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

SYLLABI 2025-2026

(CHOICE BASED CREDIT SYSTEM)

Department of Computer Science and Engineering
(Cyber Security)

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 2025

CHOICE BASED CREDIT SYSTEM

These regulations are effective from the academic year 2025 – 2026 and applicable to the candidates admitted to B. E. / B. Tech programmes. during 2025- 2026 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 SC / ST reserved category) in the above subjects taken together.

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 SC / ST reserved category) in ANY branch of Engineering and Technology are eligible to apply for admission to the third semester of B. E./B. Tech., 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)

(OR)

B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40%

marks in case of candidates belonging to SC / ST 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 ofcandidates 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 SC / ST 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. Computer Science and Business Systems	
10	B. Tech Bio – Technology	
11	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 5th 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. Programme Equivalence Certificate shall be given by the respective Head of the Department of Karpagam Academy of Higher Education, after verifying the credentials.

2. PROGRAMMES OFFERED

A candidate may undergo a programme in any one of the branches of study approved bythe 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. Computer Science and Business Systems
10. B. Tech. Bio-Technology
11. 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 onwards. 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 and register for the course for every semester within the first week of semester.** Maximum number of students to be registered in each course shall be decided by the HoD in consultation with the Dean. 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.

4.6 Value Added Course (VAC / Skill Development Course (SDC)

Besides core courses and elective courses, VAC / SDC are provided. The blend of different courses is so designed that the interested students would be trained for the holistic development to enhance employment opportunity. Upon completion of 30 Practical Hours / 15 Theory hours and evaluation, a student can claim for 1 additional credit.

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 of 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. ofsemesters
B. E./B. Tech. (HSC Candidates)	8	14
B. E./B. Tech. (Lateral Entry Candidates)	6	12

5.2 Each semester shall normally consists 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 least75% 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 74.4% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) shall produce medical certificate and fitness certificate by a Registered Medical Practitioner. 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 in Stamp paper duly signed by the parent and the student.

6.3 Candidates who have not produced / submitted relevant documents for condonation 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. Mentor

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty of the Department who shall function as Mentor for those students throughout their period of study. Such Mentors 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 Mentor may display the cumulative attendance particulars in the Department notice board and also discuss with or inform the Parents/Guardian about the progress of the students. Each student shall be provided with course plan for each course at the beginning of each semester.

8. CLASS COMMITTEE

8.1. 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.

8.2. 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 all the students, 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.

8.3 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 Executive Council, the same shall be brought to the notice of the Registrar/VC by the HoD through Dean.

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

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or one batch of students shall have a "Course Committee" comprising of all the faculty teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department/Dean depending upon whether all the faculty teaching the common course belong to a single department or several departments. The "Course committee" shall meet at least three times and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the assessment test(s). The letter "**G**" is to be mentioned in the course code for the common course.

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 becontinuously 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 seminar 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 end semester evaluation of integrated practical component is for 50 Marks and it is scaled down to 15 Marks. Similarly, the end semester evaluation for integrated theory is 100 Marks and it is scaled down to 45 Marks. Hence, the external evaluation of integrated theory and practical elements accounts for 60 marks.

For the integrated course, the ESE mark distribution is as follows:

Theory	Practical	Total
45 marks	15 Marks	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

10.4.1 Project Work

Final year project work will be normally in-house. However, as a special case, if a student is able to get a project from a government organization or private or public sector company, the student may be permitted to do his/her project work in that institution/research organization/industry.

The evaluation of Project phase I shall be through Continuous Internal assessment mode and Project phase II evaluation shall be through continuous assessments (Three reviews), evaluation of

project thesis report and viva-voce examination. Continuous assessment shall have the weightage of 40%. Evaluation of Project thesis report and viva-voce examination shall have the weightage of 60% each. Break-up of marks is as shown below:

Project Phase I Evaluation:

Continuous Internal Assessment (100 marks)		
Review I	**Review II**	**Review III**
30 marks	30 marks	40 marks

Project Phase II Evaluation:

Continuous Internal Assessment (40 marks)			**ESE (60 marks)**			
			Project Report (30 marks)		**VIVA VOCE (30 marks)**	
Review I	**Review II**	**Review III**	**Supervisors**	**External**	**Internal**	**External**
5 marks	15 marks	20 marks	15 marks	15 marks	15 marks	15 marks

10.4.2 Internships

Students must complete Internship for the duration specified in the program's corresponding curriculum. The industry in which the student intends to undergo internship should be aligned in line with the programme of study. The student must submit a report detailing observations, skills learned, usefulness, etc., together with the attendance certificate granted by the relevant industry after completing the internship or industrial training. A committee made up of three faculty members, appointed by the department head, will review this report. One faculty member will be designated as the coordinator. A student can claim one credit if he/she completes one week of training as per curriculum

Weightage for Assessment for Internship

Report	**Presentation**	**Viva-Voce**
30 Marks	40 Marks	30 Marks

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 5.2) 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, it is scaled down to 60 marks.

