charles Crowley, "Operating Systems: A Design-Oriented Approach",1st Edition, CRC Press, 2020.
2. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", 2nd Edition, Arpaci-Dusseau Books, 2018.
3. Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", 5th Edition, Pearson Education, 2022.

WEBSITES:

1. https://www.coursera.org/courses?query=operating%20system
2. https://www.tutorialspoint.com/operating_system/index.htm
3. https://www.edu.gcfglobal.org/en/computerbasics/understanding-operating-systems/1/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	3
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	3
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	3
CO4	3	2	1		-	-	-	-	2	2	-	2	-	3
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	3
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	**2**	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-IV

24BTAD442 WEB APPLICATION DEVELOPMENT 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: Java Programming

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Understand the concepts of Servlet API and JSP
- Gain knowledge of Hibernate for interacting with database
- Learn the concepts of Spring and Spring Boot

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Outline web application frameworks and architecture using Servlets and JSP for building dynamic web applications. (K2)
- Illustrate JSP and ORM concepts to effectively manage user interfaces and data
- interactions in web applications, ensuring seamless integration and functionality (K2)
- Construct effective web applications with database integration using the Spring Framework to achieve robust and scalable solutions (K3)
- Develop comprehensive web solutions using Spring Boot, focusing on real-world application scenarios to demonstrate practical expertise in modern web evelopment. (K3)
- Build advanced web technologies across different layers of a web stack
- to develop sophisticated and high-performance web applications (K3)

UNIT I SERVLET API **9**

Introduction to MVC - Features - Components. Servlet: Life Cycle – Types - Servlet Configuration - ServletContext - ServletConfig - Request Dispacher - sendRedirect - Session Tracking: Cookies – HTTPSession - Servlet with JDBC

UNIT II JSP API **9**

JSP: Comparison with Servlet – Architecture - Life Cycle - Scripting Elements – Directives - Action Tags - Implicit Objects - Java Beans in JSP - Expression Language (EL) - JSTL Core Tags - Session Management - Exception Handling – JSP with JDBC.

UNIT III HIBERNATE API **9**

Hibernate: Architecture - Object Relation Mapping – Annotation – Querying: Hibernate Query Language - Criteria Queries - Native SQL - Basic O/R Mapping - Collection Mapping - Association Mappings.

UNIT IV SPRING MVC **9**

Spring: Introduction – Architecture - Spring MVC Module - Life Cycle of Bean Factory - Constructor Injection - Dependency Injection - Inner Beans - Aliases in Bean - Bean Scopes - Spring Annotations - Spring AOP Module, Spring DAO - Database Transaction Management - Build Tools: Maven - Gradle.

UNIT V SPRING BOOT **9**

Introduction to Spring Boot - Spring Vs. Spring Boot - Internals - Auto Configuration - Annotations - Spring Data - Crud Repository - JPA Repository - Custom Queries in JPA - Spring Boot Profiles - Spring Web MVC - Thymeleaf – Spring boot with ORM.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement a web application using Servlets to handle HTTP requests and responses.
2. Develop dynamic web pages using JavaServer Pages (JSP).
3. Develop application features using Hibernate Collection Mapping and Association Mapping to manage relationships between entities.
4. Create web applications using the Spring MVC framework.
5. Develop Spring MVC applications integrated with a backend database.
6. Develop Spring applications integrated with JPA.
7. Implement RESTful APIs and microservices using Spring Boot.

TOTAL: 30

TEXT BOOKS:

1. Jim Keogh, "J2EE: The complete Reference", 1st Edition, McGraw-Hill, 2017
2. Santosh Kumar K, "Spring and Hibernate", 2nd Edition, McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Budi Kurniawan, "Servlet & JSP: A Tutorial", 1st Edition, Brainy Software, 2015.
2. Claudio and Greg, "Developing Java Applications with Spring and Spring Boot", 1st Edition, Packt Publishing, 2018.
3. Shagun Bakliwal, "Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot", 1st Edition, Packt Publishing Ltd, 2018.

WEBSITES:

1. https://www.hibernate.org/orm/documentation/6.1/
2. https://www.udemy.com/courses/development/web-development/
3. https://www.codecademy.com/catalog/subject/web-development

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24BTAD443 **MACHINE LEARNING TECHNIQUES (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PRE REQUISITES: Artificial Intelligence, Python Programming

i) THEORY

COURSE OBJECTIVES:

The Goal of this course for the students is to

- Provide a fundamental concepts of data pre-processing, supervised, unsupervised, and reinforcement learning.
- Equip students with tools and techniques for regression and classification models.
- Explore contemporary K-Means and Hierarchical Clustering and neural networks.

COURSE OUTCOMES:

Upon completion of this course the student will be able to

- Explain the fundamental concepts of supervised, unsupervised, reinforcement learning and pre-processing techniques (K2)
- Compare the performance of various regression models (K2)
- Utilize classification and clustering algorithms to frame ML models (K3)
- Build a single layer neural network and a multilayer perceptron (K3)
- Analyze machine learning techniques to solve complex problems (K4)

UNIT I INTRODUCTION AND DATA PRE-PROCESSING **9**

Machine learning – Introduction – Supervised learning – Unsupervised learning – Reinforcement learning – Machine learning lifecycle – Data Preprocessing – Importing the libraries – Importing the dataset – Handling missing data – Outlier detection and removal – Handling Imbalance class - Encoding categorical data – Splitting the dataset – Feature scaling.

UNIT II REGRESSION **9**

Regression – Simple linear regression – Multiple linear regression – Polynomial regression – Support vector regression – Decision tree regression – Random Forest regression – Evaluating regression models – Regression model selection

UNIT III CLASSIFICATION **9**

Classification – Logistic regression – K-Nearest neighbor – Support vector machine – Kernel SVM – Naive Bayes – Decision tree classification – Random Forest classification – XGBoost – Classification model selection – evaluating classification models.

UNIT IV CLUSTERING, ASSOCIATION, REINFORCEMENT LEARNING **9**

Clustering – K-Means clustering – Hierarchical clustering. Association – Apriori – Eclat algorithm. Dimensionality reduction – PCA – LDA – Kernel PCA. Reinforcement learning – Multi armed bandit problem – Upper confidence bound – Thompson sampling. Model selection – K-fold cross validation – Grid search.

UNIT V NEURAL NETWORKS **9**

Basics of Neural Networks - MP neurons - perceptron - weight - bias - activation - loss function - optimizer; Artificial Neural Networks - Single Layer Neural Network - Multilayer Perceptron.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implementation of regression algorithms.
2. Decision Tree
3. Random Forest
4. Implementation of Support Vector Machine and K-Mean Clustering
5. Association Rule Mining
6. Implementation of Principal Component Analysis and Linear Discriminant Analysis
7. Multi-layer perceptron

TOTAL: 30

TEXT BOOKS:

1. Peter Wlodarczak, "Machine Learning and its Applications", 1st Edition, John Wiley, 2020.
2. Wei-Meng, "Python Machine Learning", John Wiley, First Edition, 2019.

REFERENCE BOOKS:

1. Wei-Meng, "Python Machine Learning", 1st Edition, John Wiley, 2019.
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 3rd Edition, O'Reilly Media, 2022.
3. Pratheerth Padman, "Learn Data Science from Scratch: Mastering ML and NLP with Python in a step-by-step approach", 1st Edition, BPB Publications, 2024.

WEBSITES:

1. https://www.machinelearningmastery.com/
2. https://www.geeksforgeeks.org/machine-learning/
3. https://www.javatpoint.com/machine-learning

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	3	-	3
CO2	2	1	-	-	2	-	-	-	2	2	-	3	-	3
CO3	3	2	1	-	2	-	-	-	2	2	-	3	-	3
CO4	3	2	1	-	2	-	-	-	2	2	-	3	-	3
CO5	3	3	2	1	2	-	-	-	2	2	-	3	-	3
Avg	**2.6**	**1.8**	**1.3**	**1**	**2**	-	-	-	**2**	**2**	-	**3**	-	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-V

24BTAD444 **COMPUTER NETWORKS (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Understand the concept of data communication, functionalities of layers and switching techniques.
- Impart knowledge in wired & wireless communication protocols, flow control and congestion control mechanisms.
- Gain knowledge of application layer the data encryption and decryption techniques.

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Summarize the functionalities and roles of OSI, TCP/IP models in network communication. (K2)
- Apply routing techniques to address issues of congestion and flow control in network protocols (K3)
- Identify the purpose of protocols and standards to ensure interoperability and efficiency (K3)
- Apply public key cryptosystems to encrypt and decrypt process (K3)
- Differentiate between routing techniques using TCP and UDP protocols to understand their impact on data transmission efficiency and reliability. (K4)

UNIT I DATA COMMUNICATION AND NETWORKS **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 - Transmission Modes – Multiplexing - Transmission Media

UNIT II DATA LINK AND PHYSICAL LAYERS **9**

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN

(802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching. Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC –PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching.

UNIT III NETWORK LAYER AND ROUTING 9

Switching: Packet Switching - Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP Switching: Packet Switching - Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, DHCP - Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing –OSPF – Path-vector routing - BGP

UNIT IV TRANSPORT LAYER 9

Transport Layer: Process to Process Delivery - User Datagram Protocol – TCP - Congestion control - Congestion control in TCP and Frame Relay - Congestion avoidance (DECbit, RED) – SCTP - Techniques to improve QoS.

UNIT V APPLICATION LAYER AND SECURITY 9

Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMPApplication Layer protocols: HTTP - WWW – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP - Cryptography: Introduction – Categories of cipher techniques. Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP

TOTAL: 45

iii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement a network topology with NS2 involving a set of nodes (4 nodes).
2. Develop implementations of the stop-and-wait protocol and sliding window protocol.
3. Implement Subnetting techniques to optimize network addressing.
4. Design and implement routing algorithms for efficient data transmission.
5. Implement Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).
6. Develop a File Transfer Protocol (FTP) implementation.
7. Simulate error correction codes (e.g., CRC) for data integrity in communication protocols.

TOTAL: 30

TEXT BOOKS:

1. Behrouz A. Forouzan, Data communication and Networking, Tata McGraw –Hill, Sixth Edition, 2022.
2. William Stallings, Cryptography and Network security – Principles and Practices, Pearson Education, Seventh Edition,2017.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, Nick Feamster, David J Wetherall, Computer Networks, Pearson Education, Sixth Edition, 2022
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers, Sixth Edition, 2018.
3. James F. Kurose, Keith W. Ross, Computer Networking – A Top-Down Approach Featuring the Internet, Pearson Education, Seventh Edition, 2017.

WEBSITES:

1. https://www.javatpoint.com/computer-network-tutorial.
2. https://www.coursera.org/courses?query=computer%20network
3. https://archive.nptel.ac.in/courses/106/105/106105183//

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1		-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	1	-	-	**-**	**-**	2	2	**-**	-	-	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-V

24BTAD541 DEEP LEARNING (THEORY & LAB) 5H-4C

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

End Semester Exam:3 Hours

Pre requisites: Machine Learning Techniques

i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to

- Provide a fundamental concepts of Neural Networks fundamentals.
- Equip students with tools and techniques for optimization techniques and data analysis advanced algorithms.
- Explore contemporary Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Demonstrate proficiency in building and training Neural Networks for various tasks. (K2)
- Interpret optimization techniques effectively to improve model performance. (K3)
- Solve advanced algorithms for data analysis and dimensionality reduction. (K3)
- Develop expertise in Convolutional Neural Networks (CNNs) for image recognition. (K3)
- Survey the appropriate metrics and validation technique for Recurrent Neural Networks (RNNs) (K3)

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction to Neural networks – Biological neuron – McCulloch pitts neuron – Perceptron – Error and error surfaces – Perceptron learning algorithm – Linearly separable Boolean functions – Sigmoid neuron- Multilayer network of sigmoid neurons – Feedforward neural networks – Output functions and loss functions – Backpropagation – Activation function – Information content, Entropy, cross entropy

UNIT II OPTIMIZATION TECHNIQUES 9

Gradient descent – Contour maps – Momentum based gradient descent – Nesterov accelerated gradient descent – Stochastic and mini batch gradient descent – Adjusting learning rate and momentum – Adaptive learning rate – Bias correction in Adam.

UNIT III DEEP DIVE INTO VARIOUS ALGORITHMS **9**

Eigen value decomposition - Principal component analysis – Singular value decomposition. Autoencoders – Introduction – Regularization – Denoising autoencoders – Sparse autoencoders - Contractive autoencoders. Ensemble methods – dropout – unsupervised pretraining – better activation functions – Initialization strategies – Batch normalization.

UNIT IV CONVOLUTIONAL NEURAL NETWORKS **9**

Convolutional neural networks – Input layers – Convolution layers – Pooling layers – Dense layers – LeNet – AlexNet – VGG16 – ResNet – Transfer learning with image data – Oxford VGG Model – Google Inception model – R-CNN – Fast R-CNN – Faster R-CNN – Mask R-CNN – YOLO.

UNIT V NATURAL LANGUAGE PROCESSING USING RNN **9**

Language modelling – Vector space model – Continuous Bag of words – Skip gram model. RNN: Introduction – Bidirectional RNN – Artificial Neural Network (ANN)-large language model (LLM)-Long Short Term Memory – Bidirectional LSTM – Sequence to sequence models – Gated recurrent unit.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Simulate the functioning of McCulloch Pitts neurons in a programming environment.
2. Implement the Perceptron learning algorithm to classify linearly separable Boolean functions.
3. Construct and train a multilayer feedforward neural network for pattern recognition tasks.
4. Implement various gradient descent optimization algorithms
5. Implement auto encoders and explore regularization techniques
6. Construct and train CNNs with different architectures for image classification.
7. Implement recurrent neural networks (RNNs) for sequence modeling tasks.

TOTAL: 30

TEXT BOOKS:

1. Francois Chollet, Adam Gibson, "Deep Learning with Python", 2nd Edition, Manning Publications, 2021.
2. Magnus Ekman, "Learning Deep Learning: Theory and Practice of Neural Networks, Computer Vision, Natural Language Processing, and Transformers Using TensorFlow", 1st Edition, Addison-Wesley Professional, 2021.

REFERENCE BOOKS:

1. Vinita Silaparasetty, "Deep learning projects using tensorflow", 2 Edition, Apress,2020.
2. David Foster, "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play", 2nd edition, Thomson Learning, 2023.

WEBSITES:

1. https://www.archive.nptel.ac.in/noc/courses/noc18/SEM2/noc18-cs41/
2. https://www.deeplearningcourses.com/
3. https://www.coursera.org/learn/neural-networks-deep-learning

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-V

24BTAD542 **DATA VISUALIZATION (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Python Programming.

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Provide the various process involved in data visualization.
- Get used to with using interactive data visualization.
- Explore how to accurately represent voluminous complex data set in data visualization.

COURSE OUTCOMES:

Upon completion of this course students will be able to

- Outline about data visualization is and its importance in simplifying complex data (K2)
- Develop skills to visualize geographical data and time series, understanding trends and patterns over time (K3)
- Build the use of area charts to show quantities over a range (K3)
- Make use customized calculations fields for tailor visualizations task. (K3)
- Inspect BI tools to create visualizations that support decision-making processes (K3)

UNIT I DEFINITION AND METHODOLOGY OF DATA VISUALIZATION 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 VISUALIZATION TECHNIQUES 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 – Hierarchies and Recursion – Networks and Graphs – Displaying Arbitrary Graphs – Node link graph – Matrix representation for graphs – Infographics

UNIT III PYTHON VISUALIZATION 9

mporting Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT IV HANDLING VISUALIZATION 9

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity – Calculating fields Creating custom calculations and fields- Customizing Tooltips - Forecasting – Trend lines - Data Color Formatting

UNIT V INHERITANCE, ABSTRACTION AND EXCEPTION HANDLING 9

Workbooks Formatting – Tableau Dashboard visualization – Tableau Storyboard visualization – BI visualization - Exporting Reports – Dashboard publishing

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Establish the connection between tableau and data sets and to Perform visualization
2. Create a simple infographic with your Day today life data sets
3. Highlighted tabular dataset & Highlight the Discount earned on each sub-category using colorsby using Local Superstore data
4. Create a Map and assign Geographic locations to the fields for local geographical area
5. Predicting Visualization for precise future trends for the superstore
6. data analysis and visualization using python Matplotlib Pandas
7. Create interactive dashboards which can be used to gain insights into the profits for orders over theyears.

TOTAL: 30

TEXT BOOKS:

1. Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”,1st Edition, O'Reilly Media,2019.
2. Kalilur Rahman, “Python Data Visualization Essentials Guide: Become a Data Visualization expert by building strong proficiency in Pandas, Matplotlib, Seaborn, Plotly, Numpy, and Bokeh” 1st Edition, BPB Publications ,2021.

REFERENCE BOOKS:

1. R. Nageswara Rao, “Data Visualization a Handbook for Data Driven Design”, 1st Edition, Sage Publications,2016.
2. Robert Spence, “Information Visualization An Introduction”, Third Edition, Pearson Education, 2014.

3. Colin Ware, “Information Visualization Perception for Design”, Third edition, Margon Kaufmann Publishers, 2012.

WEBSITES:

1. https://realpython.com/
2. www.https://public.tableau.com/app/learn/how-to-videos
3. www.https://learn.microsoft.com/en-us/training/powerplatform/power bi?WT.mc_id=powerbi_landingpage-docs-link

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	3	-	3
CO2	3	2	1	-	-	-	-	-	2	2	-	3	-	3
CO3	3	2	1	-	2	-	-	-	2	2	-	3	-	3
CO4	3	2	1	-	2	-	-	-	2	2	-	3	-	3
CO5	3	2	1	-	2	-	-	-	2	2	-	3	-	3
Avg	**2.4**	**2.2**	**1**	-	2	-	-	-	**2**	**2**	-	**3**	-	**3**

1. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

SEMESTER-V

24BTAD543 BIG DATA ANALYTICS 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: Database Management Systems

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Provide a fundamental concepts of Big Data.
- Equip students with tools and techniques for learn Big Data file systems and Pig Identify basic functions of R-Language
- Explore contemporary to process Big Data information for Hive and Hbase.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Explain the evolution of Big Data, characteristics of Big Data challenges (K2)
- Apply non-relational databases techniques for storing and processing large volumes of structured and unstructured data. (K3)
- Analyse data processing and big data analytics approaches (K4)
- Examine big data solutions for selecting algorithms and data structures appropriately (K4)
- Categorize efficient big data solutions for application areas using selected algorithms and data structures. (K4)

UNIT I COMPREHENSIVE GUIDE TO HADOOP 9

Hadoop - cluster architecture - Hadoop cluster modes - Common Hadoop shell commands - Hadoop configuration files - single node cluster - multi node cluster - Hadoop administration -MapReduce - MapReduce Combiner - Demo on de-identifying Health Care Data set, Demo on Weather Data analyzing

UNIT II MASTERING APACHE PIG 9

About Pig - MapReduce Vs Pig - Programming Structure - Pig Running Modes - Pig Components Data Models in Pig - Pig Data Types - Shell and Utility Commands - Pig Latin: Relational Operators, File Loaders - Group Operator - Joins and COGROUP – Union - Diagnostic Operators - Specialized joins in Pig, Load and Store Functions - Math function, String Function, Date Function, Pig Streaming, Pig Demo on Healthcare Data set - Creating jar for assignment

UNIT III UNDERSTANDING APACHE HIVE 9

Hive Background - Hive Vs Pig - Hive Architecture and Components, Metastore in Hive - Limitations of Hive- Comparison with Traditional Database - Hive Data Types and Data Models - Partitions and Buckets,

UNIT IV HIVE & HBASE ESSENTIALS 9

Hive Tables (Managed Tables and External Tables), Importing Data, Querying Data, Managing Outputs, Hive Script, Hive UDF, Retail use case in Hive – Hbase - HBase Data Model, HBase Shell, HBase Client API, Data Loading Techniques

UNIT V EXPLORING HBASE ARCHITECTURE 9

HBase. Knowledge of HBase Architecture and its components. Topics – Hbase - Introduction to NoSQL Databases and HBase - HBase v/s RDBMS - HBase Components - HBase Architecture - HBase Cluster deployment.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Hadoop Shell Commands to Manage HDFS and Linux Basic Commands.
2. Count the number of occurrences of each word in a text file.
3. Find out successful students using Pig Latin Script.
4. Working with Online Social Networks data.
5. Calculating a Stock's Covariance.
6. Company working data analysis.
7. Government financial dataset analysis.

TOTAL: 30

TEXT BOOKS:

1. Stuart J Russel and Peter Norvig, "Hadoop: The Definitive Guide", O'Reilly Media, 4th Edition, 2015.
2. Seema Acharya, "Big Data and Analytics", Wiley, First edition, 2015.

REFERENCE BOOKS:

1. Eric Sammer, "Hadoop Operations", O'Reilly Media, First Edition, 2012.
2. Judith S Hurwitz and Alan F Nugent, "Big Data For Dummies", John Wiley & Sons, Inc, First Edition,2013.
3. Naresh Kumar and Prashant Shindgikar, "Modern Big Data Processing with Hadoop", Packt Publishing, First Edition, 2018.

WEBSITES:

1. www.coursera.org/learn/big-data-integration-processing?specialization=big-data
2 .www.edx.org/learn/big-data
3. www.ibm.com/analytics/hadoop/big-data-analytics

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	3	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO3	3	3	2	1	-	-	-	-	2	2	-	2	3	-
CO4	3	3	2	1	-	-	-	-	2	2	-	2	3	-
CO5	3	3	2	1	-	-	-	-	2	2	-	2	3	-
Avg	**2.8**	**2.4**	**1.3**	1	-	-	-	-	**2**	**2**	**-**	**2**	**3**	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-V

24BTAD512 COMMUNITY ENGAGEMENT AND SOCIAL RESPONSIBILITY **4H-2C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students to:

- Achieve socio economic development through active community engagement.
- Improve the quality of both teaching and research for better understanding of issues in the society.

COURSE OUTCOMES:

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

- Explain the role of community engagement in the development of the nation.
- Understand the social problems, social contribution of community networking and various government schemes supporting the community engagement.
- Understand the role of Indian citizens towards community development by adopting a village and carrying out the field work

UNIT I

Concept, Ethics and Spectrum of Community engagement-Local community, Rural culture and Practice of community engagement

UNIT II

Stages, Components and Principles of community development, Utility of public resources – Contributions of self-help groups

UNIT III

Rural Development Programs and Rural institutions- Local Administration and Community Involvement

UNIT IV

Social contribution of community networking, various government schemes– Programmes of community engagement and their evaluation.

UNIT V

Community Engaged Research and Ethics in Community Engaged Research- Rural Distress, Rural Poverty, Impact of COVID-19 on Migrant Laborers, Mitigation of Disaster

REFERENCE BOOKS:

1. Principles of Community Engagement, 2nd Edition, NIH Publication No. 11-7782, Printed June 2011.
2. Lando, Lily Ann & Aktar, Shamima & JM, Apgar & Attwood, Simon & J, Brown & Chisonga, Nixon & Chea, Siek & A, Choudhery & Cole, Steven & Clayton, Terry & Crissman, Charles & Douthwaite, Boru & B, Downing & F, Golam & S, Hak & Gareth, Johnstone & Kabir, Kazi Ahmed & K, Kamp & Karim, Manjurul & Waters-Bayer, Ann. (2015). Research in development: Learning from the CGIAR Research Program on Aquatic Agricultural Systems.
3. https://youtu.be/-SQK9RGBt7o
4. https://www.uvm.edu/sites/default/files/community_engagement_handout.pdf (Community Engagement)
5. https://www.atsdr.cdc.gov/communityengagement/pce_concepts.html (Perspectives of Community)
6. https://egyankosh.ac.in/bitstream/123456789/59002/1/Unit1.pdf (community concepts)
7. https://sustainingcommunity.wordpress.com/2013/07/09/ethics-and-community-engagement/(Ethics of community engagement)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO2	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO3	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO4	-	-	-	-	-	1	-	1	-	-	-	1	-	-
CO5	-	-	-	-	-	1	-	1	-	-	-	1	-	-
Avg	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

24BTCC601 **UNIVERSAL HUMAN VALUES** **2H-2C**

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

End Semester Exam:3 Hours

PRE-REQUISITE: NIL

COURSE OBJECTIVES:

The goal of this course for students is to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Illustrate the significance of value inputs in a classroom, distinguish between
- values and skills. (K2)
- Interpret the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society (K2)
- Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body. (K4)
- Illustrate the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships. (K2)
- Identify their role in ensuring a harmonious society. (K3)

UNIT I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION **5**

Understanding the need, basic guidelines, content and process for Value Education, Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING HARMONY IN MYSELF 5

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP 5

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay- tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family

TOTAL HOURS: 15

TEXT BOOKS:

1. R R Gaur, R Sangal and G P Bagaria(2009)."A Foundation Course in Human Values and Professional Ethics"
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
6. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
7. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
8. A N Tripathy, 2003, Human Values, New Age International Publishers.

CO, PO, PSO Mapping:

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-VI

24BTAD641 **COMPUTER VISION (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PRE-REQUISITE: Deep Learning

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students :

- Provide a fundamental concepts of computer vision algorithms, stereoscopic imaging and higher-level image processing operations.
- Equip students with tools and techniques for image processing facilities in Octave and open-source tools like OpenCV.
- Explore contemporary with industrial applications, object detection and object tracking algorithms.

COURSE OUTCOMES:

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

- Summarize the basic computer vision algorithms, the proper use of shape and its related cue features for computer vision applications (K2)
- Interpret object detection methodologies for image processing. (K3)
- Apply Object detection algorithms used in Computer Vision. (K3)
- Identify the performance of computer vision algorithms (K3)
- Analyse an exemplary application on the real–world computer vision problems (K3)

UNIT I IMAGE BASICS **9**

Image Formation and Representation–Intensity and Range Images – Camera models – Camera parameters – Light and colour – Color Image Processing - Image Noise – Morphological Image Processing - Image Filtering (spatial domain) – Image Compression - Mask based filtering – Frequency Domain Filtering - Image Smoothing –Image Sharpening.

UNIT II IMAGE DETECTION **9**

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

UNIT III IMAGE FEATURES 9

Image Features – Textures – Deformable Contours – Features Reduction – Principal Component analysis – Feature Descriptors – SIFT and SURF– Motion field of rigid objects – Notation of Optical flow

UNIT IV IMAGE ALGORITHMS 9

Estimation Motion Field – Horn and Schunck Algorithm – Lucas and Kanade Algorithm - Shape from Shading and shape from Texture Model based Vision – Smooth Surfaces and their Outlines– Aspect Graphs and Range Data.

UNIT V MACHINE LEARNING 9

Localization – Classification and Evaluation – AdaBoost – Random Decision Forests – Pedestrian Detection. Emotion Recognition – Real Time Object Detection – Gesture Recognition – Face Detection.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implementation of Noise removal algorithms
2. Implementation of Object detection based on Edge detection algorithms
3. Implementation of Perspective projection of the lane borders
4. Implementations of Feature Extraction of an object using SIFT.
5. Implementation of Feature Extraction of an object using SURF
6. Implementation of Emotion Recognition
7. Implementation of Object detection using AdaBoost

TOTAL: 30

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 Publishers, First Edition, 2014.

REFERENCE BOOKS:

1. Davies E R, "Computer and Machine Vision", Elsevier Publication, Fourth Edition, 2012.
2. David Forsyth and Jean Ponce, "Computer Vision: A Modern Approach", Pearson International, Second Edition,2012.

3. Richard Hartley and Andrew Zisserman, “Multiple View Geometry in 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/

CO, PO, PSO Mapping

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

4. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

24BTAD642 **NATURAL LANGUAGE PROCESSING (THEORY & LAB)** **5H-4C**

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

End Semester Exam:3 Hours

PRE–REQUISITES: Deep Learning

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to

- Provide the NLP basics, including history, challenges, and core concepts.
- Build proficiency in speech processing, syntax analysis, and semantic interpretation through practical exercises.
- Stimulate creativity and problem-solving by applying NLP techniques to real-world problems.

COURSE OUTCOMES

Upon completion of this course students will be able to

- Infer a solid grasp of NLP's origins, challenges, and core concepts. (K2)
- Outline NLP models for speech processing, syntax analysis, and semantic interpretation (K2)
- Develop NLP models for question answering, summarization, and machine translation using appropriate datasets and frameworks. (K3)
- Build an NLP accuracy improvement model to reduce linguistic complexities. (K3)
- Apply evaluation strategies to assess the effectiveness and accuracy of NLP models in real-world scenarios. (K3)

UNIT I INTRODUCTION AND WORDS ANALYSIS **9**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization- Words – Morphology and Finite State transducers – Computational Phonology and Pronunciation Modeling – Probabilistic models of pronunciation and spelling – Ngram Models of syntax – Hidden Markov and Maximum Entropy models.

UNIT II SPEECH AND SYNTACTIC **9**

Speech and Phonetics (ARPAbet, wavefile formats, phonetic dictionaries, and PRAAT) – Automatic Speech Recognition – HMM-based speech recognition – Gaussian Mixture Model acoustic models – Embedded training – Speech Recognition – discriminative training, and human

speech recognition –Context-Free Grammars, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing.

UNIT III SYNTAX **9**

First Order Predicate Calculus- Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis -Semantic Attachments - Syntax-Driven Analyzer - Robust Analysis - Lexemes and Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval

UNIT IV SEMANTICS AND PRAGMATICS **9**

First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Computational Semantics - Lexical Semantics –Pragmatics: Discourse – Dialog and Conversational agents – Natural language generation, Statistical alignment and Machine translation: Text alignment – word alignment – statistical machine translation.

UNIT V APPLICATION **9**

Supervised machine learning -Question answering and Summarization – Single document summarization, generic multiple document summarization – Machine Translation.

TOTAL: 45

ii) **LABORATORY**

LIST OF EXPERIMENTS:

1. Implement algorithms for text tokenization, including techniques such as word tokenization, sentence segmentation, and stemming.
2. Develop language models using Ngrams and explore their application in predicting the next word in a sentence.
3. Implement POS tagging algorithms such as Hidden Markov Models (HMMs) or Maximum Entropy Markov Models (MEMMs) and evaluate their accuracy.
4. Design and implement NER systems to identify and classify named entities (e.g., persons, organizations, locations) in text data.
5. Explore syntactic parsing techniques such as constituency parsing or dependency parsing and analyze their performance on various text corpora.
6. Develop algorithms for WSD to determine the correct sense of ambiguous words in context and evaluate their effectiveness.
7. Implement extractive or abstractive text summarization algorithms to generate concise summaries of longer texts and assess their quality.

TOTAL: 30

TEXT BOOKS:

1. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", O_Reilly Media, First Edition, 2009.
2. Daniel Jurafsky, James H. Martin,"Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.

REFERENCE BOOKS:

1. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Chapman and Hall/CRC Press, 2nd Edition, 2010.
2. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
3. Richard M Reese, ―Natural Language Processing with Java‖, O_Reilly Media, 2015.

WEBSITES:

1. www.nptel.ac.in/courses/106105158
2. www.archive.nptel.ac.in/courses/106/106/106106211/
3. www.coursera.org/specializations/natural-language-processing

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-VI

24BTAD643 DISTRIBUTED AND CLOUD COMPUTING 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: Big Data Analytics

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Provide a fundamental concepts of Cloud Computing and trace its evolution
- Equip students with tools and techniques for REST and Systems of Systems (SoS) in the Cloud Computing.
- Explore with Virtualization technologies, types, implementation levels, and management tools in Cloud environments.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- Explain the evolution and key characteristics of Cloud Computing. (K2)
- Relate the strategies for managing distributed resources in Cloud environments. (K2)
- Identify the cloud services and storage techniques. (K3)
- Apply the strategies for managing distributed resources in Cloud environments. (K3)
- Make use of the Cloud security challenges and implement appropriate measures. (K3)

UNIT I INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish?Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Distributed File Systems - Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM –Security Standards

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack –Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation.

TOTAL: 45

ii) LABORATORY

LIST OF EXPERIMENTS:

1. On-Demand Provisioning Techniques in Cloud
2. Implementing Service Oriented Architecture and REST
3. Hands-on with Web Services and Publish-Subscribe Model
4. Virtualization Basics and Types of Virtualization
5. Virtualizing CPU, Memory, and I/O Devices
6. Disaster Recovery Strategies in Virtualized Environments
7. Designing Layered Cloud Architecture and NIST Reference Model

TOTAL: 30

TEXT BOOKS:

1. Sean P. Kane, Karl Matthias, “Docker: Up & Running: Shipping Reliable Containers in Production”, O’Reilly Media Inc, 2015.
2. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud”, 2019.

REFERENCE BOOKS:

1. Ardian, “Using Docker: Developing and Deploying Software with Containers”, O’Reilly Media Inc, 2015.

2. Lydia Parziale, Berthold Gunreben, Paul W Novak and Ken Werner, “The Virtualization Cookbook for IBM Systems Volume 2: Red Hat Enterprise Linux 7.1 Servers”, IBM, First Edition 2015
3. Jennifer Davis and Ryn Daniels, “Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale”, O’Reilly Media Inc., 2016.

WEBSITES:

1. https://www.cloudacademy.com/course/introduction-to-devops/intro-3/
2. https://www.aws.amazon.com/training
3. https://www.javatpoint.com/devops

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

SEMESTER-VII

24BTAD701 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

PRE-REQUISITE: NIL

COURSE OBJECTIVES

The goal of this course for students is

- Develop a comprehensive understanding of the fundamental aspects of management
- Understand the roles and responsibilities of a manager
- Acquire knowledge in various verticals of management
- Cultivate students' awareness of engineering ethics and human values
- Instill values, foster loyalty, and promote respect for others' rights

COURSE OUTCOMES

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

- Outline the fundamental aspects of management (K2)
- Apply the acquired skill sets for formulating better business management processes in organizations (K3)
- Make use of the skills to plan, organize, direct, control and work in teams for efficient outcomes (K3)
- Illustrate the significance of ethics in the professional & real life (K2)
- Analyze situations and make unbiased decisions considering social, environmental, and technological impacts (K4)

UNIT I INTRODUCTION TO MANAGEMENT 9

Management – Science or Art – Manager Vs Entrepreneur – Managerial Roles, skills, and styles – Evolution of Management Thought – Types of Business Organization – Current Trends and Issues in Management.

UNIT II FUNDAMENTALS OF ORGANIZATIONAL PLANNING 9

Planning – Nature and Purpose of Planning – Planning Process – Types of Planning – Strategic Management – MBO – Decision Making Process – Organizing – Nature and Purpose of Organizing – Formal and Informal Organization – Organization Chart – Organization Structure – Line and Staff Authority – Centralization and Decentralization – HRM – Career Planning

UNIT III LEADERSHIP, COMMUNICATION, AND CONTROLLING IN MANAGEMENT 9

Directing – Nature and Purpose of Directing – Motivation – Motivation Theories – Job Satisfaction – Job Enrichment – Leadership – Communication – Process and Barrier of Communication – Controlling – System and Process of Controlling – Budgetary and Non-budgetary Control Techniques – Control Performance – Direct and Preventive Control – Reporting.

UNIT IV ETHICS AND PROFESSIONALISM 9

Scope of Engineering Ethics – Accepting and Sharing Responsibility – Resolving Ethical Dilemmas – Making Moral Choices – Rights Ethics - Duty Ethics – Virtue Ethics – Workplace Responsibilities and Rights – Teamwork – Rights of Engineers – Whistle-Blowing – Truthfulness and Trustworthiness

UNIT V ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics and Integrity - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

TOTAL :45

SUGGESTED READINGS:

1. Harold Koontz and Heinz Welhrich, "Essentials of Management - An International, Innovation and Leadership Perspective", McGraw Hill, Tenth Edition, 2015.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.
3. Tripathi P C and Reddy P N, "Principles of Management", Tata McGraw Hill, Fifth Edition, 2012.
4. Robbins S.P, Coulter M., and Vohra, N., Management, Pearson (India), Tenth Edition, 2016.
5. Christoper P Neck, Jeffery D Houghton, Emma Murray and Charles L Lattimer, "Management", Wiley, Second Edition, 2016.
6. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.
7. R. Subramanian, "Professional Ethics", Oxford University Press, 2017.

WEB REFERENCES:

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

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	2	1
CO2	3	2	1	-	-	-	-	-	-	1	-	1	2	1
CO3	3	2	1	-	-	-	-	-	-	1	-	1	1	1
CO4	2	1	-	-	-	-	-	-	-	1	-	1	2	1
CO5	3	3	2	1	-	-	-	-	-	1	-	1	2	1
Avg	2.6	1.8	1.3	-	-	-	-	-	-	1	-	1	1.8	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVES I

24BTAD4E41 **UX/UI DESIGN (THEORY & LAB)** **4H-3C**

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

End Semester Exam:3 Hours

PREREQUISITE: Agile Software Development

i) THEORY

COURSE OBJECTIVES:

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

- Provide a sound knowledge in UI & UX design.
- Explore the tools used in UI & UX in creating wireframe and prototype.
- Understand the methods of user evaluation of product with real time scenario.

COURSE OUTCOMES:

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

- Demonstrate UX Skills in product development (K2)
- Build UI for user applications from research, persona mapping, customer journey mapping. (K3)
- Apply UI design for any product development (K3)
- Make use of interaction design tool for translate the paper concepts into digital Wireframes (K3)
- Build the process to conduct usability tests and feedback. (K3)

UNIT I FOUNDATIONS OF DESIGN **6**

Overview of UI & UX Design process - Difference between User Interface - (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation – Primary and Secondary persona - Requirement definition - Creative ideation – brainstorming and ideation techniques - Scenarios and functionality extraction – Solution ideation – Flow diagrams - Case studies on Design Thinking.

UNIT II FOUNDATIONS OF UI AND UX DESIGN **6**

Visuals and UI principles - UI Elements and Patterns – Material Design and Human Interface Design - Interaction Behaviors and Principles – Branding - Style Guides - Understanding User Experience - UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research.

UNIT III ELEMENTARY SKETCHING & WIREFRAMING 6

Sketching Principles - Wireframing - Creating Wireflows - Click through Wireframing Prototyping - Wireflow Creation - Work with different tools – Figma - Low-High Fidelity Design: Inclusive Design and Designing for Accessibility - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Designing animations and interactions.

UNIT IV UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING 6

Building a Design System – Style guides, color palette, fonts, grid, iconography, UI elements, photography or imagery, and illustration - Use of grids in UI design - Design animations and interaction patterns for key UI elements.

UNIT V UASBILITY EVALUATION AND PRODUCT DESIGN 6

Type of usability evaluation - Designing evaluation protocol - Conducting usability evaluation study - Conduct Usability Test explicit - Synthesize Test Findings - Product Design: Types of products & solutions - Design Psychology for e-commerce sites.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Designing a Responsive layout for a societal application.
2. Developing an interface with proper UI Style Guides.
3. Developing Wireflow diagram for application using open-source software.
4. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles).
5. Creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.
6. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.

TOTAL: 30

TEXT BOOKS:

1. Joel Marsh, “UX for Beginners”, O'Reilly Media, Second Edition, 2016.
2. Jon Yablonski, “Laws of UX: Using Psychology to Design Better Products & Services,” O'Reilly Media, First Edition, 2020.

REFERENCE BOOKS:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interfaces,” O'Reilly Media, Third Edition, 2020.