12.1 ONLINE EXAMINATIONS

The students who are going for Project / Internship / Coursework at National level are permitted to write their CIA test through Online Mode and ESE in Offline/Online mode. When they go for an International Project / Internship / Coursework, both the CIA and ESE shall be conducted through online mode.

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

13.3 If the candidate fails to secure a pass in 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). The Evaluation for the CIA reappearance is as follows:

Test 1	Test 2	Assignment	Total
15 marks	15 marks	10 marks	40 marks

13.4 CREDIT TRANSFER THROUGH ONLINE PLATFORM / INTERNATIONAL STUDIES

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

Students are encouraged to enroll in courses offered by NPTEL/Swayam/ Swayam Plus 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 & Grade Equivalence Committee comprising the Dean of the Faculty as Chairman, Dean (R&D, Industrial Relations), Head of the Department (HoD) and one faculty member nominated by the Vice Chancellor as members. The committee's decision will be submitted for ratification/approval by the Board of Studies (BoS) and the Academic Council.

13.4.1 Online Courses / Self Study Courses

Students may be permitted to earn credit through online courses (which are provided with certificate) with the approval of Head of the Department and Dean. The credit may be transferred with the due approval for either programme core, elective or open elective course and complete at any time within the duration of the programme before the last semester.

13.4.2 One credit course

One credit elective course shall be offered by the department in collaboration with the industry/research organizations / higher learning institutions. A student shall be permitted to register for the one-credit courses offered by other departments with approval of both the Heads of the departments. A student shall replace a three credit programme elective / open elective course if he / she registered for three one credit courses and appear for the examination of the courses and get qualified in the examination. Three elective courses of 1 credit shall replace a 3-credit elective course as given in Table.

REPLACEMENTS OF ONE CREDIT COURSES

Number of credits earned		**Eligible to replace**	
Core electives	**Interdisciplinary electives**	**PEC**	**OEC**
3	0	1	-
2	1	1	-
1	2	-	1
0	3	-	1

Refer the Annexure I for NPTEL Course Durations and credit Equivalence. The Registration / Application form for Credit Transfer of SWAYAM-NPTEL / MOOC Courses shall be submitted as shown in Annexure I.

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+	61- 70	7	GOOD
B	56-60	6	AVERAGE
C	50-55	5	PASS
RA	Below 50	-	REAPPEARANCE
AAA	-	-	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.

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

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 apply for revaluation of answer scripts for not exceeding 5 subjects at a time. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the Head of the Department and Dean. Revaluation is not permitted for Supplementary Examinations, Practical Examinations, Technical Seminars, In-plant Training and Project Work.

14.4 TRANSPARENCY AND GRIEVANCE COMMITTEE

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

15. ELIGIBILITY FOR AWARD OF DEGREE

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

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

16.1A 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 numberof 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/lateral entrant is eligible to register for B.E. (Honours)/ B.Tech.(Honours), if he/she has passed all the courses in first attempt from first/third semester onwards and holds / maintains a CGPA of 7.5 in III and IV Semester. Prior approval of the concerned Head of the Department and respective Dean for the enrolment into Honours degree before the commencement of V semester is mandatory. A candidate is eligible for the award of BE(Honours) / B.Tech.(Honours), if he/she earns an additional 18 credits by undergoing additional courses over and above the courses prescribed in the respective curriculum. The opted additional courses shall be Emerging / Multidisciplinary /MOOC /NPTEL/Industry courses/KAHE courses which are related to the major discipline of study. All these 18 credits need to be completed in III year and IV year only. However, if he/she fails to secure 18 additional credits but maintains a CGPA of 7.5 and above is not eligible for Honours 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) 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.

These advanced learners can request for an on-demand examination for the courses from IV semester onwards. 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 Executive council of Karpagam Academy of Higher Education.

21. KARPAGAM INNOVATION AND INCUBATION COUNCIL (KIIC)

(A Section 8 Company)

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

21.1 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 setup a startup (or) to work as part 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, their attendance may be accepted by KAHE for 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 provided by the KIIC's attendance report, 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 of 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

S. No.	Description/Startup phases	In place of the Subject / Coursetitle	Grades/Credits /Marks
1	Idea stage/Problem Identification	Seminar/Presentation of concept	Same Marks/ Credits can be awarded thatare listed in the course title's curriculum for the respective startup phases.
2	Proof of Concept (POC) /Solutiondevelopment	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 Projectphase II	

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 university curriculum.

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost,reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES (POS)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering
problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
(WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

i) independent and life-long learning

ii) adaptability to new and emerging technologies

and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs):

I. To perform well in their professional career by acquiring enough knowledge in the domainof Cyber Security.

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

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

PROGRAMME SPECIFIC OUTCOMES(PSOs):

1. Design and develop algorithms to implement secure and efficient computing systems applying mathematical, statistical and core computer science principles by following ethical values to meet societal and industrial needs.
2. Deploy the latest technology tools and cyber security centric skills to enhance research, higher studies and entrepreneurship for keeping digital world safe and secure.

MAPPING:

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

Annexure I

Credit Transfer of Online Courses (SWAYAM / NPTEL)

1. The credit transfer shall be applicable to the students of UG programme from 2022 Batch onwards

The proposed conversion from percentage marks given by (SWAYAM NPTEL) to the corresponding grades shall be as follows: -

NPTEL Course Durations and credit Equivalence		
S. NO	**Course Duration**	**Credit Equivalence for Transfer of Credits**
1	4 Weeks	1 Credit
2	8 Weeks	2 Credit
3	12 Weeks	3 Credit
4	16 Weeks	4 Credit

Type of NPTEL certificate	NPTEL Score	Equivalent Grade (KAHE)	KAHE Score
Elite + Gold	>=90	O	91-100
Elite + Silver	75-89	A+	81-90
Elite	60-74	A	71-80
Successfully completed	40-59	B+	66-70
No certificate	< 40	-	-

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
CYBER SECURITY
FACULTY OF ENGINEERING
UG PROGRAM (CBCS) – B.E –CSE CYBER SECURITY (FULL TIME)
(2025–2026 Batch and onwards)

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
SEMESTER I												
25BEHS101G	Technical English - I	HS	5,7,8,9,11	2	3	0	0	3	40	60	100	1
25BEHS103G	Matrices and Calculus	BS	1,2,3,11	1	3	1	0	4	40	60	100	4
25BECS141G	Programming in C	ES	1,2,3,8,9,11	1	3	0	2	4	40	60	100	6
25BEHS143G	Physics for Computing Engineers	BS	1,2,3,6,8,11	2	3	0	2	4	40	60	100	9
25BEHS144G	Environmental Chemistry	BS	1,2,3,4,6,7,8,11	-	3	0	2	4	40	60	100	12
25BEHS111G	Communication Skills Laboratory	HS	5,7,8,9,11	2	0	0	2	1	40	60	100	15
25BEMC151G	Women Safety and Security*	MC	-	-	1	0	0	0	100	0	100	17
25BEMC152G	தமிழர் மரபும் பண்பாடும் *	MC	-	-	1	0	0	0	100	0	100	19
				Semester Total	**17**	**1**	**8**	**20**	**440**	**360**	**800**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
SEMESTER II												
25BEHS201G	Technical English - II	HS	5,7,8,9,11	2	3	0	0	3	40	60	100	21
25BECY201	Basics of Cyber Security	ES	1,2,3,7,8,9,11	2	3	1	0	4	40	60	100	24
25BEHS202AG/ 25BEHS202BG/ 25BEHS202CG	Graph Theory/ Computational Methods for Engineers/ Transforms and its Applications	BS	1,2,3,11	1	3	1	0	4	40	60	100	26/29 /32

25BECY241G	Web Technology	ES	1,2,3,5,8,9,11	1	3	0	2	4	40	60	100	35
25BECS241G/ 25BTAD241G	Data Structures and Algorithms/ Python Programming	ES	1,2,3,8,9,11/ 1,2,3,4,8,9,11	1/2	3	0	2	4	40	60	100	38/41
25BEEC243G	Digital Logic Circuits	ES	1,2,3,7,8,9,10,11	1	3	0	2	4	40	60	100	44
25BEHS246G	Yoga*	SD	6,7,11	-	1	0	2	2	100	-	100	46
25BEMC251G	Vedic Mathematics*	MC	-	-	1	0	0	0	100	-	100	48
25BECY291	Application Development – I*	PW	1,2,3,4,5,6,7,8,9,10, 11	1,2	0	0	2	1	100	-	100	49
				Semester Total	**20**	**2**	**10**	**26**	**540**	**360**	**900**	