2. Steve Schoger, Adam Wathan, “Refactoring UI,” Self-published, First Edition, 2018.
3. Steve Krug, “Don't Make Me Think, Revisited: A Common-Sense Approach to Web and Mobile Usability,” New Riders, Third Edition, 2014.

WEBSITES:

1. https://www.coursera.org/specializations/ui-ux-design
2. https://www.interaction-design.org/literature
3. https://www.geeksforgeeks.org/user-experience-or-ux-design/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

SEMESTER -IV

24BTAD4E42 CRYPTOGRAPHY AND NETWORK SECURITY (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES: Computer Networks

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.

COURSE OUTCOMES:

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

- Infer the fundamentals of computer networks security. (K2)
- Utilize block cipher mode of operation in cryptographic process. (K3)
- Apply mathematical concepts in cryptographic contexts. (K3)
- Make use of authentication protocols for secure data transmission (K3)
- Identify real-world instances of cybercrimes and security breaches. (K3)

UNIT I INTRODUCTION TO SECURITY **6**

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography

UNIT II SYMMETRIC CIPHERS **6**

SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY **6**

Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem .Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 6

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos mutual trust: Key management and distribution

UNIT V CYBER CRIMES AND CYBER SECURITY 6

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

TOTAL:30

iii) LABORATORY

LIST OF EXPERIMENTS:

1. Write a program to implement the following cipher techniques to perform encryption and decryption
   i. Caesar Cipher
   ii. Playfair Cipher
   iii. Hill Cipher
2. Write a program to implement the following transposition techniques
   i. Rail fence technique –Row major transformation
   ii. Rail fence technique - Column major transformation
3. Write a program to implement DES & RSA algorithm
4. Write a program to implement the Diffie-Hellman Key Exchange mechanism. Consider one of the parties as Alice and the other party as bob.
5. Write a program to calculate the message digest of a text using the MD algorithms.
6. Write a program to implement digital signature standard.

TOTAL: 30

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Sarhan M. Musa, " Network Security and Cryptography", Second Edition, Mercury Learning and Information, 2022.

REFERENCES:

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.
3. Bhushan Trivedi. Savita Gandhi, “Cryptography and Network Security”, First Edition, BPB Publications, 2022.

WEBSITES:

1. https://www.javatpoint.com/advantages-and-disadvantages-of-cryptography
2. https://www.javatpoint.com/computer-network-security
3. https://www.tutorialspoint.com/cryptography/index.htm
4. https://www.geeksforgeeks.org/cryptography-and-its-types/
5. https://www.geeksforgeeks.org/network-security/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

SEMESTER -IV

24BTAD4E43 DIGITAL MARKETING (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISTES : Web Application Development

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide a comprehensive understanding of digital marketing concepts and strategies.
- Equip students with tools and techniques for effective online marketing and brand management.
- Explore contemporary digital marketing trends and technologies.

COURSE OUTCOMES:

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

- Infer the fundamental concepts and principles of digital marketing (K2)
- Develop effective digital marketing strategies using social media. (K3)
- Utilize digital marketing tools and platforms for promotion activity. (K3)
- Plan to measure the effectiveness of digital marketing campaigns. (K3)
- Survey contemporary trends and best practices in digital marketing. (K4)

UNIT I INTRODUCTION TO DIGITAL MARKETING 6

Definition and Importance of Market Risk and Supply Chain Analytics - Overview of Financial Markets and Supply Chain Management - Types of Analytics: Descriptive, Predictive, and Prescriptive - Role of Data in Decision-Making - Key Performance Indicators (KPIs) and Metrics for Risk and Supply Chain - Analytics Process and Lifecycle - Challenges and Opportunities.

UNIT II SEARCH ENGINE OPTIMIZATION (SEO) AND SEARCH ENGINE MARKETING (SEM) 6

Data Types and Sources in Market Risk and Supply Chain - Data Collection Methods - Data Quality and Data Cleaning Techniques - Data Integration and Transformation - Handling Missing Data - Data Preprocessing for Analysis - Exploratory Data Analysis (EDA) - Data Visualization Techniques - Tools for Data Collection and Preparation (Excel, SQL, ETL Tools)

UNIT III SOCIAL MEDIA MARKETING AND CONTENT MARKETING 6

Statistical Analysis and Hypothesis Testing - Regression Analysis and Predictive Modeling - Time Series Analysis and Forecasting - Classification and Clustering Techniques - Simulation and Scenario Analysis - Machine Learning Algorithms for Risk and Supply Chain Analytics - Optimization Techniques for Decision Making.

UNIT IV EMAIL MARKETING AND AFFILIATE MARKETING 6

Value at Risk (VaR), Expected Shortfall (ES), Stress Testing - Sensitivity Analysis, Greeks (Delta, Gamma, Vega, Theta) - Risk Management Software (RiskMetrics, Bloomberg) - Network Design and Configuration - Facility Location and Allocation - Transportation and Distribution Planning - Inventory Management and Control.

UNIT V WEB ANALYTICS AND CONVERSION RATE OPTIMIZATION 6

Hedging Strategies and Instruments (Options, Futures, Swaps) - Supply Chain Analytics in Retail, Manufacturing, Healthcare - IoT, Big Data, Blockchain in Supply Chain - Ethical and Legal Considerations - Future Trends in Market Risk and Supply Chain Analytics - Case Studies - Practical Exercises on Analyzing Contemporary Issues.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Keyword Research and Analysis
2. On-page SEO Optimization
3. Running a Google Ads Campaign
4. Social Media Campaign Creation and Management
5. Creating and Distributing Content for Content Marketing
6. Designing and Implementing an Email Marketing Campaign

TOTAL: 30

TEXT BOOKS:

1. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, "Marketing 4.0: Moving from Traditional to Digital", Wiley, 2021
2. Damian Ryan, "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation", Kogan Page, 2020

REFERENCE BOOKS:

1. Tony . Dave Chaffey, Fiona Ellis-Chadwick, "Digital Marketing: Strategy, Implementation and Practice", Pearson, 2021
2. Ryan Deiss, Russ Henneberry, "Digital Marketing for Dummies", Wiley, 2020
3. Ann Handley, C.C. Chapman, "Content Rules: How to Create Killer Blogs, Podcasts, Videos, Ebooks, Webinars (and More) That Engage Customers and Ignite Your Business", Wiley, 2021
4. Jason McDonald, "Social Media Marketing Workbook: How to Use Social Media for Business", CreateSpace Independent Publishing Platform, 2020
5. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity", Wiley, 2021

WEBSITES:

1. https://www.tutorialspoint.com/digital_marketing/index.htm
2. https://www.javatpoint.com/digital-marketing
3. https://www.simplilearn.com/tutorials/digital-marketing-tutorial

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	-	-	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -IV

24BTAD4E44 AUGMENTED REALITY AND VIRTUAL REALITY 4H-3C
(THEORY & LAB)

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

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

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

- Impart the fundamental aspects and principles of AR/VR technologies.
- Know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- Learn about the graphical processing units and their architectures.

COURSE OUTCOMES:

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

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

- Illustrate the basic concepts of AR and VR. (K2)
- Make use of tools and technologies related to AR/VR (K3)
- Interpret the working principle of AR/VR related to Sensor devices (K2)
- Build real-world asserts using modeling techniques. (K3)
- Develop AR/VR applications in different domains. (K3)

UNIT I INTRODUCTION 6

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II VR MODELING 6

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object

Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation–Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III VR PROGRAMMING **6**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV APPLICATIONS **6**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications– Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics– Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY **5**

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation Navigation-Wearable devices.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Use the primitive objects and apply various projection types by handling camera.
2. Model three dimensional objects using various modeling techniques and apply textures over them.
3. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
4. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
5. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
6. Develop simple MR enabled gaming applications.

TOTAL: 30

TEXT BOOKS:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018 (Unit 1,2)
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016 (Unit 5)
3. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2018 (Unit 3,4)

REFERENCE BOOKS:

1. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
2. Philippe Fuchs, Pascal Guitton, and Guillaume Moreau, "Virtual Reality: Concepts and Technologies", CRC Press, 1st edition, 2011.
3. Stephen Cawood and Mark Fiala, "Augmented Reality: A Practical Guide", Addison-Wesley Professional, 1st edition, 2013.
4. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality", Morgan & Claypool Publishers, 1st edition, 2015.
5. Alan B. Craig, "Understanding Augmented Reality: Concepts and Applications", Morgan Kaufmann, 1st edition, 2013.

WEBSITES:

1. https://archive.nptel.ac.in/courses/121/106/121106013/
2. https://www.udemy.com/course/fundamentals-of-augmented-reality-virtual-reality-101-ar-vr/?couponCode=NVDIN35
3. https://www.coursera.org/courses?query=augmented%20reality
4. https://uploadvr.com
5. https://unity.com/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

SEMESTER -IV

24BTAD4E45 IMAGE AND VIDEO ANALYTICS (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES: Deep Learning

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Know the basics of image processing techniques for computer vision
- Learn the techniques used for image pre-processing, object detection and object recognition
- Interpret the video analytics techniques

COURSE OUTCOMES:

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

- Interpret the tasks associated with image representation (K2)
- Outline the techniques used for image pre-processing. (K2)
- Make use of deep learning architectures designed for object detection (K3)
- Build real-world applications using face recognition technology (K3)
- identify the challenges of processing video data in application domains. (K3)

UNIT I INTRODUCTION **6**

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II IMAGE PRE-PROCESSING **6**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models – Edges in multispectral images - Local pre-processing in the frequency domain - Line detection by local preprocessing operators - Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING **6**

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures.

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 6

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- Deep Face solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet Gesture Recognition.

UNIT V VIDEO ANALYTICS 6

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem - RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture Improvement in Inception v2-Video analytics-RestNet and Inception v3.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Write a program that computes the T-pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity.
3. Develop programs for the following geometric transforms:
   (a) Rotation
   (b) Change of scale
   (c) Skewing
   (d) Affine transform calculated from three pairs of corresponding points
   Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition
5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.
6. Develop a program for Facial Detection and Recognition.

TOTAL: 30

TEXTBOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing, Analysis, and Machine Vision”, 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhan, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021.

REFERENCES:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Verlag London Limited, 2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
3. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

WEBSITES:

1. https://www.geeksforgeeks.org/computer-vision/
2. https://viso.ai/computer-vision/video-analytics-ultimate-overview/
3. https://www.slideshare.net/slideshow/applications-of-video-analytics/250975825

CO, PO, PSO Mapping

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

1. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

SEMESTER -IV

24BTAD4E46 RECOMMENDER SYSTEMS (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE REQUISITES:- Machine Learning Techniques

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the basic concepts of recommender systems and applications
- Interpret filtering and classification technique types of recommender systems
- Analyze hybrid approaches toward recommendation systems

COURSE OUTCOMES:

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

Outline the fundamentals of recommender systems and evaluation metrics (K2)

- Compare non personalized, content based and collaborative filtering for recommender systems. (K2)
- Apply algorithms and techniques for efficient content retrieval. (K3)
- Build recommender systems using popular libraries and framework (K3)
- Identify measures for recommender systems effectiveness (K3)

UNIT I INTRODUCTION **6**

Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses; covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT II COLLABORATIVE FILTERING **6**

User-based nearest neighbour recommendation, Item- based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems

UNIT III CONTENT-BASED RECOMMENDATION **6**

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms

UNIT IV KNOWLEDGE BASED RECOMMENDATION AND HYBRID APPROACHES 6

Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders. Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT V EVALUATING RECOMMENDER SYSTEM 6

Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement Data similarity measures using Python
2. Implement dimension reduction techniques for recommender systems
3. Implement user profile learning
4. Implement content-based recommendation systems
5. Implement collaborative filter techniques
6. Create an attack for tampering with recommender systems

TOTAL: 30

TEXT BOOK:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed. 2.

REFERENCES:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer (2011), 1st ed.
2. P. Pavan Kumar, S. Vairachilai, Sirisha Potluri, Sachi Nandan Mohanty, Recommender Systems, CRC Press (2021), 1st ed.
3. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.
4. Charu C. Aggarwal, "Recommender Systems: The Textbook," Springer, 2016.

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc24_ge35/preview
2. https://www.tutorialspoint.com/recommender-systems-complete-course-beginner-to-advance/index.asp
3. https://web-ainf.aau.at/pub/jannach/slides/Tutorial_IJCAI_2013.pdf

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	-	**2**	-

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

PROFESSIONAL ELECTIVES II

SEMESTER -V

24BTAD5E41 DEVOPS (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Know DevOps terminology, Continuous Integration and Deployment using Jenkins and Ansible.
- Manage and collaborate code efficiently with teams using Git and GitHub.
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real world problems.

COURSE OUTCOMES:

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

- Interpret the collaborative culture between DevOps teams and gain information of cloud service providers. (K2)
- Develop a strong foundation in version control, collaboration, and project management. (K3)
- Build automating test cases in Jenkins and Maven. (K3)
- Make use of Jenkins and Ansible for continuous integration and deployment. (K3)
- Deploy the applications in Cloud platform using DevOps tools. (K3)

UNIT I INTRODUCTION TO DEVOPS **6**

Software process models - Iterative Agile software development –DevOps Essentials – Lifecycle, Stages, Workflow and Principles - Roles, Responsibilities, and Skills of a DevOps Engineer - DevOps on cloud - AWS- GCP- Azure.

UNIT II VERSION CONTROL WITH GIT AND GITHUB **6**

Git and GitHub - Version Control System and Types - Difference between CVCS and DVCS - GIT Basic - GIT Command Line - Installing Git - Initial setup - Git Essentials - Creating repository - Cloning - check-in and committing - Fetch pull and remote - Branching, Creating, Switching and Merging the branches.

UNIT III CONTINUOUS INTEGRATION USING JENKINS 7

Understanding continuous integration - Introduction about Jenkins: Build Cycle, Jenkins Architecture - Jenkins Installation - Overview of Maven – Maven project Structure – Maven Plugins – Project Object Model(POM) – Maven Build life cycle – Adding external dependencies to maven pom.xml – Maven build and test project - Exploring Jenkins Dashboard, Jobs - Creating Jobs, Running the Jobs - Setting up the global environments for Jobs - Disabling and deleting jobs - Build Deployments.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 5

Ansible Introduction – Installation - Ansible master/slave architecture - Ansible modules - Ansible Inventory files - Adhoc commands - YAML basics – Ansible Playbook – Creating Roles using Ansible Galaxy, Include vs Import.

UNIT V DEVOPS ON AWS 6

AWS DevOps Architecture - Thinking in DevOps: The Build, The Test - Automate Testing - Continuous Integration - Build the Pipeline - Deployment Strategies for Virtual Machines - Deployment Strategies for Server less - Deploying to Compute.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Study and use of DevOps Automation Tools.
2. Perform implementation of various git commands to push and pull a repository, from GitHub.
3. Creating simple Maven project and perform unit test and resolve dependencies.
4. Create CI pipeline using Jenkins.
5. Create a CD pipeline in Jenkins and deploy in Cloud.
6. Create an Ansible playbook for a simple web application infrastructure.

TOTAL: 30

TEXT BOOKS:

1. Ojasvi Jagtap, Subodh Jain, Getting Started with DevOps, 2017. (Unit 1,2,3)
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015. (Unit 4)
3. Osama Mustafa, A Complete Guide to DevOps with AWS- Deploy, Build, and Scale Services with AWS Tools and Techniques, Apress Berkeley, CA ,2023(Unit 5)

REFERENCE BOOKS:

1. Emily Freeman, DevOps for Dummies, 1st Edition, For Dummies, 2019.
2. Robert Kernman ,DevOps: Jenkins: The Ultimate Beginner's Guide Kindle Edition,2020
3. John Ferguson Smart, Jenkins: The Definitive Guide, 1st Edition, O′Reilly, 2011.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
5. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.

WEBSITES:

1. https://bugfender.com/wp-content/themes/bugfender-wordpress-theme/assets/docs/Jenkins-Starter-Guide-Ebook.pdf
2. https://maven.apache.org/
3. https://www.ansible.com/
4. https://aws.amazon.com/devops/
5. https://www.coursera.org/specializations/aws-devops

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	2	3	-
CO2	3	2	1	-	2	-	-	-	2	2	-	2	3	-
CO3	3	2	1	-	2	-	-	-	2	2	-	2	3	-
CO4	3	3	2	1	2	-	-	-	2	2	-	2	3	-
CO5	3	3	2	1	2	-	-	-	2	2	-	2	3	-
Avg	**2.8**	**2.2**	**1.5**	**1**	**2**	-	-	-	**2**	**2**	-	**2**	**3**	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -V

24BTAD5E42 **ETHICAL HACKING (THEORY & LAB)** **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: NIL

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the basics of computer based vulnerabilities
- Explore different foot printing, reconnaissance and scanning methods
- Expose the enumeration and vulnerability analysis methods

COURSE OUTCOMES:

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

- Understand the Core Concepts of Computer-Based Vulnerabilities (K2)
- Illustrate the foot printing, reconnaissance and scanning method. (K2)
- Demonstrate the enumeration and vulnerability analysis methods (K2)
- Utilize the hacking options available in Web and wireless applications (K3)
- Make use of tools to perform ethical hacking to expose the vulnerabilities (K3)

UNIT I INTRODUCTION **6**

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

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS **6**

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

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS **6**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities -Windows OS

Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss.

UNIT IV SYSTEM HACKING 6

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

UNIT V NETWORK PROTECTION SYSTEMS 6

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

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Install Metasploit and apply its tools.
3. Practice the basics of reconnaissance.
4. Using FOCA / SearchDiggity tools, extract metadata and expanding the target list.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.

TOTAL: 30

TEXTBOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.153

REFERENCE BOOK:

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

WEBSITES:

1. https://archive.nptel.ac.in/courses/106/105/106105217/
2. https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
3. http://www.wireshark.org.
4. https://www.eccouncil.org/cybersecurity-exchange/ethical-hacking/vulnerability-analysis-everything-you-need-to-know/
5. https://github.com/husnainfareed/awesome-ethical-hacking-resources

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -V

24BTAD5E43 INDUSTRIAL PSYCHOLOGY (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES : Nil

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide a comprehensive understanding of the principles and practices of industrial psychology.
- Equip students with the skills to apply psychological concepts in workplace settings.
- Explore contemporary issues and trends in industrial psychology.

COURSE OUTCOMES:

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

- Explain the fundamental concepts and principles of industrial psychology. (K2)
- Apply psychological theories to improve workplace performance and employee well-being. (K3)
- Model psychological assessments and interventions in organizational settings (K3)
- Solve workplace issues using psychological methods. (K3)
- Survey the contemporary trends and practices in industrial psychology. (K4)

UNIT I INTRODUCTION TO INDUSTRIAL PSYCHOLOGY 6

Definition and Scope of Industrial Psychology - Historical Development of Industrial Psychology - Importance of Industrial Psychology in Organizations - Models in Industrial Psychology - Role of Industrial Psychologists - Ethical Issues in Industrial Psychology - Research Methods in Industrial Psychology - Job Analysis and Design - Employee Selection and Recruitment.

UNIT II MOTIVATION AND JOB SATISFACTION 6

Theories of Motivation - Intrinsic and Extrinsic Motivation - Factors Influencing Job Satisfaction - Measuring Job Satisfaction - Relationship between Motivation and Job Satisfaction - Impact of Job Satisfaction on Performance - Strategies to Enhance Motivation and Job Satisfaction - Case Studies on Motivation and Job Satisfaction.

UNIT III TRAINING AND DEVELOPMENT 6

Importance of Training and Development - Training Needs Analysis - Designing Effective Training Programs - Methods of Training (On-the-Job, Off-the-Job) - Evaluating Training Effectiveness - Career Development and Planning - Role of Industrial Psychologists in Training - Leadership Development Programs - Case Studies on Training and Development.