Course Code	**Name of the course**	**Category**	**Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No**
			PO	**PSO**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**	
									40	**60**	**100**	
SEMESTER III												
25BECS301G	Computer Architecture	PC	1,2,3,8,9,11	1	3	0	0	3	40	60	100	50
25BEHS302AG/ 25BEHS302BG	Discrete Mathematics and Stochastic Process/ Numerical Methods	BS	1,2,3,11	1	3	1	0	4	40	60	100	52/55
25BECY341	Principles of Operating Systems	PC	1,2,3,8,9,10,11	2	3	0	2	4	40	60	100	58
25BECS341AG/ 25BECS341BG	Data Structures and Algorithms/ Design and Analysis of Algorithms	PC	1,2,3,8,9,11/ 1,2,3,4,8,9,11	1	3	0	2	4	40	60	100	61/64
25BECS343G	Database Management Systems	PC	1,2,3,8,9,10,11	2	3	0	2	4	40	60	100	67
25BECS344G	Java Programming	PC	1,2,3,8,9,11	2	3	0	2	4	40	60	100	70
25BEMC351G	Aptitude and Reasoning*	MC	-	-	1	0	0	0	100	-	100	73
25BECY391	Application Development- II*	PW	1,2,3,4,5,6,7,8,9,10 ,11	1,2	0	0	2	1	100	-	100	75
25BECY392	Internship – I*	PW	1,2,3,4,5,6,7,8,9,10 ,11	1,2	0	0	2	1	100	-	100	76
				Semester Total	**19**	**1**	**12**	**25**	**540**	**360**	**900**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
SEMESTER IV												
25BECY401	Information Security	PC	1,2,3,6,9,11	2	3	0	0	3	40	60	100	77
25BEHS402AG/ 25BEHS402BG	Statistics and Optimization Techniques/ Probability and Statistics	BS	1,2,3,11	1	3	1	0	4	40	60	100	79/81
25BECY441AG/ 25BECY441BG	Web Application Development/ Low Code Application Development	PC	1,2,3,5,8,9,10,11/ 1,2,3,5,8,9,11	2	3	0	2	4	40	60	100	83/86
25BECS441AG/ 25BECS441BG	Advanced Algorithms /Design and Analysis of Algorithms	PC	1,2,3,4,8,9,11	1	3	0	2	4	40	60	100	89/92
25BECS442G	Computer Networks	PC	1,2,3,8,9,11	2	3	0	2	4	40	60	100	95
25BXXX4E4XXX	Professional Elective-I	PE	-	-	2	0	2	3	40	60	100	132-147
25BECY411	Skill Development – I*	SD	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	2	1	100	-	100	98
25BEMC451G	Foundation of Entrepreneurship*	MC	-	-	1	0	0	0	100	-	100	99
25BEMC452G	Essence of Traditional Indian Knowledge and Heritage*	MC	-	-	1	0	0	0	100	-	100	101
25BECY491	Application Development – III*	PW	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	2	1	100	-	100	102
Semester Total					**19**	**1**	**12**	**24**	**640**	**360**	**1000**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
SEMESTER V												
25BECY501	Automata and Compiler Design	PC	1,2,3,8,9,11	1	3	1	0	4	40	60	100	103

25BECY541	Cryptography and Cyber Security	PC	1,2,3,4,7,8,9,11	2	3	0	2	4	40	60	100	105
25BTAD545G	Artificial Intelligence	PC	1,2,3,4,8,9,11	1	3	0	2	4	40	60	100	108
25BXXX5E4XXX	Professional Elective – II	PE	-	-	2	0	2	3	40	60	100	150-165
25BXXX5E4XXX	Professional Elective –III	PE	-	-	2	0	2	3	40	60	100	168-183
25BECY511	Skill Development-II*	SD	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	2	1	100	-	100	111
25BECY512	Community Engagement and Social Responsibility*	ES	6,7,8,9,10,11	-	1	0	2	2	100	-	100	112
25BECY551	Mobile Application Development*	PW	-	-	1	0	0	0	100	-	100	114
25BECY591	Internship – II*	PW	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	2	1	100	-	100	116
Semester Total					**15**	**1**	**14**	**22**	**600**	**300**	**900**	

Course Code	**Name of the course**	**Category**	**Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No**
			PO	**PSO**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**Total**	
									40	**60**	**100**	
SEMESTER VI												
25BEHS601G	Universal Human Values*	HS	6,7,8,11	-	2	0	0	2	100	-	100	117
25BECY641	Vulnerability Assessment and Penetration Testing	PC	1,2,3,4,5,11	2	3	0	2	4	40	60	100	120
25BECY642	Machine Learning for Cyber Security	PC	1,2,3,4,8,9	2	3	0	2	4	40	60	100	123
25BECY643	Digital and Mobile Forensics	PC	1,2,3,4,8,9	2	3	0	2	4	40	60	100	125
25BXXX6E4XXX	Professional Elective- IV	PE	-		2	0	2	3	40	60	100	186-201
25BXXX6E4XXX	Professional Elective - V	PE	-		2	0	2	3	40	60	100	204-219
25BECY691	Mini Project*	PW	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	2	1	100	-	100	127
Semester Total					**15**	**0**	**12**	**21**	**400**	**300**	**700**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
SEMESTER VII												
25BECY701	Principles of Management and Engineering Ethics	HS	1,2,3,4,9,11	1	3	0	0	3	40	60	100	128
25BXXX7E4XXX	Professional Elective - VI	PE	-		2	0	2	3	40	60	100	222-238
25BECY791	Project Work Phase I/Field Project	PW	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	8	4	40	60	100	130
Semester Total					**5**	**0**	**10**	**10**	**120**	**180**	**300**	

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
SEMESTER VIII												
25BECY891	Project Work Phase- II	PW	1,2,3,4,5,6,7,8,9,10,11	1,2	0	0	16	8	80	120	200	131
Semester Total					**0**	**0**	**16**	**8**	**80**	**120**	**200**	

OPEN ELECTIVE									
Course Details	**Platform**	**Category**		**Credits**	**Online Exam**		**Total**	
Open Elective – I**	MOOC - NPTEL/ SWAYAM/ SWAYAM PLUS	OE		3	100		100	-
Open Elective – II**	MOOC- NPTEL/ SWAYAM/ SWAYAM PLUS	OE		3	100		100	-
Total		**0**	**0**	**0**	**6**	**200**		**200**	**-**
PROGRAM TOTAL		**110**	**6**	**94**	**162**	**3360**	**2540**	**5900**	

***Internal Evaluation Only**
****Refer clause 13.4 in Regulation 2025**

Verticals/ Professional Elective	Vertical I - Artificial Intelligence and Data Science	Vertical II – Next-Gen Computing	Vertical III- Data Privacy And Security	Vertical IV- Cloud Computing and Security	Vertical V- Full Stack Development	Vertical VI - Emerging Technologies
Professional Elective 1	Big Data Analytics	Human Computer Interaction	Ethical Hacking	Distributed and Cloud Computing	MERN Stack Development	Embedded and IOT
Professional Elective 2	Process Mining	Image and Video Analytics	Network Security	IT Infrastructure Services I (IT Networking and Cloud)	Catalyst Product Development	Business Analysis
Professional Elective 3	Deep Learning	Augmented Reality and Virtual Reality	Biometric Security	Integration Platform as Service	MLOps	Advanced Networking and Automation
Professional Elective 4	Natural Language Processing	Generative Artificial Intelligence	Malware Analysis	Social Network Security	Web Application Security	Robotic Process Automation
Professional Elective 5	NoSQL Databases	Quantum Computing	Software Defined Networks	IT Infrastructure Services II	Engineering Secure Software Systems	Game Theory
Professional Elective 6	AI in Edge Computing	3D Printing and Design	Firewall and Intrusion Detection Systems	Cryptocurrency and Blockchain Technologies	Software Testing and Automation	Modern Cryptography

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	ESE	Total	
									40	60	100	
PROFESSIONAL ELECTIVE I												
25BTAD4E41G	Big Data Analytics	PE	1,2,3,4,8,9	1	2	0	2	3	40	60	100	132
25BECY4E42G	Human Computer Interaction	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	135
25BECY4E43G	Ethical Hacking	PE	1,2,3,7,8,9,11	1	2	0	2	3	40	60	100	138
25BTAD4E44G	Distributed and Cloud Computing	PE	1,2,3,8,9,11	1	2	0	2	3	40	60	100	141
25BECY4E45G	MERN Stack Development	PE	1,2,3,8,9,10,11	2	2	0	2	3	40	60	100	144
25BEEC4E46	Embedded Systems and IOT	PE	1,2,3,4,5,9,11,1	1	2	0	2	3	40	60	100	147

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	PO	PSO	
									40	60	100	
PROFESSIONAL ELECTIVE II												
25BECS5E41G	Process Mining	PE	1,2,3,4,8,9,11	2	2	0	2	3	40	60	100	150
25BTAD5E42G	Image and Video Analytics	PE	1,2,3,8,9	2	2	0	2	3	40	60	100	153
25BECY5E43	Network Security	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	156
25BECS5E44G	IT Infrastructure Services I (IT Networking and Cloud)	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	159
25BECY5E45G	Catalyst Product Development	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	162
25BECS5E46G	Business Analysis	PE	1,2,3,4,5,8,9,11	2	2	0	2	3	40	60	100	165

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	PO	PSO	
									40	60	100	
PROFESSIONAL ELECTIVE III												
25BTAD5E47G	Deep Learning	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	168
25BTAD5E48G	Augmented Reality and Virtual Reality	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	171
25BECY5E49	Biometric Security	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	174
25BTAD5E410G	Integration Platform as Service	PE	1,2,3,8,9,11	1	2	0	2	3	40	60	100	177
25BECY5E411	MLOps	PE	1,2,3,4,5,8,9	1	2	0	2	3	40	60	100	180
25BECS5E412G	Advanced Networking and Automation	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	183