UNIT IV PERFORMANCE APPRAISAL AND MANAGEMENT 6

Purpose and Importance of Performance Appraisal - Methods of Performance Appraisal - Common Errors in Performance Appraisal - Performance Management Systems - Employee Feedback and Counseling - Legal and Ethical Issues in Performance Appraisal - Role of Technology in Performance Appraisal - Case Studies on Performance Appraisal.

UNIT V ORGANIZATIONAL BEHAVIOR AND EMPLOYEE RELATIONS 6

Introduction to Organizational Behavior - Individual Behavior and Differences - Group Behavior and Team Dynamics - Organizational Culture and Climate - Conflict Resolution and Negotiation - Employee Engagement and Retention - Role of Industrial Psychologists in Employee Relations - Case Studies on Organizational Behavior.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Job Analysis and Design
2. Job Satisfaction Survey
3. Training Needs Analysis
4. Performance Appraisal Methods
5. Conducting 360-Degree Feedback
6. Conflict Resolution Techniques

TOTAL: 30

TEXT BOOKS:

1. Paul E. Spector, "Industrial and Organizational Psychology: Research and Practice", Wiley, 2020.
2. Michael G. Aamodt, "Industrial/Organizational Psychology: An Applied Approach", Cengage Learning, 2021.

REFERENCE BOOKS:

1. Frank J. Landy, Jeffrey M. Conte, "Work in the 21st Century: An Introduction to Industrial and Organizational Psychology", Wiley, 2021.
2. John W. Newstrom, "Organizational Behavior: Human Behavior at Work", McGraw-Hill Education, 2021.
3. Angelo Kinicki, Mel Fugate, "Organizational Behavior: A Practical, Problem-Solving Approach", McGraw-Hill Education, 2021.

WEBSITES:

1. https://alison.com/tag/industrial-psychology
2. https://profilelogin.admissione.online/UploadFiles/Documents/ProfileLgoin/Subtitle/NColge_1372_Industrial%20and%20Organisational%20Psychology.pdf
3. https://www.tutorialspoint.com/the-psychology-of-organizational-management
4. https://nobaproject.com/modules/industrial-organizational-i-o-psychology
5. https://positivepsychology.com/industrial-psychology/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -V

24BTAD5E44 QUANTUM COMPUTING (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PREREQUISITE: Cryptography and Network Security

i) THEORY

COURSE OBJECTIVES:

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

- Introduce the principles of quantum mechanics as they relate to computing.
- Learn about quantum computation models and quantum gates.
- Gain practical experience with quantum programming using quantum simulators and quantum hardware.

COURSE OUTCOMES:

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

- Interpret the foundational principles of quantum mechanics relevant to computing. (K2)
- Apply quantum algorithms to solve computational problems. (K3)
- Build quantum circuits using quantum gates. (K3)
- Develop quantum algorithms using quantum programming languages and tools. (K3)
- Make use of security aspect in Quantum computing. (K3)

UNIT I QUANTUM COMPUTING BASIC CONCEPTS 7

Classical and Quantum Computing - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions - entanglement – interference

UNIT II QUANTUM COMPUTATION MODELS 5

Quantum bits (qubits) and quantum states - Basic single qubit gates - Multiple qubit gates - Circuit development - Measurement in quantum computing

UNIT III QUANTUM ALGORITHMS 7

Quantum parallelism - Deutsch’s algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover’s Algorithm

UNIT IV QUANTUM INFORMATION THEORY **6**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

UNIT V QUANTUM APPLICATIONS **5**

Quantum cryptography and quantum key distribution- Shor's Factoring Algorithm - Quantum machine learning

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Single and multiple qubit gate simulation - Quantum Composer
2. Composing simple quantum circuits with q-gates and measuring the output into classical bits.
3. IBM Qiskit Platform Introduction
4. Implementation of Shor's Algorithms and Grover's Algorithm
5. Implementation of Deutsch's Algorithm and Deutsch-Jozsa's Algorithm
6. QKD Simulation

TOTAL: 30

TEXT BOOKS:

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020). (Unit 1)
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2013.(Unit 1,2,3,4)
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".(Unit 5)

REFERENCE BOOKS:

1. Eleanor G. Rieffel and Wolfgang H. Polak, "Quantum Computing: A Gentle Introduction," The MIT Press, 2014.
2. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
3. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2012.
4. Benenti, Giuliano, Casati, Giulio, and Strini, Giuliano, "Principles of Quantum Computation and Information: Basic Concepts," World Scientific Publishing Company, 2019.

WEBSITES:

1. https://www.udemy.com/topic/quantum-computing/
2. https://www.coursera.org/courses?query=quantum%20computing
3. https://quantum.ibm.com/
4. https://azure.microsoft.com/en-us/solutions/quantum-computing/
5. https://quantumcomputingreport.com/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -V

24BTAD5E45 HEALTH CARE ANALYTICS (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES: Machine Learning Techniques, Deep Learning

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the health data formats, health care systems and standards.
- Understand the health data management frameworks, and explore the use of machine learning and deep learning algorithms in healthcare.
- Apply healthcare analytics for critical care applications.

COURSE OUTCOMES:

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

- Illustrate the fundamentals of Healthcare Data Analytics. (K2)
- Construct a machine learning model for healthcare data. (K3)
- Utilize health-care management systems to protect clinical data. (K3)
- Develop models for effective predictions in healthcare applications. (K3)
- Inspect the challenges and optimizations involved health care project. (K3)

UNIT I INTRODUCTION TO HEALTHCARE ANALYSIS **6**

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policies- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning, Probabilistic reasoning, Bayes Theorem and Weighted sum approach.

.

UNIT II ANALYTICS ON MACHINE LEARNING **6**

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing.

UNIT III HEALTH CARE MANAGEMENT **6**

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram Healthcare bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

UNIT IV HEALTHCARE AND DEEP LEARNING 6

Introduction to Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

UNIT V CASE STUDIES 6

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1.Understanding the Behavior of Uninsurable Patients.
2. Using Performance Feedback to Improve Outcomes in the Emergency Department.
3. Evaluating the Impact of Early Detection and Remote Monitoring on Sepsis Mortality.
4. Predicting Healthcare Outcomes from Increased Risk of Opioid Use and Chronic Pain.
5. Future of Health Care with Data Driven Technologies.
6. Design emergency care system Heart Disease Prediction.

TOTAL: 30

TEXT BOOKS:

1. Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015.
2. Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018.

REFERENCE BOOKS:

1. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2. Hui Jang, Eva K.Lee, “HealthCare Analysis: From Data to Knowledge to Healthcare Improvement”, First Edition, Wiley, 2016.
3. Kulkarni ,Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, “Big Data Analytics in HealthCare”, Springer, 2020.

WEBSITES:

1. https://intellipaat.com/blog/data-analytics-in-healthcare/
2. https://www.geeksforgeeks.org/how-to-become-a-healthcare-data-analyst/
3. https://www.tatvasoft.com/outsourcing/2023/09/healthcare-data-analytics.html

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	2	1	-	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	**-**	**-**	-	-	-	**2**	**2**	**-**	**-**	**-**	**2**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -V

24BTAD5E46 SOFT COMPUTING (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Programming skills in Python or Java

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the concepts of fuzzy rule, fuzzy data, crisp rule, crisp data, fuzzy relation.
- Learn the algorithm-based computing, probabilistic computing, hybrid system concepts.
- Interpret soft computing techniques such as neural networks, fuzzy systems, genetic algorithms.

COURSE OUTCOMES:

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

- Interpret the concepts of fuzzy logic, crisp logic, fuzzy relation, fuzzy implication rule (K2)
- Compare supervised and unsupervised learning algorithms (K2)
- Identify the strength and weakness of neural network models. (K3)
- Solve uncertainty in data ambiguity using fuzzy relations (K3)
- Make use of optimization techniques to handle complex data. (K3)

UNIT I INTRODUCTION TO SOFT COMPUTING **6**

What is Soft Computing, soft computing vs. hard computing, soft computing paradigms, and applications of soft computing. Basics of Machine Learning. Dealing with Imprecision and Uncertainty- Probabilistic Reasoning Bayesian network, Pearl's Scheme for Evidential Reasoning, Dempster-Shafer Theory for Uncertainty Management, Certainty Factor Based Reasoning.

UNIT II NEURAL NETWORKS **6**

Basics of Neural Networks- Neural Network Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, characteristics and applications of ANN, McCulloch Pitt model, different activation functions, Supervised Learning algorithms- Perceptron (Single Layer, Multi layer), Un-Supervised Learning algorithms- Hebbian Learning, Winner take all, Self Organizing Maps.

UNIT III FUZZY LOGIC 6

Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system : fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems.

UNIT IV OPTIMIZATION 6

Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method, Simulated Annealing, Random Search, Downhill Simplex Search Derivative-free Optimization- Genetic algorithm Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction and Genetic modeling

UNIT V EVOLUTIONARY COMPUTING 6

Genetic programming (GP), Ant colony optimization (ACO), Particle swarm optimization (PSO), Artificial Immune System (AIS).

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implementation of fuzzy control/ inference system
2. Programming exercise on classification with a discrete perceptron
3. Implementation of XOR with backpropagation algorithm
4. Implementation of self organizing maps for a specific application
5. Programming exercises on maximizing a function using Genetic algorithm
6. Implementation of two input sine function

TOTAL: 30

TEXT BOOKS:

1. James A. Freeman and David M. Skapura, "Neural networks : algorithms, applications, and programming techniques", 1st Edition, Pearson Education, New Delhi, 2007.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani, "Neuro - Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Eastern Economy Edition, Prentice Hall India Learning Private Limited, 2002.

REFERENCE BOOKS:

1. Amit Konar, "Artificial Intelligence and Soft Computing", 1st Edition, CRC Press, 2000.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", 1st Edition, Pearson Education India, 2015.
3. Mitchell Melanie, "An Introduction to Genetic Algorithm", 1st Edition, Prentice Hall, 1998.

WEBSITES:

1. http:\\www2.fiit.stuba.sk/~kvasnicka/Free%20books/Goldberg_Genetic_Algorithms_in_Search.pdf
2. https:\\www.simplilearn.com/tutorials/deep-learning-tutorial/neural-network
3. https:\\www.tutorialspoint.com/fuzzy_logic/index.html

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	-	**2**	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PROFESSIONAL ELECTIVES III

24BTAD5E47 LOW CODE APPLICATION DEVELOPMENT (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Python Programming, Web Technology

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Identify the key components of no-code development and tools to create and publish applications.
- Develop data using machine learning tools and present results in a meaningful way.
- Build voice applications using effective UI/UX design and bots that integrate with external services to enhance functionality.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Classify the web scraping techniques and formatting appropriate no-code environment. (K2)
- Identify efficient data models for no code applications (K3)
- Develop a AI bots using automated models (K3)
- Apply UI/UX design principles to create intuitive and effective interfaces. (K3)
- Analyze different voice-based life cycle with AI models (K4)

UNIT I – WEB SCRAPING AND API PARABOLA WITH NO CODE **6**

No-Code Stacks_No-Code Fundamentals. Web Scraping: Scrape Data from Websites_ Initial Scraper Setup_ Defining our data_ Using our Scraped Data. Work With APIs: Filtering Data_ Numerical Formatting_ Exporting Data _ Publishing

UNIT II - BUILD AUTOMATIONS AND CREATE BOTS WITH NO CODE **6**

Automations using Zapier: Introduction _ Connecting Google sheets - Connecting twitter - Publishing Zapier Automation. Bots: Configuring Slack _ Creating First bot using slack - Including conditional and helper functions - Connecting Giphy - Connecting slack to bot _ Publishing our bot.

UNIT III - DATA SCIENCE **6**

Introduction to Data science: Data flow_ Machine learning. Obviously AI : Introduction_ Sourcing our data Uploading our data Analyze our data _ Publish using Obviously AI.

UNIT IV - VOICE APP **6**

Voice App: Introduction - Voice Flow – Initial setup - Create the launch sequence for voice application - Querying the user - Calling API for data - Returning Data to the user - Testing the application - Publish the voice app.

UNIT V – UI / UX DESIGN FOR APPLICATION **6**

UI/UX: Introduction - Business Use case - Tools. Figma: Introduction – File setup - Placing Images - Add logo to the Frame - Body copy - Building Forms - Profile Image – Proportions - Project.

TOTAL : 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement a nocode workflow or architecture to clean a dataset to pre-process the data.
2. Implement a nocode workflow to narrate instances of confusion matrix, accuracy, precision, sensitivity, specificity
3. Implement a nocode workflow or architecture to execute KNN framework on any medical real-time dataset.
4. Implement a nocode workflow or architecture to execute Random Forest framework on any real-time dataset.
5. Implement a nocode workflow or architecture to execute SVM framework on any real-time dataset Simulation of patient flows in hospitals to optimize resource allocation and reduce waiting times.
6. Simulation capabilities to model and spread of information or influence within the network.
7. Sentiment analysis techniques to analyze player sentiment and feedback.

TOTAL : 30

TEXT BOOKS:

1. Paul E Love," Mastering No-Code: Create Professional Quality Apps Without Coding" (Vol. 1), 2021.
2. Mikhail Zhilkin," Data Science Without Makeup 1st Edition", 2021.

REFERENCES BOOKS:

1. Mittal Akhil," Getting Started with Chatbots", 2019.
2. Fabio staiano," Designing and Prototyping Interfaces with Figma", 2022.
3. Maxie Bryant, No Code: Quick Optimization Techniques for Code-Free Web, Development, Independently published, 2020.

WEB SITES:

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

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -V

24BTAD5E48 AI IN CYBER SECURITY (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES : Artificial Intelligence

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Learn AI for Cyber Security and Cyber Laws.
- Learn how to detect and prevent a cyber-attack.
- Apply incident response strategies for mitigating cyber security incidents.

COURSE OUTCOMES:

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

- Outline the fundamental concepts of artificial intelligence as applied to cybersecurity (K2)
- Illustrate AI models for threat detection and vulnerability assessment (K2)
- Apply social engineering methods to obtain information from human targets (K3)
- Identify the effectiveness of different security measures in various scenarios (K3)
- Apply ML techniques to assess cyber security risks for cloud-based AI. (K3)

UNIT I INTRODUCTION TO AI FOR CYBER SECURITY 6

Introducing AI in the context of cyber security – The evolution from expert systems to data mining and AI – different forms of automated learning – Applying AI in cyber security – Beginning with AI via Jupyter Notebooks – Classification of Cybercrimes– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II AI FOR CYBER SECURITY ARSENAL 6

Classification– Regression– Dimensionality reduction– Clustering– Speech recognition– Video anomaly detection– Natural language processing– Large-scale image processing– Social media analysis

UNIT III RECONNAISSANCE 6

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

UNIT IV INTRUSION DETECTION AND INTRUSION PREVENTION 6

Securing user authentication-Authentication abuse prevention-Account reputation scoring-User authentication with keystroke recognition-Biometric authentication with facial recognition-Fraud prevention with cloud AI solutions-Introducing fraud detection algorithms-Predictive analytics for credit card fraud detection-importing sample data and Juptuer notebook in the cloud-Evaluating the quality of predictions.

UNIT V CYBER SECURITY THREATS AND DEFENDING SENSITIVE INFORMATION 6

Image spam detection with support vector machines – Phishing detection with logistic regression and decision trees – Spam detection with Naive Bayes – Spam detection adopting NLP – Authentication abuse prevention – Account reputation scoring – Biometric authentication with facial recognition - Fraud Prevention with Cloud AI Solutions

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Installation of Anaconda, setting up Virtual Environments, Installing Additional Libraries
2. Load a dataset containing network traffic logs and malware samples. Preprocess the data to handle missing values and categorical variables.
3. Perform open-source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
4. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
5. Use Fail2banto scan log files and ban Ips that show the malicious signs
6. Launch brute-force attacks on the Linux server using Hydra.
7. Perform real-time network traffic analysis and data pocket logging using Snort

TOTAL: 30

TEXT BOOKS:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.
2. Ric Messier, " Learning Kali Linux: Security Testing, Penetration Testing, and Ethical Hacking", OREILLY Publication,2018.

REFERENCE BOOKS:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011.
2. Kimberly Graves, "CEH Official Certified Ethical Hacker Review Guide", Wiley Publishers, 2007.
3. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015

WEBSITES:

1. https://www.coursera.org/courses?query=cybersecurity
2. https://www.nptel.ac.in/courses/106106248
3. https://www.geeksforgeeks.org/

CO, PO, PSO Mapping

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

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -V

24BTAD5E49 MARKET RISK AND SUPPLY CHAIN ANALYTICS (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISTES : Artificial Intelligence, Statistics and Optimization Techniques

i) THOERY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide a comprehensive understanding of market risk and supply chain analytics and their roles in financial and operational decision-making.
- Equip students with analytical tools and techniques to measure, manage, and optimize market risk and supply chain performance.
- Explore contemporary approaches and technologies used in market risk and supply chain analytics.

COURSE OUTCOMES:

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

- Illustrate the fundamental concepts and principles of market risk and supply chain analytics (K2)
- Show the market risk and supply chain problems using data-driven approaches (K3)
- Build the analytical techniques to manage market risk exposure and optimize supply chain performance (K3)
- Make use of contemporary tools and technologies for market risk and supply chain data analysis (K3)
- Analyze strategies for effective market risk management and supply chain efficiency (K4)

UNIT I INTRODUCTION 6

Definition and Importance of Market Risk and Supply Chain Analytics - Overview of Financial Markets and Supply Chain Management - Types of Analytics: Descriptive, Predictive, and Prescriptive - Role of Data in Decision-Making - Key Performance Indicators (KPIs) and Metrics for Risk and Supply Chain - Analytics Process and Lifecycle - Challenges and Opportunities in Market Risk and Supply Chain Analytics - Case Studies on Applications - Practical Exercises on Identifying Problems in Market Risk and Supply Chain.

UNIT II DATA COLLECTION AND PREPARATION 6

Data Types and Sources in Market Risk and Supply Chain - Data Collection Methods - Data Quality and Data Cleaning Techniques - Data Integration and Transformation - Handling Missing Data - Data Preprocessing for Analysis - Exploratory Data Analysis (EDA) - Data Visualization Techniques - Tools for Data Collection and Preparation (Excel, SQL, ETL Tools).

UNIT III ANALYTICAL TECHNIQUES AND MODELS 6

Statistical Analysis and Hypothesis Testing - Regression Analysis and Predictive Modeling - Time Series Analysis and Forecasting - Classification and Clustering Techniques - Simulation and Scenario Analysis - Machine Learning Algorithms for Risk and Supply Chain Analytics - Optimization Techniques for Decision Making - Tools for Analytical Modeling (R, Python, SAS).

UNIT IV RISK MEASUREMENT AND SUPPLY CHAIN OPTIMIZATION 6

Value at Risk (VaR), Expected Shortfall (ES), Stress Testing - Sensitivity Analysis, Greeks (Delta, Gamma, Vega, Theta) - Risk Management Software (RiskMetrics, Bloomberg) - Network Design and Configuration - Facility Location and Allocation - Transportation and Distribution Planning - Inventory Management and Control - Supplier Selection and Procurement - Risk Management in Supply Chain - Tools for Optimization (Gurobi, CPLEX).