Course Code	Name of the course	Category	Outcomes		Instruction hours/week			Credits	Maximum Marks			Page No
			PO	PSO	L	T	P	C	CIA	PO	PSO	
									40	60	100	
PROFESSIONAL ELECTIVE IV												

25BTAD6E41G	Natural Language Processing	PE	1,2,3,8,9,11	1	2	0	2	3	40	60	100	186
25BTAD6E42G	Generative Artificial Intelligence	PE	1,2,3,4,5,8,9	1	2	0	2	3	40	60	100	189
25BECY6E43G	Malware Analysis	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	192
25BECY6E44G	Social Network Security	PE	1,2,3,4,8,9,11	2	2	0	2	3	40	60	100	195
25BECY6E45G	Web Application Security	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	198
25BTAD6E46G	Robotic Process Automation	PE	1,2,3,4,5,8,9	1	2	0	2	3	40	60	100	201

Course Code	**Name of the course**	**Category**	**Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No**
			PO	**PSO**	**L**	**T**	**P**	**C**	**CIA**	**PO**	**PSO**	
									40	**60**	**100**	
PROFESSIONAL ELECTIVE V												
25BTAD6E47G	NoSQL Databases	PE	1,2,3,5,8,9,11	1	2	0	2	3	40	60	100	204
25BECY6E48G	Quantum Computing	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	207
25BECY6E49	Software Defined Networks	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	210
25BECS6E410G	IT Infrastructure Services II	PE	1,2,3,4,8,9,11	2	2	0	2	3	40	60	100	213
25BECY6E411G	Engineering Secure Software Systems	PE	1,2,3,8,9,11	1	2	0	2	3	40	60	100	216
25BECS6E412G	Game Theory	PE	1,2,3,4,8,9,11	2	2	0	2	3	40	60	100	219

Course Code	**Name of the course**	**Category**	**Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No**
			PO	**PSO**	**L**	**T**	**P**	**C**	**CIA**	**PO**	**PSO**	
									40	**60**	**100**	
PROFESSIONAL ELECTIVE VI												
25BTAD7E41G	AI in Edge Computing	PE	1,2,3,4,8,9	2	2	0	2	3	40	60	100	222
25BECS7E42G	3D Printing and Design	PE	1,2,3,4,8,9,11	2	2	0	2	3	40	60	100	225
25BECY7E43	Firewall and Intrusion Detection Systems	PE	1,2,3,8,9,11	1	2	0	2	3	40	60	100	228

25BECY7E44G	Cryptocurrency and Blockchain Technologies	PE	1,2,3,4,8,9,11	1	2	0	2	3	40	60	100	232
25BECY7E45	Software Testing and Automation	PE	1,2,3,8,9,11	2	2	0	2	3	40	60	100	235
25BECY7E46G	Modern Cryptography	PE	1,2,3,4,8,9,11	2	2	0	2	3	40	60	100	238

Credit Distribution:

S. No.	Course Category	Credit Distribution	Percentage
1	Basic Science	24	14.8
2	Engineering Science	22	13.6
3	Humanities and Science	12	7.4
4	Professional Core	58	35.8
5	Professional Elective	18	11.1
6	Open Elective	06	3.7
7	Skill Development	04	2.5
8	Project Work	18	11.1
9	Mandatory Course	0	0
	Total	162	100

Courses Offered to Other Departments:

S. No.	Course Code	Course Name	Department Offered
1	25BECY241G	Web Technology	AI&DS
2	25BECY441AG	Web Application Development	AI&DS
3	25BECY4E46G	Human Computer Interaction	CSE
4	25BECY5E42G	Catalyst Product Development	CSE
5	25BECY5E410G, 25BECY5E48G	Ethical Hacking	CSE, AI&DS
6	25BECY6E48G, 25BECY7E41G	MERN Stack Development	CSE, AI&DS
7	25BECY6E42G	Data Security and Access Control	AI&DS
8	25BECY6E412G, 25BECY7E44G	Quantum Computing	CSE, AI&DS
9	25BECY7E44G	Social Network Security	CSE
10	25BECY6E44G	Malware Analysis	CSE
11	25BECY6E42G	Web Application Security	CSE
12	25BECY4E44G	Engineering Secure Software Systems	CSE
13	25BECY4E45G	Cryptocurrency And Blockchain Technologies	CSE
14	25BECY6E410G	Modern Cryptography	CSE

B.E. CSE (CYBER SECURITY) **2025-2026**

SEMESTER-I

25BEHS101G **TECHNICAL ENGLISH-I (THEORY)** **3H-3C**

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

End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is:

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

COURSE OUTCOMES:

Upon completion of this course, the 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 documents 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**

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

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 question.

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.

WEB REFERENCES:

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	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

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

End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students:

- To provide sufficient knowledge in calculus and matrix algebra in the respective fields.
- To find an extremum value for a function of several variables subject to a given constraint.
- To provide knowledge in evaluating double and triple integrals
- To 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.
4. Grewal, B. S., Higher engineering mathematics. 2018, Khanna Publishers, New Delhi.

WEB REFERENCES:

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:

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

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

B.E CSE (CYBER SECURITY) **2025-2026**

25BECS141G **SEMESTER-I**

PROGRAMMING IN C **5H-4C**

(THEORY & LABORATORY)

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:

- Understand problem solving using C
- Learn the arrays, strings and functions of C Language
- Develop C Programs using structures, unions and file handling

COURSE OUTCOMES:

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

- Interpret problem solving aspect using C programming **K2**
- Construct solutions for computational problems by utilizing C constructs to ensure optimized performance and accuracy in program development. **K3**
- Develop applications in C using functions and file handling **K3**
- Make use of pointers, structures, unions and arrays in C **K3**
- Solve the real-world problems using programming logics in C **K3**

UNIT I INTRODUCTION **9**

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

UNIT II ARRAYS AND STRINGS **9**

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

UNIT III FUNCTIONS **9**

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

UNIT IV POINTERS **9**

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

UNIT V USER DEFINED TYPES AND FILE HANDLING **9**

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

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Create a program using operators and expressions in C.
2. Implement programs using arrays in C.
3. Develop programs to perform sort operations in C.
4. Write programs using functions and storage classes in C.
5. Create programs using pointers and function pointers in C.
6. Develop programs using structures and unions in C.
7. Construct programs using file handling and preprocessor directives in C.

TOTAL: 30

TEXT BOOKS:

1. Brian Kernighan and Dennis Ritchie, “The C Programming Language”, 2nd Edition, Pearson, 2017.
2. Behrouz A. Forouzan, Richard F.Gilberg, “Computer Science: A Structured Programming Approach Using C”, 3rd Edition, CENGAGE, 2022.

REFERENCES:

1. Reema Thareja, “Programming in C”, AICTE Edition, Oxford University Press, 2019.
2. Balagurusamy, “Programming in ANSI C”, 8th Edition, Mc Graw Hill Education, 2019.
3. Yashwant Kanetkar, “Let Us C”, 17th Edition, BPB Publications, 2020.
4. Herbert Schildt, “C: The Complete Reference”, 4th Edition, Mc Graw Hill Education, 2019.

WEB REFERENCES:

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. https://onlinecourses.nptel.ac.in/noc24_cs02/preview

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**	**-**

25BEHS143G **SEMESTER-I**

PHYSICS FOR COMPUTING ENGINEERS (THEORY & LABORATORY) **5H-4C**

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

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is to:

- Instill 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
- Understand the nano materials and its applications

COURSE OUTCOMES:

Upon completion of this course, the 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**
- Apply the performance of light and laser in 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 - 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 NANO MATERIALS 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+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. 2nd 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:

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

WEB REFERENCES:

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

(ii) LABORATORY:

LIST OF EXPERIMENTS – PHYSICS

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.

CO, PO, PSO Mapping:

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	1	-	2	-	-	1	-	1
CO2	3	2	-	-	-	1	-	2	-	-	1	-	1
CO3	3	2	-	-	-	1	-	2	-	-	1	-	1
CO4	3	2	1	-	-	1	-	2	-	-	1	-	1
CO5	2	2		-	-	1	-	2	-	-	1	-	1
Avg	**2.6**	**1.6**	**1.0**	**-**	**-**	**1.0**	-	**2**	-	**-**	**1.0**	**-**	**1.0**

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

25BEHS144G **SEMESTER-I**

ENVIRONMENTAL CHEMISTRY (THEORY & LABORATORY) **5H-4C**

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

End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is 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, the student will be able to:

- Identify the problems associated with water and appropriate technologies **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 – Surfacewater treatment-Water quality parameters-Alkalinity-Typesof alkalinities and determination- Hardness-Types and estimation by EDTA method-Boiler feedwater-Requirements- Disadvantages of using hard water in boilers - Internal conditioning(Phosphate,CalgonandCarbonateconditioning 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+30

TEXT BOOKS:

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

REFERENCE BOOKS:

1. C. N. Banwell, (2001) Fundamentals of Molecular Spectroscopy, McGraw-Hill.
2. 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.