UNIT V APPLICATIONS AND CONTEMPORARY ISSUES 6

Hedging Strategies and Instruments (Options, Futures, Swaps) - Portfolio Diversification and Risk Reduction - Market Risk in Emerging Markets - Supply Chain Analytics in Retail, Manufacturing, Healthcare - IoT, Big Data, Blockchain in Supply Chain - Ethical and Legal Considerations - Future Trends in Market Risk and Supply Chain Analytics.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Market Risk Assessment Using Value-at-Risk (VaR)
2. Implementing Monte Carlo Simulations for Risk Analysis
3. Credit Risk Modeling and Scoring
4. Supply Chain Network Design and Optimization
5. Inventory Management with Predictive Analytics
6. Demand Forecasting Using Time Series Analysis
7. Supplier Risk Assessment and Mitigation Strategies

TOTAL: 30

TEXT BOOKS:

1. Philippe Jorion, "Value at Risk: The New Benchmark for Managing Financial Risk", McGraw-Hill, 3rd Edition, 2020
2. Nada R. Sanders, "Big Data Driven Supply Chain Management: A Framework for Implementing Analytics and Turning Information into Intelligence", Pearson, 2020

REFERENCE BOOKS:

1. Hokey Min, "Analytics for Supply Chain Management", McGraw-Hill, 2021
2. Linda Allen, Jacob Boudoukh, Anthony Saunders, "Understanding Market, Credit, and Operational Risk: The Value at Risk Approach", Wiley, 2021

WEBSITES:

1. https://www.tutorialspoint.com/supply-chain-risk-management-principles/index.asp
2. https://www.geeksforgeeks.org/market-basket-analysis-in-data-mining/
3. https://www.ibm.com/topics/supply-chain-analytics
4. https://www.javatpoint.com/scm

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -V

24BTAD5E410 GAME THEORY (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PREREQUISITE: Theory of Computation

i) THEORY

COURSE OBJECTIVES:

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

- Know the basics of 2D and 3D graphics for game development.
- Survey the gaming development environment and tool kits.
- Learn and develop simple games using Pygame environment

COURSE OUTCOMES:

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

- Outline the concepts of 2D and 3d Graphics. (K2)
- Interpret game design principles in storyboard development. (K2)
- Develop gaming engines using appropriate algorithms. (K3)
- Analysis of gaming environments and frameworks. (K4)
- Build simple gaming application in Pygame. (K3)

UNIT I 3D GRAPHICS FOR GAME DESIGN **6**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES **6**

Character Development, Rudiments of game design, Storyboard Development for Gaming, The Anatomy of a Game Designer – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN **6**

Game Engine Architecture, Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Path finding.

UNIT IV GAMING PLATFORMS AND FRAMEWORKS 6

Game Development Technical Aspects, Game Design Team Roles, Pygame Game Development,– Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games.

UNIT V GAME DEVELOPMENT USING PYGAME 6

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Character design, sprites, movement and character control
2. Level design: design of the world in the form of tiles along with interactive and collectible objects.
3. Design of interaction between the player and the world, optionally using the physics engine.
4. Developing a 2D interactive using Pygame
5. Developing a 3D Game using Unreal
6. Developing a Multiplayer game using unity

TOTAL: 30

TEXT BOOKS:

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison Wesley,2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.

REFERENCE BOOKS:

1. Paul Craven, "Python Arcade games", Apress Publishers,2016.
2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press,2006.
3. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.
4. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.

WEBSITES :

1.https://www.gametheory.net/

2.https://plato.stanford.edu/entries/game-theory/

3.https://ocw.mit.edu/courses/14-126-game-theory-spring-2016

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO2	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO4	3	2	1		-	-	-	-	2	2	-	2	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	2
Avg	**2.6**	**1.8**	**1.3**	1	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**2**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -V

24BTAD5E411 AI FOR SUSTAINABILITY 4H-3C
(THEORY & LAB)

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

PRE-REQUISTES: Artificial Intelligence

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Learn core principles of AI and Sustainability.
- Illustrate how AI techniques can be applied across different sectors of sustainability.
- Explore and critically examine the ethical, social, and policy implications of integrating artificial intelligence

COURSE OUTCOMES:

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

- Outline the core principles of integrating AI with sustainability. (K2)
- Identify machine learning techniques for sustainability-related domains. (K3)
- Apply AI techniques to monitor and manage environmental challenges. (K3)
- Develop a sustainable AI model for implications of responsible solutions . (K3)
- Survey the sustainable lifecycle of a real-world problems (K4)

UNIT INTRODUCTION TO AI AND SUSTAINABILITY 6

Definition of artificial intelligence and its historical development– Definition of sustainability and its pillars – Introduction to sustainable development goals – Global sustainability challenges– Integrating AI with sustainability practices for long-term global benefits – AI technologies contribution to achieve SDGs - Applications of AI across various industries and sectors.

UNIT II AI TECHNIQUES FOR SUSTAINABLE SOLUTIONS 6

Machine Learning for Sustainability – Optimization Techniques - Linear programming, stochastic optimization, and metaheuristic algorithms - predictive modeling in biodiversity conservation - sustainable urban planning - optimizing resource allocation, waste management systems, and transportation logistics for sustainability - Use of AI in predicting climate impacts on agriculture.

UNIT III AI FOR ENVIRONMENTAL MONITORING AND MANAGEMENT 6

Remote Sensing and GIS – Integration of AI with satellite imagery analysis – Use of GIS with AI for spatial analysis and mapping - NLP in analyzing environmental policy documents - NLP for understanding public perceptions and informing policy decisions-Challenges and opportunities in scaling AI-powered sensor networks for global sustainability impact.

UNIT IV ETHICAL AND SOCIAL IMPLICATIONS OF AI IN SUSTAINABILITY 6

Ethical frameworks for AI use in environmental justice -Challenges in data privacy and security– Legal and regulatory frameworks governing AI-driven environmental monitoring– Strategies for ensuring secure and responsible use of AI technologies in sustainability – International agreements and policies– Role of governments, NGOs, and international organizations.

UNIT V REAL TIME APPLICATION 6

Detailed analysis of real-world applications– Different regions and sectors showcasing innovative AI solutions– Hands-on project applying AI techniques to address a specific sustainability challenge – Climate Change Mitigation - Biodiversity Conservation - Global Health and Pandemic Preparedness.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Perform study on highlighting ethical dilemmas in AI applications for sustainability.
2. Investigate how AI can be leveraged for sustainable development initiatives.
3. Develop a machine learning model to optimize energy consumption or predict environmental changes.
4. Develop a sentiment analysis model using NLP techniques to analyze public opinion on a specific environmental policy.
5. Build a machine learning model to predict water quality parameters (e.g., pH, turbidity) using historical IoT sensor data
6. Analyze public sentiment on climate change using NLP Techniques.

TOTAL: 30

TEXT BOOKS:

1. Hui Lin Ong, Ruey-an Doong, ”Artificial Intelligence and Environmental Sustainability: Challenges and Solutions in the Era of Industry 4.0”, First Edition ,Springer, April 2023.
2. Henrik Skaug Saetra, ”AI for the Sustainable Development Goals”, First Edition, O’Reilly, February 2022.

REFERENCE BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press,2018

WEBSITES:

1. https://www.deeplearning.ai
2. https://www.kaggle.com/
3. https://ec.europa.eu/futurium/en/system/files/ged/vincent-pedemonte_ai-for-sustainability_0.pdf

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -V

24BTAD5E412 COGNITIVE SCIENCE (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Fundamentals of Programming

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students to:

- Know the theoretical background of cognition
- Understand the link between cognition and computational intelligence
- Explore probabilistic programming language

COURSE OUTCOMES:

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

- Interpret the fundamental of cognitive science concepts and AI applications. (K2)
- Apply planning and learning methods in cognitive systems. (K3)
- Make use of computational intelligence techniques for reasoning and problem-solving. (K3)
- Develop cognitive models for memory and language. (K3)
- Analyze the models for cognitive processes and their development. (K4)

UNIT I INTRODUCTION TO COGNITIVE SCIENCE **6**

Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology- Understanding, Common Sense Reasoning.

UNIT II PLANNING AND LEARNING METHODS **6**

Planning – Situation Logic- Learning in Cognitive Systems- Rote Learning – Learning by Examples - Incremental Concept Learning – Inductive Learning – Classification Techniques – Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees.

UNIT III COMPUTATIONAL INTELLIGENCE **6**

Reasoning by analogy – Explanation based reasoning – Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning – Temporal Constraint Networks- Spatial reasoning- Visual Spatial reasoning- Meta reasoning – Learning by correcting mistakesAI ethics

UNIT IV COGNITIVE MODELING **6**

Declarative/ logic-based computational cognitive modelling - connectionist models of cognition – Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning.

UNIT V LEARNING MODELS OF COGNITION **6**

Modelling Select Aspects of Cognition Classical models of rationality - symbolic reasoning and decision making under uncertainty - Formal models of inductive generalization causality - Categorization and similarity analysis - Cognitive Development - Child concept acquisition - Child language learning - Acquisition of arithmetic skills – Distributed Cognition and Learning- Simple and Complex Decision Making – Reasoning Under Uncertainty – Natural Language Understanding – Natural Language Processing – Automated

TOTAL: 30

ii) LABORATORY

LAB EXPERIMENTS:

1.Demonstration of Mathematical functions using WebPPL.
2. Implementation of reasoning algorithms.
3. Developing an Application system using generative model.
4. Developing an Application using conditional inference learning model.
5. Application development using hierarchical model.
6. Application development using Mixture model.

TOTAL: 30

TEXT BOOKS:

1.Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020
2.Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016

REFERENCE BOOKS:

1.Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016

2.Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.
3.Elaine Rich,Kevin Knight, Shivashankar B. Nair, "Artificial Intellegence", 3rd Edition, TMS, third edirion.

WEBSITES:

1. https://www.geeksforgeeks.org/cognitive-computing/
2. https://ocw.mit.edu/courses/9-66j-computational-cognitive-science-fall-2004
3. https:// elsevier.com/books/cognitive-computing-theory-and-applications/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	2	-
CO3	3	2	1	-	-	-	-	-	2	2	-	2	2	-
CO4	3	2	1	-	-	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	2	2	-
Avg	**2.8**	**2**	**1.3**	1	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PROFESSIONAL ELECTIVES IV

SEMESTER -VI

24BTAD6E41 MOBILE APPLICATION DEVELOPMENT (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Web Technology

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Illustrate android SDK for creating mobile applications
- Understand how to work with layouts in mobile application development frameworks
- Apply android multimedia application to develop android API's.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Infer software development kits (SDKs) for iOS, Android, BlackBerry, and Windows. (K2)
- Identify the methods in storing, sharing and retrieving data in Android applications (K3)
- Experiment with responsive and user-friendly interfaces using appropriate layouts and constraints. (K3)
- Develop a mobile application by effectively setting up and utilizing the Android SDK environment (K3)
- Inspect the mobile app using key features and functions of the Android API (K4)

UNIT I MOBILE PLATFORM AND APPLICATIONS 6

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues

UNIT II INTRODUCTION TO ANDROID 6

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS **6**

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA **6**

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures

UNIT V ANDROID APIs **6**

Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TOTAL:30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font, Layout Managers and event listeners.
2. Develop an application that makes use of databases
3. Develop a native application that uses GPS location information
4. Implement an application that creates an alert upon receiving a message
5. Develop an application that makes use of RSS Feed.
6. Create an android application that converts the user input text to voice.
7. Use debugging tools (e.g., Android Studio Debugger, Xcode Debugger) to identify and fix issues.

TOTAL:30

TEXT BOOKS:

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 3rd Edition. 2012.
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.

REFERENCE BOOKS:

1. Prasanth Kumar Pattnaik, Rajib Mall,” Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd,New Delhi-2012

2. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2010 Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009
3. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O‟Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
4. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197.
5. Bill Phillips, Chris Stewart and Kristin Marsicano, “Android Programming: The Big NerdRanch Guide”, 4th Edition, Big Nerd Ranch Guides, 2019. ISBN-13: 978-0134706054

WEB SITES:

1. https://www.ibm.com/topics/mobile-application-development
2. https://developer.android.com/studio/intro
3. https://www.coursera.org/learn/introduction-to-android-mobile-application-development

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	-	-	-	**2**	**2**	**-**	**-**	**2**	**-**

1. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

SEMESTER -VI

24BTAD6E42 DATA SECURITY AND ACCESS CONTROL (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISTES : Database Management System.

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Learn about fundamentals and models of access control.
- Develop logical thinking abilities and to propose novel solutions for real world problems through security algorithms.
- Enhance understanding of recent advancements in data security, explore smart card security applications, and apply database security in real-time scenarios.

COURSE OUTCOMES:

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

- Outline the limitations of data security and access control. (K2)
- Compare authentication, authorization and accounting access control mechanisms. (K2)
- Identify integrity models to safeguard the data in enterprise IT infrastructures (K3)
- Build a secure data storage and transaction management in smart card environments. (K3)
- Survey the real-world scenarios in emerging database security platforms (K4)

UNIT I FUNDAMENTALS OF ACCESS CONTROL 6

Introduction to Access Control-Purpose and fundamentals of access control-brief history-Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC)-Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations-Capability List and Limitations.

UNIT II ROLE-BASED ACCESS CONTROL 6

Role-Based Access Control (RBAC) and Limitations, Core RBAC-Hierarchical RBAC-Statically Constrained RBAC- Dynamically Constrained RBAC- Limitations of RBAC-Comparing RBAC to DAC and MAC Access control policy.

UNIT III ENTERPRISE IT INFRASTRUCTURES **6**

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style Biba's integrity model- Clark-Wilson model, Domain type enforcement model-mapping the enterprise view to the system view-Role hierarchies- inheritance schemes-hierarchy structures and inheritance forms using SoD in real system Temporal Constraints in RBAC-MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs-RBAC for UNIX and JAVA environments.

UNIT IV SMART CARD SECURITY **6**

Smart Card based Information Security-Smart card operating system fundamentals-design and implantation principles, memory organization-smart card files, file management-atomic operation-smart card data transmission ATR,PPS Security techniques- user identification-smart card security-quality assurance and testing-smart card life cycle-5 phases-smart card terminals.

UNIT V TRENDS IN DATABASE SECURITY **6**

Recent trends in Database security and access control mechanisms:- Data Masking and Encryption-Database Activity Monitoring (DAM)- Blockchain for Database Security, Case study of Role-Based Access Control (RBAC) systems, Multi-line Insurance Company.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Set up a simple RBAC system using a programming language (e.g.,Python).
2. Implement basic authentication mechanisms such as username/password, OAuth, or JWT (JSON Web Tokens).
3. Implement RBAC in a web application scenario.
4. Implement RBAC using database-driven permissions.
5. Implement RBAC in a cloud environment (e.g., AWS, Azure).
6. Identify integration challenges when combining RBAC with MAC or DAC.

TOTAL: 30

TEXT BOOKS:

1. Chris Sanders, Jason Smith, "Applied Network Security Monitoring: Collection, Detection, and Analysis", 3rd edition, 2021.
2. David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli , "Role Based Access Control", Artech House; 2nd edition, 2007

REFERENCE BOOKS:

1. Thomas L. Norman, "Electronic Access Control, Butterworth-Heinemann", Elsevier, 2018.
2. Gertz, Michael, Jajodia, Sushil (Eds.), "The Handbook of Database Security: Applications & Trends", Springer, 2008.
3. Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016.

WEBSITES:

1. https://www.datasunrise.com/blog/professional-info/what-is-access-control/
2. https://www.techtarget.com/
3. https://www.geeksforgeeks.org/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO2	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	2	-	2
Avg	**2.6**	**1.8**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	**2**	-	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VI

24BTAD6E43 INVESTMENT ANALYSIS WITH AI (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISTES : Artificial Intelligence

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide a comprehensive understanding of investment analysis and its role in financial decision-making.
- Equip students with AI tools and techniques to enhance investment analysis and portfolio management.
- Explore contemporary approaches and technologies used in AI-driven investment analysis.

COURSE OUTCOMES:

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

- Illustrate the fundamental concepts and principles of investment analysis (K2)
- Apply sentiment analysis and entity recognition for financial sentiment tracking. (K3)
- Choose AI techniques to optimize investment portfolios (K3)
- Identify the ethical considerations and challenges in using AI for investment decisions. (K3)
- Model a strategy for effective investment decision-making using AI (K3)

UNIT I INTRODUCTION TO INVESTMENT ANALYSIS AND AI 6

Definition and Importance of Investment Analysis - Overview of Financial Markets and Instruments - Types of Investments: Stocks, Bonds, Mutual Funds, ETFs - Basics of Artificial Intelligence and Machine Learning - Role of AI in Investment Analysis - Key Performance Indicators (KPIs) in Investment.

UNIT II DATA COLLECTION AND PREPARATION FOR INVESTMENT ANALYSIS 6

Data Types and Sources in Investment Analysis - Financial Data Collection Methods - Data Quality and Data Cleaning Techniques - Data Integration and Transformation - Handling Missing Data - Data Preprocessing for Investment Analysis - Exploratory Data Analysis (EDA).

UNIT III AI TECHNIQUES AND MODELS FOR INVESTMENT ANALYSIS 6

Statistical Analysis and Hypothesis Testing in Finance - Regression Analysis and Predictive Modeling - Time Series Analysis and Forecasting - Classification and Clustering Techniques - Deep Learning Algorithms for Investment Analysis - Natural Language Processing (NLP) in Financial Analysis - Sentiment Analysis for Investment Decisions.

UNIT IV PORTFOLIO MANAGEMENT AND OPTIMIZATION 6

Modern Portfolio Theory (MPT) - Risk and Return in Investment - Portfolio Diversification and Asset Allocation - Portfolio Optimization Techniques - AI-Driven Portfolio Management - Risk Management in Investment - Performance Evaluation of Investment Portfolios - Tools for Portfolio Management (Robo-Advisors, Portfolio Management Software).

UNIT V APPLICATIONS AND CONTEMPORARY ISSUES IN AI-DRIVEN INVESTMENT ANALYSIS 6

Algorithmic Trading and High-Frequency Trading - Robo-Advisors and Automated Investment Services - Ethical and Legal Considerations in AI-Driven Investment - Impact of AI on Financial Markets - Behavioral Finance and AI - Future Trends in AI-Driven Investment Analysis - Case Studies on AI Applications in Investments.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Data Collection and Preprocessing for Financial Analysis
2. Implementing Time Series Forecasting Models
3. Sentiment Analysis on Financial News Articles
4. Predicting Stock Prices Using Neural Networks
5. Developing a Financial Dashboard Using Python
6. Risk Analysis and Management with AI Techniques

TOTAL: 30

TEXT BOOKS:

1. David J. Leinweber, "Nerds on Wall Street: Math, Machines and Wired Markets", Wiley, 2020.
2. Marcos Lopez de Prado, "Advances in Financial Machine Learning", Wiley, 2021.

REFERENCE BOOKS:

1. Yves Hilpisch, "Artificial Intelligence in Finance", O'Reilly Media, 2021
2. Ernest P. Chan, "Machine Trading: Deploying Computer Algorithms to Conquer the Markets", Wiley, 2020
3. Morton Glantz, Robert Kissell, "Multi-Asset Risk Modeling: Techniques for a Global Economy in an Electronic and Algorithmic Trading Era", Academic Press, 2021

WEBSITES:

1. https://www.geeksforgeeks.org/artificial-intelligence-in-financial-market/
2. https://www.leewayhertz.com/ai-for-investment-analysis/
3. https://www.miquido.com/blog/ai-in-investment/
4. https://www.tutorialspoint.com/analysis-of-investment-online-training/index.asp
5. https://cloud.google.com/discover/finance-ai

CO, PO, PSO Mapping

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

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VI

24BTAD6E44 INDUSTRIAL IoT (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES: Computer Architecture

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Understand the fundamentals of Internet of Things
- Learn about the basics of IOT protocols
- Build a small low-cost embedded system using IoT

COURSE OUTCOMES:

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

- Interpret the basic concepts of Internet of Things and its characteristics. (K2)
- Outline IIoT business models and its relative importance. (K2)
- Identify the types of EDGE devices for IIoT hardware communications. (K3)
- Solve real-world problems of IIoT in wireless networking. (K3)
- Classify the integration of sensors, actuators, and industrial devices in IIoT systems(K4)

UNIT I INTRODUCTION AND ARCHITECTURE OF IoT **6**

Introduction – Definition and characteristics of IoT – Physical and Logical Design of IoT - Communication models and APIs – Challenges in IoT - Evolution of IoT- Components of IoT - A Simplified IoT Architecture – Core IoT Functional Stack.

UNIT II INDUSTRIAL IoT **6**

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

UNIT III COMMUNICATION TECHNOLOGIES OF IIOT **6**

Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication.

UNIT IV COMMUNICATION TECHNOLOGIES OF IIOT **6**

Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud data base, Could computing, Fog or Edge computing.Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

UNIT V CASE STUDY **6**

Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries

TOTAL :30

ii) LABORATORY

LIST OF EXPPERIMENTS:

1. Introduction to Arduino and Introduction to raspberry Pi.
2. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
3. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
4. Create Wireless network of sensors using Zigbee.
5. Interface Bluetooth with Ardrino/Rasbery pi and write a program to turn LED ON/OFF received from smartphone.
6. Connect IOT devices through cloud using IoT protocol such as MQTT.

TOTAL :30

TEXT BOOKS:

1. Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress), January 2019
2. "Industrial Internet of Things: Cybermanufacturing Systems"by Sabina Jeschke, ChristianBrecher, Houbing Song, Danda B. Rawat (Springer), 2017
3. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018

REFERENCE BOOKS:

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

WEBSITES:

1. https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT
2. https://onlinecourses.nptel.ac.in/noc20_cs69/preview
3. https://www.cisco.com/c/en/us/solutions/internet-of-things/what-is-industrial-iot.html#~adopting-iiot

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	-	**2**	-

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

24BTAD6E45 AI IN EDGE COMPUTING (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISITES: Artificial Intelligence, Machine Learning Techniques

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to

- Gain insight into the tools, techniques and components involved in Edge Artificial Intelligence.
- Explore the use of artificial intelligence techniques to optimize edge computing infrastructure and operations.
- Utilize Mobile Edge AI and its implementations across edge computing platforms.

COURSE OUTCOMES:

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

- Classify different system paradigms and frameworks used in edge computing architectures. (K2)
- Illustrate the fundamental computing techniques of Edge AI. (K2)
- Identify AI applications for optimizing edge services in IoV environments. (K3)
- Utilize optimizations involved in mobile edge AI deployments (K3)
- Analyze case studies showcasing successful implementations of edge AI solutions in different sectors (K4)

UNIT I INTRODUCTION **6**

Fundamentals of Edge Computing: Introduction-Key Techniques-Benefits-Systems Paradigms of Edge computing- Edge Computing Frameworks-Value Scenarios for Edge Computing- system architectures. Fundamentals of Artificial Intelligence: Artificial Intelligence and Deep Learning, Neural Networks in Deep Learning-Deep Reinforcement Learning - Distributed DL Training.

UNIT II EDGE AI COMPUTING TOOLS **6**

Role in Edge Computing: A high-level hardware hierarchy of edge computing paradigm-Virtualization: Virtual Machine and Container-Network Virtualization- Introduction to DevOps: Understanding the history and evolution- Overview of the benefits and challenges-DevOps tools and practices- Case Study: Edge device toolkit providers- Google's Distributed Cloud Edge / NVIDIA Jetson platform `

UNIT III ARTIFICIAL INTELLIGENCE FOR OPTIMIZING EDGE 6

AI for Adaptive Edge Caching: use cases DNNs and DRL- Optimizing Edge Task Offloading-Edge Management and Maintenance: Communication-security- joint Edge Optimization-Case Study: Artificial intelligence for edge service optimization in the Internet of Vehicles.

UNIT IV MOBILE EDGE AI 6

Overview- Edge inference: On-device inference- Computation offloading- Server-based edge inference-Device-edge joint inference-Edge training: Data partition-based-Model partition based-Coded computing- Case Study: Energy-Efficient Mobile Edge Computing under Delay Constraints.

UNIT V AI APPLICATIONS ON EDGE 6

Real-time Video Analytics- Autonomous Internet of Vehicles(IoVs)- Intelligent Manufacturing-Smart Home and City- Urban Healthcare- Urban Energy Management-Manufacturing-Transportation and traffic-Case study: Edge AI solution for people's data privacy and security.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Install and configure an edge computing framework.
2. Implement a basic neural network for image classification using TensorFlow or PyTorch.
3. Automate deployment and scaling of edge applications using Docker and Kubernetes.
4. Implement an edge caching strategy using deep neural networks (DNNs) and reinforcement learning (RL).
5. Develop models for inference on edge devices (e.g., NVIDIA Jetson), measure latency, and compare with cloud-based inference
6. Implement edge training techniques such as data partition-based and model partition-based training.
7. Design an edge AI solution for a smart city application (e.g., traffic monitoring).

TOTAL: 30

TEXT BOOKS:

1. Wang, X., Han, Y., Leung, V. C., Niyato, D., Yan, X., & Chen, X" Edge AI:Convergence of edge computing and artificial intelligence", Springer,2020.
2. Jie Cao, Quan Zhang, Weisong Shi, "Edge Computing: A Primer", Springer International Publishing,2018.

REFERENCE BOOKS:

1. Lin, X., Han, S., Zhang, Z., & Ma, S., "Edge AI Computing: A Comprehensive Handbook", Wiley.2018
2. Russell, S., & Norvig, P, "Artificial Intelligence: A Modern Approach", Fourth Edition, 2022.
3. Yuanming Shi, Kai Yang, Zhanpeng Yang, Yong Zhou, Mobile Edge Artificial Intelligence Opportunities and Challenges,Elsevier,2021.
4. Shi, W., Zhang, L., Liu, Y., & Hou, Y, Edge Computing: Models, Technologies, and Applications, Institution of Engineering and Technology, 2020.

WEBSITES:

1. https://www.geeksforgeeks.org/introduction-deep-learning/
2. https://www.atlassian.com/devops/devops-tools
3. https://tryolabs.com/guides/video-analytics-guide

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.6**	**1.8**	**1.3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VI

24BTAD6E46 GENERATIVE AI (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE–REQUISITES: Artificial Intelligence**,** Machine Learning Techniques and Deep Learning

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the foundational concepts of generative models.
- Explore various types of generative models, including GANs, VAEs, and Transformers.
- Gain hands-on experience in implementing and training generative models.

COURSE OUTCOMES:

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

- Compare and Differentiate Generative Models (K2)
- Interpret autoencoder architecture in generative AI (K2)
- Develop generative adversarial networks for data augmentation. (K3)
- Identify transformer models for text generation for neural networks. (K3)
- Apply ethical implications and responsible ai practices (K3)

UNIT I FOUNDATIONS OF GENERATIVE MODELS 6

Introduction to Generative AI : Overview of generative AI and its applications- Types of generative models- Introduction to deep learning frameworks. Probability and Statistical Methods : Probability distributions and Bayesian inference - Maximum likelihood estimation (MLE) - Variational inference.

UNIT II VARIATIONAL AUTOENCODERS (VAES) 6

Autoencoders: Basic autoencoder architecture- Training autoencoders- Applications of autoencoders. Introduction to VAEs: Structure and theory of VAEs- Latent space representation- Variational inference in VAEs. Advanced Topics in VAEs: Conditional VAEs- Semi-supervised learning with VAEs- Applications of VAEs in data generation and anomaly detection

UNIT III GENERATIVE ADVERSARIAL NETWORKS (GANS) 6

Introduction to GANs: Fundamentals of GANs-Generator and discriminator networks-Training GANs and common challenges. Advanced GAN Architectures: Deep Convolutional GANs (DCGANs)-

Conditional GANs (cGANs)- CycleGANs and StyleGANs. Practical Applications of GANs: Image synthesis and editing-Data augmentation-Evaluation metrics for GANs.

UNIT IV TRANSFORMER MODELS AND TEXT GENERATION 6

Introduction to Transformers: Architecture of Transformer Models-Self-attention mechanism-Training Transformers. Language Models and Text Generation: Recurrent neural networks (RNNs) and LSTMs-Generative Pre-trained Transformers (GPT) and applications in text generation and language translation - Chat Bot.

UNIT V ADVANCED APPLICATIONS AND ETHICAL CONSIDERATIONS 6

Generative Models for Images and Audio: Image generation techniques-Neural style transfer Audio synthesis and music generation. Ethical and Societal Implications: Ethical issues in generative AI-Deep fackes and their impact-Responsible AI practices.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement the encoder and decoder networks for a VAE.
2. Implement a conditional VAE (CVAE).
3. Implement the generator and discriminator networks for a GAN.
4. Implement a Deep Convolutional GAN (DCGAN).
5. Implement a CycleGAN for image-to-image translation (e.g., converting horses to zebras).
6. Implement a basic Transformer model.

TOTAL: 30

TEXT BOOKS:

1. David Foster," Deep Learning: Teaching Machines to Paint, Write, Compose and Play", O'Reilly Media, 2nd edition, 2023.
2. Numa Dhamani, "Introduction to Generative AI", Manning, First edition,2024.
3. Carlos Rodriguez, "Generative AI Foundations in Python: Discover key techniques and navigate modern challenges in LLMs", Packt Publishing, First edition, 2024.

REFERENCE BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Rafael Valle, "Hands-on Generative Adversarial Networks with Keras". Packt Publisher, 2019.

WEBSITES:

1. https://www.coursera.org/learn/generative-ai-introduction-and applications
2. https://www.coursera.org/learn/generative-ai-prompt-engineering-for-everyone
3. https://www.coursera.org/learn/generative-ai-foundation-models-and-platforms

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	2	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	2	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	2	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	2	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

PROFESSIONAL ELECTIVES V

SEMESTER -VI

24BTAD6E47 MERN STACK DEVELOPMENT (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PREREQUISITE: Web Application Development or Web Programming

i) THEORY

COURSE OBJECTIVES:

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

- Gain comprehensive knowledge of front-end development using ReactJS
- Understand and apply backend development concepts using Node.js and ExpressJS.
- Learn and manage data storage and manipulation using MongoDB.

COURSE OUTCOMES:

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

- Utilize ReactJS concepts for front end development and manage state effectively across different components. (K3)
- Integrate MongoDB with Node.js applications to perform CRUD operations and handle data storage efficiently (K3)
- Develop RESTful web services using Node.js and Express.js. (K3)
- Apply the best practices in ReactJS, Node.js, and Express.js for improving performance and security of web applications. (K3)
- Deploy full-stack web applications by using the MERN stack, incorporating front-end, back- end, and database components. (K3)

UNIT I – INTRODUCTION TO THE MERN STACK & REACT JS BASICS 6

MERN Stack: Overview of MongoDB, Express.js, ReactJS, Node.js. ReactJS Basics: Introduction to ReactJS - DOM and Virtual DOM - Setting Up the Development Environment - React Components: Function Components, Class Components - JSX and Rendering Elements - Handling Events - State and Lifecycle: useState Hook - useEffect Hook - Conditional Rendering - Lists and Keys - Forms and Controlled Components - Lifting State Up - Composition vs Inheritance - Axios for HTTP requests.

UNIT II – FRONTEND DEVELOPMENT WITH REACT JS ADVANCED 6

React Router: Navigation - Advanced Hooks: useImmer – useContext – useReducer – useRef - useMemo – useCallback – useLayoutEffect - useImperativeHandle - Custom Hooks - Context API for State Management - Introduction to Redux - Higher-Order Components - Error Boundaries - React Performance

Optimization - Lazy Loading and Suspense for Code Splitting - Testing with React Testing Library and Jest - Styling: CSS Modules - Styled Components - Material UI

UNIT III – WORKING WITH MONGODB **6**

MongoDB Basics: Introduction to MongoDB - MongoDB Basics - Documents - Collections - Query Language - Installation - The Mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB - CRUD - MongoDB Atlas for Cloud Database Management

UNIT IV – NODE JS BASICS **6**

Node.js Basics: Introduction to Node.js - Setting Up Node.js: Installation and Version Management, Node.js REPL - Node.js Modules: Built-in Modules (os, fs, path, http) - Creating and Exporting Modules - Using npm - Asynchronous Programming: Callbacks – Promises - Async/Await – Building a Simple Web Server: Using the HTTP Module - Handling Requests and Responses - Working with APIs: Making HTTP Requests - Consuming APIs - Error Handling.

UNIT V – EXPRESS JS AND ADVANCED BACKEND DEVELOPMENT **6**

Express.js Basics: Introduction to Express.js - Middleware: Built-in Middleware, Third-party Middleware - Custom Middleware - Routing: Defining Routes - Route Parameters - Handling Different HTTP Methods - Modular Routes - Serving Static Files - Working with Templates: Using Template Engines - Data Access and REST APIs - Authentication and Authorization: JWT Authentication - Error Handling: Error Handling Middleware - Deploy MERN application in Cloud Platform

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Develop basic React components to understand JSX, state, events and routing.
2. Manage state in a complex application using Context API and Redux.
3. Set up MongoDB and perform basic CRUD operations using MongoDB shell and Mongoose.
4. Create a basic web server with Node.js to handle HTTP requests and serve static files.
5. Develop RESTful APIs using Express.js, including CRUD operations and middleware.
6. Deploy a full-stack MERN application to a cloud platform.

TOTAL: 30

TEXT BOOKS:

1. Carlos Santana Roldan, “React 18 Design Patterns and Best Practices - Fourth Edition: Design, build, and deploy production-ready web applications with React by leveraging industry-best practices”, Packt Publishing, Fourth Edition, 2023.

2. Vasan Subramanian, “Pro MERN Stack: Full Stack Web App Development with Mongo Express React and Node”, Apress Media LLC, Second Edition, 2019.

REFERENCE BOOKS:

1. Alex Banks and Eve Porcello, “Learning React: Modern Patterns for Developing React Apps”, O'Reilly Media, Third Edition, 2022.
2. Basarat Syed, “Node.js Complete Reference Guide: Master Node.js Frameworks, Libraries and Tools”, Packt Publishing, First Edition, 2020.
3. Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow, “MongoDB: The Definitive Guide”, O'Reilly Media, Third Edition, 2020.

WEBSITES:

1. https://react.dev/
2. https://www.mongodb.com/docs/
3. https://expressjs.com/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

SEMESTER -VI

24BTAD6E48 DIGITAL AND MOBILE FORENSICS (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISTES : Web Application Development.

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Understand basic digital forensics, digital crime and investigation and techniques.
- Interpret the preparedness for digital forensic readiness.
- Utilize the forensics tools for iOS devices and Android devices.

COURSE OUTCOMES:

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

- Illustrate the role of digital forensics in criminal and civil investigations. (K2)
- Compare the complexities of corporate digital crime evidence (K2)
- Model a methodology for digital forensics using frameworks and readiness. (K3)
- Identify challenges in the rapidly evolving field of digital forensics (K3)
- Categorize the digital evidence extraction from iOS and Android devices. (K4)

UNIT I INTRODUCTION TO DIGITAL FORENSICS 6

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

UNIT II DIGITAL CRIME AND INVESTIGATION 6

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

UNIT III DIGITAL FORENSIC READINESS 6

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

UNIT IV iOS FORENSICS **6**

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

UNIT V ANDROID FORENSICS **6**

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

TOTAL :30

i) LABORATORY

LIST OF EXPERIMENTS:

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

TOTAL :30

TEXT BOOK:

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

REFERENCE BOOK:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
2. Gerard Johansen, Kristopher Rush, "Digital Forensics and Incident Response: A Practical Guide to Deploying Digital Forensics and Incident Response", Apress, 2017.
3. EC-Council,Computer Forensics: Investigating Network Intrusions and Cyber Crime", Cengage Learning, 3rd Eidtion, 2018.

WEB SITES:

1. https://www.geeksforgeeks.org/mobile-forensics-definition-uses-and-principles/
2. https://codehs.com/tutorial/jennifer/digital-forensics
3. https://www.tutorialspoint.com/python_digital_forensics/index.htm

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.6**	**1.8**	**1.3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VI

24BTAD6E49 BUSINESS ANALYTICS FOR MANAGEMENT DECISION (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISTES : Matrices and Calculus, Big Data Analytics

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide a comprehensive understanding of business analytics and its application in decision-making.
- Equip students with analytical tools and techniques for solving business problems.
- Explore contemporary trends and challenges in business analytics.

.

COURSE OUTCOMES:

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

- Apply business analytics techniques for decision-making (K2)
- Utilize statistical and computational methods in business problems (K3)
- Build predictive models to support management decisions (K3)
- Identify the business analytics tools and techniques using software like excel and python (K3)
- Analyze the impact of business analytics on organizational performance and strategy (K4)

UNIT I - FOUNDATIONS OF BUSINESS ANALYTICS 6

Introduction to Business Analytics - Importance and Scope - Key Concepts: Data, Information, Knowledge - Types of Analytics: Descriptive, Predictive, Prescriptive - Analytics Lifecycle - Introduction to Statistical Analysis for Decision Making - Data-driven Decision Making - Role of Business Analysts in Organizations - Integration of Business Analytics with Business Strategy

UNIT II - DATA EXPLORATION AND VISUALIZATION 6

Data Exploration Techniques - Data Cleaning and Transformation - Exploratory Data Analysis (EDA) - Visualization Techniques: Graphs, Charts, Dashboards - Introduction to Data Visualization Tools - Interactive Data Visualization - Geospatial Data Visualization - Visual Analytics Techniques

UNIT III - PREDICTIVE ANALYTICS **6**

Introduction to Predictive Modeling - Regression Analysis: Simple Linear Regression, Multiple Regression - Classification Techniques: Logistic Regression, Decision Trees, Random Forests - Time Series Forecasting - Model Evaluation and Validation Techniques - Feature Selection and Engineering -Ensemble Learning Methods - Text Analytics and Natural Language Processing (NLP) - Customer Churn Prediction

UNIT IV - PRESCRIPTIVE ANALYTICS **6**

Introduction to Prescriptive Analytics - Optimization Techniques: Linear Programming, Integer Programming - Decision Analysis: Decision Trees, Decision Support Systems - Simulation Modeling and Analysis - Risk Analysis and Uncertainty Modeling - Multi-criteria Decision Making - Supply Chain Optimization - Pricing Optimization Strategies

UNIT V - DECISION-MAKING ANALYTICS **6**

Decision Making Models -Risk Management Strategies - Ethical Decision Making - Data-Driven Decision Making - Decision Support System - Strategic Decision Making Crisis Management Decision Making Decision Making in International Business - Leadership and Decision Making -Organizational Behavior and Decision Making

TOTAL:30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Collect and preprocess business data for analysis.
2. Perform exploratory data analysis (EDA) using descriptive statistics, data visualization techniques, and correlation analysis.
3. Apply inferential statistics such as hypothesis testing and regression analysis to business scenarios.
4. Use predictive analytics techniques (e.g., predictive modeling, forecasting) to make future projections.
5. Implement clustering and segmentation analysis to identify customer segments or patterns in data.
6. Conduct sentiment analysis or text mining on business-related textual data.

TOTAL:30

TEXT BOOKS:

1. James R. Evans, "Business Analytics: Methods, Models, and Decisions", Pearson, 2020
2. Dursun Delen, "Business Analytics: Data Analysis and Decision Making", Cengage Learning, 2021

REFERENCE BOOKS:

1. U. Dinesh Kumar, "Business Analytics: Concepts, Theories, and Applications", Springer, 2022.
2. James R. Evans, "Business Analytics for Managers: Taking Business Intelligence Beyond Reporting", Wiley, 2023.
3. Marc J. Schniederjans, Qing Cao, "Business Analytics: Data Analysis & Decision Making", Cengage Learning, 2024.

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc20_mg11/preview
2. https://www.tutorialspoint.com/business_analysis/index.htm
3. https://www.techtarget.com/searchbusinessanalytics/definition/business-analytics-BA
4. https://www.geeksforgeeks.org/what-is-business-analytics/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	-	-	2
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	**-**	**-**	**-**	**2**

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

24BTAD6E410 BLOCKCHAIN TECHNOLOGY (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES: Computer Networks

i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to:

- Understand the basics of Blockchain, Bitcoin and Cryptocurrency.
- Learn Different protocols and consensus algorithms in Blockchain
- Use Hyperledger Fabric, Ethereum networks in Blockchain applications.