WEB REFERENCES:

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

(ii) LABORATORY

LIST OF EXPERIMENTS – CHEMISTRY

1. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixture using volumetric titration
2. Determination of Ca/Mg using complex microtitration
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. pHMetry – Determination of Acid/Base
7. Potentiometry- Estimation of iron content in a water sample.

CO, PO, PSO Mapping:

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

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

25BEHS111G **SEMESTER-I**

COMMUNICATION SKILLS LABORATORY (LABORATORY) **2H-1C**

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

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is:

- 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
- To 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
- To apply the communicative competence of learners in listening, speaking, reading and writing

COURSE OUTCOMES:

Learners 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

TOTAL: 30

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

25BEMC151G **SEMESTER-I**

WOMEN SAFETY AND SECURITY **1H-0C**

Instruction Hours/week: L:1 T:0 P:0 **Marks: Internal:100 External:- TOTAL:100**

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to

- Make aware about the practical issues concerning gender and politics.
- Acquaint knowledge about the national policies and programmes and the gendered structures of governance and polity
- Observe the liability of women and women's work in the context of globalization.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

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

UNIT I FUNDAMENTAL CONCEPTS OF WOMEN'S STUDIES **5**

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 **5**

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 **5**

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.

25BEMC152G தமிழர் மரபும் பண்பாடும் 1H-0C

Instruction Hours/week: L:1 T:0 P:0 Marks: Internal:100 External:- TOTAL:100
End Semester Exam:3 Hours

பாடத்திட்ட பயன் விளைவு:

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

பாடத்திட்டப் பொதுநோக்கம்:

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

அலகு:1 தமிழர் மரபு

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

அலகு: 2 தமிழர் பண்பாடு

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

அலகு:3 தமிழர் கலைகள்

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

அலகு: 4 தமிழர் சமயம்

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

அலகு: 5 இலக்கியங்களில் தமிழர் பண்பாட்டுப் பதிவுகள்

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

TOTAL: 15

பார்வைநூல்கள்:

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

25BEHS201G **SEMESTER-II**

TECHNICAL ENGLISH – II **3H-3C**

(THEORY)

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

End Semester Exam: 3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course is;

- To acquire the context of grammar and the importance of Listening, Speaking, Reading and Writing
- To understand and develop critical Listening, Speaking, Reading, and Writing skills
- To apply students' capability to listen vigilantly, read proficiently, innovative writing, and speak fluently

COURSE OUTCOMES

Upon completion of this course, the 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**

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

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.

WEBSITE URLs:

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

CO, PO, PSO Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

25BECY201 BASICS OF CYBER SECURITY (THEORY) 4H-4C

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

End Semester Exam:3 Hours

(i) THEORY

PRE REQUISITES: Nil

COURSE OBJECTIVES:

The goal of this course is for the students to

- Understand the fundamental concepts of cyber-crime.
- Aware of tools used in the cyber security.
- Familiarize with various Indian IT Act in cyber-crime and cyber security

COURSE OUTCOMES:

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

- Explain the basic concepts of cyber crime and its perspectives. **K2**
- Identify cybercriminal activities and their security implications. **K3**
- Demonstrate the types of attacks in cyber security. **K2**
- Interpret the Indian IT Act and its amendments. **K2**
- Apply the organizational implications of cyber security. **K3**

UNIT I INTRODUCTION TO CYBER CRIME 9

Cyber Crime and Information Security - Classification of Cyber Criminals - Cyber Crime Legal perspective and Indian Perspective - Cyber Crime and Indian ITA - A Global Perspective on Cyber Crimes - Categories of Cyber Crimes - Criminal plans for attack - Social Engineering - Cyber Stalking - Cyber café and cyber criminals – Botnet - Attack vector - Cloud computing.

UNIT II CYBER CRIME CHALLENGES AND COUNTER MEASURES 9

Proliferation - Trends in Mobility - Credit card frauds - Security challenges - Registry setting - Authentication service – Attacks - Security Implication for Organization - Organizational measures - Organizational Securities Policies - Physical Security counter measures

UNIT III ATTACKS IN CYBER SECURITY 9

Proxy servers and anonymizers – Phishing - Password Cracking - Keyloggers and spywares - Virus and worms -Trojan horse – Steganography - DoS and DDoS attack - SQL Injection - Buffer Overflow - Attacks on wireless networks - Phishing and Identity Theft

UNIT IV IT ACT 9

Cyber Crime and Legal landscape-Indian IT Act - Digital Signature and Indian IT Act - Amendments to the Indian IT Act - Cybercrime and punishment. Understanding Computer

Forensics: Need for computer forensics - Computer forensics and steganography - Computer forensics from compliance perspective – Challenges

UNIT V CYBER SECURITY ORGANIZATIONAL IMPLICATIONS 9

Special tools and techniques: Hand held devices