COURSE OUTCOMES:

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

- Contrast the blockchain and cryptographic hash functions (K2)
- Apply Bitcoin consensus algorithms to achieve decentralized decision-making without relying on central authorities. (K3)
- Build contracts to ensure security in blockchains. (K3)
- Choose appropriate platform to secure blocks in blockchain. (K3)
- Develop the real time applications using blockchain framework. (K3)

UNIT I INTRODUCTION TO BLOCKCHAIN **6**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II BITCOIN AND CRYPTOCURRENCY **6**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT III BITCOIN CONSENSUS **6**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW, Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM **6**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM,Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V BLOCKCHAIN APPLICATIONS **6**

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance- Case Study.

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
3. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.
5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

TOTAL: 30

TEXT BOOKS:

1. Mastering Blockchain: Inner workings of blockchain, from cryptography and decentralized identities, to DeFi, NFTs and Web3, 4th Edition, 2023.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly Media; 1st edition (January 13, 2015).

REFERENCES:

1. Daniel Drescher, “Blockchain Basics”, First Edition, A press, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packet Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

WEB SITES:

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2. http://www.digimat.in/nptel/courses/video/106104220/L01.html
3. https://www.coursera.org/specializations/blockchain
4. https://store.cfainstitute.org/defi--introduction-to-blockchain-and-cryptocurrency/
5. https://www.investopedia.com/terms/c/cryptocurrency.asp

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	-	-	-	**2**	**2**	**-**	**-**	**2**	**-**

1. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

SEMESTER -VI

24BTAD6E411 SOCIAL NETWORK ANALYTICS (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE-REQUISTES : Big Data Analytics

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to

- Learn knowledge representation using ontology.
- Understand human behaviour in social web and related communities.
- Learn visualization of social networks.

COURSE OUTCOMES:

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

- Interpret the evolution and principles of the semantic web initiatives (K2)
- Outline ontologies and semantic technologies in personalized real-world recommendation systems. (K2)
- Make use of methods for community detection and mining in large-scale social networks. (K3)
- Identify the importance of user data management in predicting human behavior within social communities (K3)
- Apply graph theory concepts in real-world social network data. (K3)

UNIT I INTRODUCTION **6**

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

UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION **6**

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

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 6

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

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 6

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment Trust network analysis - Trust transitivity analysis.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 6

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

TOTAL:30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Working of semantic web and how it is useful for developers. Show with an example or case study.
2. Perform Design modelling, aggregating of semantic web.
3. Perform knowledge representation of semantic web.
4. Representation of OWL ontology.
5. Installation of Gephi software for network visualization and analysis.
6. Making of network graphs and conducting analysis on the dataset from Kaggle.

TOTAL: 30

TEXT BOOKS:

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

REFERENCES:

1. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.

3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

WEBSITES:

1. https://www.techtarget.com/searchcio/definition/Semantic-Web
2. https://www.academia.edu/33091380/Social_Network_Analysis
3. https://www.mdpi.com/2297-8747/29/3/37
4. https://www.coursehero.com/file/p1e2b0lk/Blog-communities-are-different-from-traditional-web-communities-Properties-of/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	-	-	-	**2**	**2**	-	-	**2**	-

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VI

24BTAD6E412 PATTERN RECOGNITION (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE–REQUISITES: Artificial Intelligence and Machine Learning Techniques

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide knowledge about pattern recognition algorithms.
- Equip students with methods and operations of pattern classification.
- Explore contemporary basic fuzzy systems and neural network architecture applications in pattern recognition.

COURSE OUTCOMES:

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

- Explain the basic concepts of pattern recognition and its applications. (K2)
- Classify pattern recognition methods for classification approaches. (K2)
- Develop the ability to use linear models for accurate pattern recognition. (K3)
- Identify the proficient application of neural networks for pattern recognition. (K3)
- Utilize exemplary applications on real-world pattern recognition problems (K3)

UNIT I OVERVIEW OF PATTERN RECOGNITION 6

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

UNIT II CLUSTERING CONCEPT 6

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

UNIT III LINEAR MODELS FOR CLASSIFICATION 6

Entropy Minimization – Karhunenloeve Transformation – Feature Selection through Functions Approximation – Binary Feature Selection – K-NN- State Machines – Hidden Markov Models: Maximum Likelihood for the HMM-Forward - Backward Algorithm-Sum and Product Algorithm for the HMM

UNIT IV PROBABILITY DENSITY ESTIMATION 6

Scaling Factors-Viterbi Algorithm-Extensions of the Hidden Markov Model – Support Vector Machines: Maximum Margin Classifier-Relevance Vector Machines. Fuzzy Classification: Fuzzy Set Theory-Fuzzy and Crisp Classification-Fuzzy Clustering-Fuzzy Pattern Recognition

UNIT V NEURAL NETWORK 6

Introduction to Neural Networks: Elementary Neural Network for Pattern Recognition-Feed-forward Network Functions-Error Backpropagation-Hebbnet-Perceptron-ADALINE and Back Propagation

TOTAL: 30

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.

TOTAL: 30

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, 2019.

REFERENCE BOOKS:

1. Andrew Webb, "Statistical Pattern Recognition", Arnold Publishers, First Edition, 2002.
2. Rajasekaran S and Vijayalakshmi Pai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall, Fifteenth Printing, 2011.

WEBSITES:

1. https://www.nptel.ac.in/courses/117/108/117108048/
2. https://www.nptel.ac.in/courses/117/105/117105101/
3. https://www.ocw.mit.edu/courses/media-arts-and-sciences/mas-622j-pattern-recognition-and-analysis-fall-2006/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	-	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	-	-	-	-	**2**	**2**	-	-	**2**	-

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

PROFESSIONAL ELECTIVES VI

SEMESTER -VII

24BTAD7E41 **NOSQL DATABASES (THEORY & LAB)** **4H-3C**

Instruction Hours/week: L:2 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 characteristics, history and the primary benefits for using NoSQLdata.
- Infer the major types of NoSQL databases including a primary use case advantage and disadvantages of each type
- Understand wide-column, document, key-value, graph and object-oriented databases, add content, and run queries.

COURSE OUTCOMES:

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

- Outline the characteristics and features of using NoSQL and SQL databases (K2)
- Utilize the different indexing techniques to improve database performance (K3)
- Make use of retrieve functions to extract data from MongoDB collections (K3)
- Experiment with the column data operating techniques using query language (K3)
- Organize structured and unstructured data to handle real time web applications (K3)

UNIT I NOSQL OVERVIEW **6**

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 UNDERSTANDING MONGODB **6**

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 QUERY CONSTRUCTION IN NOSQL 6

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

UNIT IV COLUMN FAMILY DATABASES 6

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

UNIT V GRAPH DATABASES 6

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

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Designing a NoSQL database employing the NoSQL models.
2. Querying a database updating and deleting database content using MongoDB.
3. Employing XML and JSON to retrieve data in MongoDB.
4. Querying a database updating and deleting database content using Redis.
5. Write applications that use Cassandra Query Language to fetch and display data.
6. Non-relational, distributed database design and creation using NoSQL web-based databases.

TOTAL: 30

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/C

CO, PO, PSO Mapping

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

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VII

24BTAD7E42 SECURITY AND PRIVACY IN CLOUD (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Introduce Cloud Computing terminology, definition & concepts
- Understand the security design and architectural considerations for Cloud
- Able to monitor and audit cloud applications for security

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Infer the cloud security concepts. (K2)
- Interpret the security challenges in the cloud. (K2)
- Identify the user identities and Access Management. (K3)
- Apply the risks, audit and monitoring mechanisms in the cloud. (K3)
- Develop the architectural and design considerations for security in the cloud. (K3)

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 6

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 6

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 6

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS 6

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT 6

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

TOTAL:30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. Simulate resource management using cloud sim
3. Simulate log forensics using cloud sim
4. Simulate a secure file sharing using a cloud sim
5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc)
6. Implement any encryption algorithm to protect the images

TEXT BOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, “Cloud Computing:”, Wiley 2013.
2. Dave shackleford, “Virtualization Security”, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy”, OREILLY 2011.

REFERENCE BOOKS:

1. Mark C. Chu-Carroll ―Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

WEB SITES:

1. https://studytm.wordpress.com/wp-content/uploads/2014/03/hand-book-of-cloud-computing.pdf
2. https://terrorgum.com/tfox/books/cloudcomputingbasics_aselfteachingintroduction.pdf
3. https://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/CLOUD%20COMPUTING%20Principles%20and%20Paradigms.pdf
4. https://samples.jblearning.com/9781284198355/9781284198355_FMxx_Chapple.pdf
5. https://www.researchgate.net/publication/360286722_Cloud_Computing_and_Security_Fundamentals

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -VII

24BTAD7E43 ROBOTICS PROCESS AUTOMATION 4H-3C
(THEORY & LAB)

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

PRE-REQUISTES: Web Technology

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the basic concepts of Robotic Process Automation.
- Expose to the key RPA design and development strategies and methodologies.
- Identify the Exception Handling, Debugging and Logging operations in RPA.

i) THEORY

COURSE OUTCOMES

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

- Outline the benefits of Robotic Process Automation in industrial sectors (K2)
- Identify the robotic process automation tools for process mining. (K3)
- Utilize RPA control design flows and work flows for the target process (K3)
- Build an application to handle exceptions in automation processes (K3)
- Develop orchestration to control the bots in RPA process. (K3)

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 6

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 6

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 6

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 6

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYMENT AND MAINTENANCE 6

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open-Source RPA, Future of RPA

TOTAL :30

ii) LABORATORY

LIST OF EXPERIMENTS:

1.Create a Sequence to obtain user inputs display them using a message box
2. Create a State Machine workflow to compare user input with a random number.
3. Build a process in the RPA platform using UI Automation Activities.
4. Implement Automation using System Trigger
5. Automate login to (web)Email account
6. Implement Error Handling in RPA platform

TOTAL :30

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020

REFERENCE BOOKS:

1.Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, Introduction to Robotic Process Automation: A Primer, Institute of Robotic Process, Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

2.Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018

3.A Gerardus Blokdyk, "Robotic Process Automation RPA A Complete Guide ", 2020.

WEBSITES:

1. https://www.geeksforgeeks.org/robotics-process-automation-an-introduction/
2. https://www.javatpoint.com/rpa
3. https://www.tutorialspoint.com/robotics-process-automation-an-introduction

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	-	-	-	**2**	**2**	-	-	**2**	-

1. **1 - Low, 2 - Medium, 3 - High, '-' - No Correlation**

SEMESTER -VII

24BTAD7E44 3D PRINTING AND DESIGN (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PREREQUISITE: NIL

i) THEORY

COURSE OBJECTIVES:

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

- Describe the basic ideas behind the 3D printing process.
- Grasp additive manufacturing and computer-aided design.
- Uses of 3D printing process in real time application

COURSE OUTCOMES:

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

- Interpret the fundamental ideas behind 3D printing technology. (K2)
- Illustrate the process of 3D printing. (K2)
- Identify a certain substance for the specified use in 3D Modeling. (K3)
- Build a product using additive manufacturing (AM) or 3D printing. (K3)
- Analyze the approaches f modelling and designing industrial applications.(K4)

UNIT I INTRODUCTION **6**

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of 3D printing process, Applications to various fields.

UNIT II PROCESS **6**

Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defense, Automotive, Construction, Food Processing, Machine Tools.

UNIT III MATERIALS **6**

Polymers, Metals, Non-Metals, Ceramics, Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. Support Materials.

UNIT IV ADDITIVE MANUFACTURING EQUIPMENT **6**

Process Equipment- Design and process parameters-Governing Bonding Mechanism Common faults and troubleshooting - Process Design- Post Processing: Requirement and Techniques- Product Quality.

UNIT V INDUSTRIAL APPLICATION **6**

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays Future trends

TOTAL: 30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. 3D Modelling of a single component
2. Assembly of CAD modelled Components
3. Exercise on CAD Data Exchange.
4. Generation of .stl files.
5. Identification of a product for Additive Manufacturing and its process plan.
6. Printing of identified product on an available AM machine.

TOTAL: 30

TEXT BOOKS:

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.2020
3. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017

REFERENCE BOOKS:

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010

WEBSITES:

1.https://www.thingiverse.com/
2.https://www.myminifactory.com/
3.https://www.tinkercad.com/

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER -VII

24BTAD7E45 ROBOTIC AND INTELLIGENT SYSTEMS (THEORY & LAB) 4H-3C

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

End Semester Exam:3 Hours

PRE-REQUISITES: Solid foundation in mathematics, Python Programming, Artificial Intelligence & Machine Learning

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to

- Gain a foundational knowledge of robotics and its various uses.
- Learn the use of object recognition and sensor applications in robotics for effective path planning and navigation.
- Demonstrate various applications of Robotics and Intelligent systems.

COURSE OUTCOMES:

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

- Outline the basic components and mechanisms involved in robotic technology (K2)
- Identify the role of sensor-based systems in robotic automation. (K3)
- Build a accurate object recognition models for intelligent systems (K3)
- Utilize the Path planning methods for navigation process (K3)
- Develop real-time application using sensor signal in robotics. (K3)
- Learner should be able to

UNIT I FUNDAMENTALS OF ROBOTICS 6

Historical Perspective - Specifications of Robots - Classifications of robots - Work envelope, Flexible automation versus Robotic technology - Applications of Robots - Basic components of robotic system - Mechanisms and transmission – Gripper – Types.

UNIT II ROBOT SENSING AND VISION 6

Use of Sensors and Sensor Based System in Robotics - Machine Vision System - Sensing, Digitizing, Image Processing and Analysis, segmentation - Threshold- edge detection- binary morphology – grey morphology and Application of Machine Vision System.

UNIT III OBJECT RECOGNITION 6

Object recognition - Approaches to Object Recognition - Recognition by combination of views – Object Recognition using machine learning - Robotic Assembly Sensors and Intelligent Sensors - visual servo-control.

UNIT IV ROBOT PLANNING AND NAVIGATION 6

Planning and navigation – Planning and reacting – Path planning – Obstacle avoidance – Navigation architectures.

UNIT V APPLICATIONS OF ROBOTS 6

Application of robots in active perception, medical, manufacturing industries, space and underwater - Humanoid robots - Micro robots - Social issues and Future of robotics.

TOTAL:30

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Investigate different kinds of vision sensors and lighting techniques for machine vision.
2. Identify different objects and classify those objects using Machine Learning Techniques.
3. Build tracking system for static and real-time objects using Machine Learning Techniques.
4. Implement a simple action recognition system using OpenCV and a pre-trained deep learning model.
5. Use computer vision techniques (e.g., feature tracking, image processing) to compute control commands based on visual feedback.
6. Implement a basic pick and place operation using a robotic simulation environment such as V-REP,Gazebo.

TOTAL: 30

TEXT BOOKS:

1. Groover. M.P., “Industrial Robotics, technology, programming and application”, Mc-Graw Hill, 2012.
2. Peter Corke, “Robotics, Vision and Control: Fundamental Algorithms”, Third Edition, Springer Tracts in Advanced Robotics, 2023.
3. R. Siegwart, I. R. Nourbaksh, and D. Scaramuzza, “Introduction to Autonomous Mobile Robots”, Second Edition, MIT Press, 2011.

REFERENCE BOOKS:

1. S. K. Saha, “Introduction to Robotics”, Tata McGraw-Hill Publishing Company Ltd.,2008.
2. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer-Verlag London Limited 2011.
3. Ramon Pallas-Areny, John G. Webster, “Sensors and Signal Conditioning”, 2nd Edition, Wiley India Pvt. Ltd., India, 2012.

WEBSITES:

1.https://docs.opencv.org/

2.https://www.cim.mcgill.ca/~yiannis/417/2012/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	-	2	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO3	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	-	2	-
CO5	3	3	2	1	2	-	-	-	2	2	-	-	2	-
Avg	**2.8**	**2**	**1.3**	**1**	**2**	-	-	-	**2**	**2**	-	-	**2**	-

1. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

SEMESTER -VII

24BTAD7E46 REINFORCEMENT LEARNING (THEORY & LAB) **4H-3C**

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

End Semester Exam:3 Hours

PRE–REQUISITES: Artificial Intelligence and Machine Learning Techniques

i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand basic exploration methods and the exploration / exploitation trade-off
- Interpret value functions, as a general-purpose tool for optimal decision-making
- Develop dynamic programming as an efficient solution approach to an industrial control problem

COURSE OUTCOMES:

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

- Outline the fundamentals of reinforcement learning (K2)
- Interpret the decision-making process in uncertain environments. (K2)
- Identify the exploration methods and exploitation trade-off in reinforcement learning. (K3)
- Apply reinforcement learning tool for optimal decision-making process. (K3)
- Utilize reinforcement learning in complex real-world applications.
  learning in complex real-world applications. (K3)

UNIT I INTRODUCTION **6**

Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. Probability Primer Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

UNIT II MARKOV DECISION PROCESS **6**

Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

UNIT III PREDICTION AND CONTROL BY DYNAMIC PROGRAMING 6

Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

UNIT IV TD METHODS 6

Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants. Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, After states, Control with function approximation, Least squares, Experience replay in deep Q-Networks.

UNIT V POLICY GRADIENTS 6

Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.

TOTAL :**30**

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Setting Up the RL Environment: Install and configure the necessary libraries and tools.
2. Exploring OpenAI Gym Environments: Understand and interact with different Gym environments. (Hints: OpenAI Gym, Matplotlib)
3. Implement and understand the Q-learning algorithm.
4. Implement and train a Deep Q-Network.
5. Implement and understand policy gradient algorithms.
6. Implement and understand actor-critic algorithms.

Hardware Requirement: Computer with sufficient RAM and CPU/GPU for training RL models.
Software Requirement: Python, Jupyter Notebook, TensorFlow or PyTorch, OpenAI Gym, stable-baselines3.

TOTAL: 30

TEXT BOOKS:

1. Richard S. Sutton and Andrew G. Barto,"Reinforcement Learning: An Introduction", 2nd Edition, MIT Press, 2018
2. Alberto Leon-Garcia, “Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Pearson Education, 2008.

REFERENCES BOOKS:

1. Dimitri P. Bertsekas and John N. Tsitsiklis, " A Course in Reinforcement Learning " Athena Scientific Publisher,5th Edition, 2024
2. Sayon Dutta, Reinforcement Learning with TensorFlow, Packt Publishing, First Edition, 2018.
3. Kevin P. Murphy , "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc20_cs73/preview
2. https://www.cs.toronto.edu/~urtasun/courses/CSC411/tutorial1.pdf
3. https://www.geeksforgeeks.org/

CO, PO, PSO Mapping

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

1. **1 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation**

LIST OF

MANDATORY COURSES

SEMESTER-I

24BTMC151 WOMEN SAFETY AND SECURITY 1H - 0C

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course is for the students to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Infer into the basic concepts related to sex, gender, femininity etc. (K2)
- Demonstrate the rationale for women's studies (K2)
- Compare Gender Equality Issues and Movements in Women's Studies (K2)
- Summarize the Social construction of Gender, Gender Roles and Gender stereotyping. (K2)
- Illustrate Social Structures, Changing Status of Women in India. (K2)

UNIT I FUNDAMENTAL CONCEPTS OF WOMEN'S STUDIES

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

UNIT II SOCIAL EMPOWERMENT

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

UNIT III POLITICAL EMPOWERMENT

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

TEXT BOOKS:

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

24BTMC152 **தமிழர் மரபும் பண்பாடும்** **1H - 0C**

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

End Semester Exam:3 Hours

பாடத்திட்ட பயன்விளைவு

- வரலாற்றிற்கு முற்பட்ட தமிழகத்தை மாணவர்களுக்கு அறிமுகப்படுத்துதல்
- பழந்தமிழர் பண்பாடு சார்ந்த வாழ்க்கை முறையை மாணவர்கள் அறியஊக்குவித்தல்
- தமிழ் மொழியின் பழைமையும், திராவிட மொழிகளில் தமிழ் மொழியின் தனிச்சிறப்பையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
- தமிழர்களின் வாழ்வியல், தமிழர்கலைகள், ஆற்றங்கரைப் பண்பாடுகள் குறித்து மாணவர்கள் அறியச்செய்தல்.
- இந்தியக்குடியுரிமைப் பணி முதலான போட்டித் தேர்வுகளில் விருப்பப்பாடமாக இடம்பெறுகின்ற தமிழ் நாகரிகமும் பண்பாடும் குறித்த முழுமையானஅறிமுகம் பெற்றிருத்தல்

பாடத்திட்டப் பொதுநோக்கம்

- இந்தியக் குடியுரிமைப் பணிமுதலான போட்டித்தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற, ‘ தமிழ்இலக்கியவரலாறு’ குறித்த முழுமையான அறிமுகம்பெற்றிருத்தல். (K2)
- கல்வெட்டியல், ஓலைச் சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத்தேடலுக்குரிய ஆய்வு மனப்பான்மையுடன், இலக்கியங்களை அணுகுதல். (K2)
- தமிழின் வளர்ச்சித்துறையாகிய, ‘அறிவியல் தமிழ்’ ; ‘இணையதமிழ்’ குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச்சிந்தனை மேம்பாடு. (K2)
- வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத் திறன் மேம்பாடும் பெற்றிருத்தல் . (K2)
- சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப் பேணுவதற்குக் கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மை வளர்ச்சி மொழிபெயர்ப்புத் துறைசார்ந்த வேலை வாய்புத்திறன் பெற்றிருத்தல். (K2)

அலகு:1 தமிழர்மரபு

மரபு-விளக்கம்-சங்ககாலதமிழர்மரபு – திணைப்பகுப்பும்தமிழர்மரபும்-உலகப்பொதுமை – அகத்திணைமரபு – புறத்திணைமரபு- இடைக்காலத்தமிழர்மரபு – பிற்காலமரபும்மாற்றமும் – தற்காலதமிழர்மரபு - வளர்ச்சி.

அலகு: 2 தமிழர்பண்பாடு

பண்பாடு – விளக்கம் – பழந்தமிழர்பண்பாடு – இயற்கைசார்ந்தவாழ்வியல் – தமிழர்சமயம் – அரசியல்நிலை–சமூகப்பழக்கவழக்கங்கள் – நம்பிக்கைகள் – வாழ்வியல்அறங்கள் – வணிகம்போன்றவை.

அலகு:3 தமிழர்கலைகள்

தமிழகத்தில்கலைகளின்வளர்ச்சி – சிற்பக்கலைவளர்ச்சி –கோயில்கலை – கற்கோவில்கள் - ஓவியக்கலை – அழகுக்கலைகள் - கூத்துக்கலை – மருத்துவக்கலை – நாடகக்கலை– இசைக்கலைபோன்றவை.

அலகு: 4 தமிழர்சமயம்

பழந்தமிழரின்சமயம் – சங்ககாலசமயம் – தொல்காப்பியத்தில்சமயம் – சைவசமயம் – வைணவம் – தமிழ்ப்பண்பாட்டில்பௌத்தம் – தமிழ்ப்பண்பாட்டில்சமணத்தின்தாக்கம்– தமிழ்ப்பண்பாட்டில் இசுலாம் மற்றும் கிறித்துவ சமயத்தின் தாக்கம்-தமிழர்பண்பாட்டில் விழாக்கள்- கோயில்களும் விழாக்களும்-சமூகஒருங்கிணைப்பில்விழாக்களின்பங்கு-சங்க இலக்கியத்தில் விழாக்கள் பற்றியகுறிப்புகள்-இடைக்கால இலக்கியங்களில் விழாக்கள் பற்றிய செய்திகள் – விழாக்களின் சமூகப்பங்களிப்பு – தற்காலத்தில் தமிழர்விழாக்கள் – விளையாட்டும் விழாக்களும்.

அலகு: 5 இலக்கியங்களில்தமிழர்பண்பாட்டுப்பதிவுகள்

சங்க இலக்கியமும் வாழ்வியலும்-திருக்குறளில் வாழ்வியல் நெறிகள் – இரட்டைக்காப்பியங்களும் வாழ்வியலும் – சிற்றிலக்கியங்களில் வாழ்வியல்பதிவுகள்-இக்கால இலக்கியமும் வாழ்வியலும்.

பார்வைநூல்கள்:

1. தமிழ் இலக்கிய வரலாறு – தமிழண்ணல், மீனாட்சி புத்தகநிலையம்- மதுரை-இரண்டாம்பதிப்பு-ஜூலை – 2000.
2. தமிழர் நாகரிகமும் பண்பாடும், அ. தட்சிணாமூர்த்தி, ஐந்திணைப்பதிப்பகம், சென்னை, திருத்தியபதிப்பு – 2022.
3. தமிழர் வரலாறும் பண்பாடும், நா. வானமாமலை, நியூசெஞ்சுரிபுக்ஹவுஸ், சென்னை, ஆறாம்பதிப்பு - 2007 .
4. தமிழக வரலாறு மக்களும் பண்பாடும், கே.கே. பிள்ளை, உலகத்தமிழராய்ச்சி நிறுவனம், சென்னை.

SEMESTER-II

24BTMC251 YOGA 4H - 2C

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course, is for the students:

- Have knowledge of Physical fitness and exercise management to lead better quality life
- Enable to officiate, supervise various sports events and organize sports events
- Acquire the knowledge of Physical Education, Sports and Yoga and
- Understand the purpose and its development
- Gain knowledge to plan, organize and execute sports events

COURSE OUTCOMES:

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

- Practice physical activities and yoga for strength, flexibility and relaxation. (K3)
- Use techniques for increasing concentration and decreasing anxiety for stronger academic performance. (K3)
- Perform yoga exercises in various combination and forms. (K3)
- Improve personal fitness through participation in sports and yoga activities. (K3)
- Follow sound nutritional practices for maintaining good health and physical performance. (K3)

UNIT I INTRODUCTION TO PHYSICAL FITNESS

Explain importance of physical education - Describe importance of Physical Fitness & Wellness - Explain the components of physical fitness - Demonstrate healthy life style - Prevent health threats by changing life style

UNIT II FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN SPORTS & YOGA

Explain importance of anatomy and physiology - Describe effects of exercise in various body systems - Describe concept of correct posture - Explain corrective measures for posture deformities.

UNIT III YOGA & PRANAYAMA

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

TEXT BOOKS:

1. Ajmer Singh, Modern Trends and Physical Education class 11 & class 12, Kalyani Publication, New Delhi ISBN: 9789327264319.
2. B.K.S. Iyengar, Light on Yoga, Thomson's Publication, New Delhi ISBN: 8172235011 V.K.Sharma, Health and Physical Education, NCERT Books; Class11,12 Saraswati House Publication, New Delhi
3. Acharya Yatendra, Yoga and Stress Management, Fingerprint Publishing ISBN: 938905303X
4. Swami Vivekanand, Patanjali Yoga Sutras, Fingerprint Publishing ISBN 9389567351.
5. Ramdev, Pranayam Rahasya, Patanjali-Divya Prakashan, Haridwar ISBN: 9788189235017
6. Ramdev, Yoga its Philosophy & Practice, Divya Prakashan, Haridwar.

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	2	-	-	-	2	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	2	-	-
CO3	-	-	-	-	-	2	-	2	-	-	-	2	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	2	-	-
CO5	-	-	-	-	-	2	-	2	-	-	-	2	-	-
Avg	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTMC351 **APTITUDE AND REASONING** **1H-0C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

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

COURSE OUTCOMES:

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

- Explain the basics of quantitative ability. (K2)
- Solve questions related to Logaraithm, Permutation and Combinations, Probability, Basic Accountancy, Time, Speed, distance, work, Ratio and area etc. (K3)
- Utilize satisfactory competency in Verbal Reasoning Questions. (K3)
- Solve campus placements aptitude papers covering Quantitative Ability and verbal skills. (K3)
- Apply Quantitative and Verbal reasoning in puzzle-related questions. (K3)

UNIT -I 1.QUANTITATIVE ABILITY (BASIC MATHEMATICS)

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

UNIT II 2.QUANTITATIVE ABILITY (APPLIED & ENGINEERING MATHEMATICS)

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

UNIT III 3.VERBAL - APTITUDE

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

Total :15

TEXTBOOKS

1. A Modern Approach to Verbal & Non-Verbal Reasoning By R S Agarwal
2. Analytical and Logical Reasoning BySijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical Reasoning for CAT and other management entrance tests By Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by AbhijitGuha 4th edition

WEBSITES

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

SEMESTER-IV

24BTMC451 FOUNDATION OF ENTREPRENEURSHIP 1H-0C

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Gain entrepreneurial competence to run the business efficiently. (K2)
- Undertake businesses in the entrepreneurial environment (K2)
- Prepare business plans and undertake feasible projects. (K2)
- Be efficient in launching and develop their business ventures successfully (K2)
- Monitor the business effectively towards growth and development (K2)

UNIT I ENTREPRENEURIAL COMPETENCE

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

UNIT II ENTREPRENEURIAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development

UNIT III BUSINESS PLAN PREPARATION

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

UNIT IV LAUNCHING OF SMALL BUSINESS

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

UNIT V MANAGEMENT OF SMALL BUSINESS

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

Total :15

TEXT BOOKS

1. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.
2. R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.
3. Rajeev Roy ,Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
4. Donald F Kuratko,T.VRao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.

SEMESTER-IV

24BTMC452 ESSENCE OF TRADITIONAL INDIAN KNOWLEDGE AND HERITAGE 1H-0C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course for the students is to

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

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Understand the cultural diversity (K2)
- Infer the need of cultural unity (K2)
- Know the Dravidian culture (K2)
- Realize the power of Indian educational system called gurukul (K2)
- Come to know the concepts of vedic thought (K2)

UNIT I INTRODUCTION TO INDIAN THOUGHT AND CULTURE

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

UNIT II TRADITIONAL KNOWLEDGE SYSTEMS OF INDIA

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

TEXT BOOKS

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

LIST OF
PROJECT WORK

SEMESTER-II

24BTAD291 APPLICATION DEVELOPMENT I **2H-1C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Develop basic programming skills applicable to software development
- Utilize development tools and techniques.
- Validate applications to ensure quality and performance.

COURSE OUTCOMES:

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

- Interpret the principles and components of application development. (K2)
- Apply basic programming techniques to simple applications. (K3)
- Develop functional applications using appropriate development tools and languages (K3)
- Analyze user requirements to meet application solutions. (K4)
- Function applications to ensure security and performance standards. (K4)

Students have to develop applications in the following domains:

1. Artificial Intelligence
2. Data science
3. Machine learning
4. Deep learning
5. Quantum Computing
6. Web application
7. Image Processing
8. Cyber Security
9. Others

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	2	1	1	1	1	2	2	2	2	3
CO2	3	2	1	1	2	1	1	1	1	2	2	2	2	3
CO3	3	2	1	1	2	1	1	1	1	2	2	2	2	3
CO4	3	3	2	1	2	1	1	1	1	2	2	2	2	3
CO5	3	3	2	1	2	1	1	1	1	2	2	2	2	3
Avg	2.8	2.2	1.5	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTAD391 APPLICATION DEVELOPMENT II **2H-1C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Develop basic programming skills applicable to software development
- Utilize development tools and techniques.
- Validate applications to ensure quality and performance.

COURSE OUTCOMES:

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

- Interpret the principles and components of application development. (K2)
- Apply basic programming techniques to simple applications. (K3)
- Develop functional applications using appropriate development tools and languages (K3)
- Analyze user requirements to meet application solutions. (K4)
- Function applications to ensure security and performance standards. (K4)

Students have to develop applications in the following domains:

1. Artificial Intelligence
2. Data science
3. Machine learning
4. Deep learning
5. Quantum Computing
6. Web application
7. Image Processing
8. Cyber Security
9. Others

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	2	1	1	1	1	2	2	2	2	3
CO2	3	2	1	1	2	1	1	1	1	2	2	2	2	3
CO3	3	2	1	1	2	1	1	1	1	2	2	2	2	3
CO4	3	3	2	1	2	1	1	1	1	2	2	2	2	3
CO5	3	3	2	1	2	1	1	1	1	2	2	2	2	3
Avg	2.8	2.2	1.5	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-III

24BTMC392 FIELD PROJECT / INTERNSHIP I **2H-1C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Be self motivated and diligent professional
- Involve new learning, expanded growth or improvement on the job
- Enable the students to develop their engineering skills

COURSE OUTCOMES:

Upon completion, the students will be able to

- Interpret research literature in engineering problem domain. (K2)
- Identify mathematics, science and engineering concepts and modern engineering tools necessary to communicate the identified Study /internship. (K3)
- Apply critical thinking and analytical skills in problem solving. (K3)
- Develop innovative solutions to real world problems. (K3)
- Analyze the diverse engineering disciplines to dynamic projects environment (K4)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	3	2	2	2	2	2	3	3	3	3
CO2	3	2	1	1	3	2	2	2	2	2	3	3	3	3
CO3	3	2	1	1	3	2	2	2	2	2	3	3	3	3
CO4	3	2	1	1	3	2	2	2	2	2	3	3	3	3
CO5	3	3	2	1	3	2	2	2	2	2	3	3	3	3
Avg	**2.8**	**2**	**1.3**	**1**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-IV

24BTAD491 APPLICATION DEVELOPMENT III **2H-1C**

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

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Develop basic programming skills applicable to software development
- Utilize development tools and techniques.
- Validate applications to ensure quality and performance.

COURSE OUTCOMES:

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

- Interpret the principles and components of application development. (K2)
- Apply basic programming techniques to simple applications. (K3)
- Develop functional applications using appropriate development tools and languages (K3)
- Analyze user requirements to meet application solutions. (K4)
- Function applications to ensure security and performance standards. (K4)

Students have to develop applications in the following domains:

1. Artificial Intelligence
2. Data science
3. Machine learning
4. Deep learning
5. Quantum Computing
6. Web application
7. Image Processing
8. Cyber Security
9. Others

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	2	1	1	1	1	2	2	2	2	3
CO2	3	2	1	1	2	1	1	1	1	2	2	2	2	3
CO3	3	2	1	1	2	1	1	1	1	2	2	2	2	3
CO4	3	3	2	1	2	1	1	1	1	2	2	2	2	3
CO5	3	3	2	1	2	1	1	1	1	2	2	2	2	3
Avg	2.8	2.2	1.5	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER V

24BTAD591 **FIELD PROJECT / INTERNSHIP II** **2H-1C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Be self motivated and diligent professional
- Involve new learning, expanded growth or improvement on the job
- Enable the students to develop their engineering skills

COURSE OUTCOMES:

Upon completion, the students will be able to

- Interpret research literature in engineering problem domain. (K2)
- Identify mathematics, science and engineering concepts and modern engineering tools necessary to communicate the identified Study /internship. (K3)
- Apply critical thinking and analytical skills in problem solving. (K3)
- Develop innovative solutions to real world problems. (K3)
- Analyze the diverse engineering disciplines to dynamic projects environment (K4)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	3	2	2	2	2	2	3	3	3	3
CO2	3	2	1	1	3	2	2	2	2	2	3	3	3	3
CO3	3	2	1	1	3	2	2	2	2	2	3	3	3	3
CO4	3	2	1	1	3	2	2	2	2	2	3	3	3	3
CO5	3	3	2	1	3	2	2	2	2	2	3	3	3	3
Avg	**2.8**	**2**	**1.3**	**1**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER VI

24BTAD691 **MINI PROJECT** **2H-1C**

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

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Define the problem of the proposed research.
- Apply the concept of artificial intelligence and data science in solving research problem.
- Demonstrate and validate the result of the chosen problem.

COURSE OUTCOMES:

Upon completion the students will be able to

- Apply practically acquired knowledge within the chosen area of project domain. (K3)
- Identify the technical aspects of a project with comprehensive and systematic approach. (K3)
- Develop effective communication and report writing related to project findings. (K3)
- Examine the principles of project management and finance during the implementation of the project (K4)
- Function as an individual or in a team in development of engineering projects. (K4)

CO, PO PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER VII

24BTAD791 PROJECT WORK PHASE I/ FIELD PROJECT/ INTERNSHIP III 8H-4C

Instruction Hours/week: L:0 T:0 P:8 **Marks:** Internal**:40** External**:60** Total**:100**

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Apply engineering knowledge in practical problem solving.
- Foster innovation in design of products, processes or systems.
- Develop creative thinking in finding viable solutions to engineering problems.

COURSE OUTCOMES:

Upon completion , the students will be able to

- Identify theoretical concepts to solve industrial problems with teamwork and multidisciplinary approach (K3)
- Apply project management skills for planning, scheduling, execution and monitoring. (K3)
- Utilize the techniques, skills and modern tools necessary for the project. (K3)
- Examine research gaps and propose creative solutions (K4)
- Analyze products, processes for sustainable and socially relevant applications (K4)

CO,PO PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER VIII

24BTAD891 PROJECT WORK PHASE II **16H-8C**

Instruction Hours/week: L:0 T:0 P:16 **Marks:** Internal**:80** External**:120** Total**:200**

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Apply engineering knowledge in practical problem solving.
- Foster innovation in design of products, processes or systems.
- Develop creative thinking in finding viable solutions to engineering problems.

COURSE OUTCOMES:

Upon completion , the students will be able to

- Identify theoretical concepts to solve industrial problems with teamwork and multidisciplinary approach (K3)
- Apply project management skills for planning, scheduling, execution and monitoring. (K3)
- Utilize the techniques, skills and modern tools necessary for the project. (K3)
- Examine research gaps and propose creative solutions (K4)
- Analyze products, processes for sustainable and socially relevant applications (K4)

CO,PO PSO MAPPING

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SKILL DEVELOPMENT COURSES

SEMESTER-IV

24BTSD411 SKILL DEVELOPMENT I **2H-1C**

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

End Semester Exam:3 Hours

Students have to undergo skill-oriented courses offered in latest engineering trends from reputed industries

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Acquire experience with tools and platforms related to new technologies.
- Identify technical skills required for developing, implementing and maintaining applications.
- Develop practical solutions to demonstrate the effective use of new technologies.

COURSE OUTCOMES:

Upon completion, the students will be able to

- Interpret proficiency in implementing industry best practices in job-related tasks. (K2)
- Build skills to generate and validate new ideas and drive innovation within startups or existing businesses. (K3)
- Develop the ability to adapt emerging technologies relevant to business and research contexts (K3)
- Utilize research skills necessary for higher studies and research projects. (K3)
- Make use of emerging technologies to solve complex problems. (K3)

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-V

24BTSD511 SKILL DEVELOPMENT II **2H-1C**

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

End Semester Exam:3 Hours

Students have to undergo skill-oriented courses offered in latest engineering trends from reputed industries

PRE- REQUISITES: None

COURSE OBJECTIVES:

The goal of this course for the students is to

- Acquire experience with tools and platforms related to new technologies.
- Identify technical skills required for developing, implementing and maintaining applications.
- Develop practical solutions to demonstrate the effective use of new technologies.

COURSE OUTCOMES:

Upon completion, the students will be able to

- Interpret proficiency in implementing industry best practices in job-related tasks. (K2)
- Build skills to generate and validate new ideas and drive innovation within startups or existing businesses. (K3)
- Develop the ability to adapt emerging technologies relevant to business and research contexts (K3)
- Utilize research skills necessary for higher studies and research projects. (K3)
- Make use of emerging technologies to solve complex problems. (K3)

CO, PO, PSO Mapping

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

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation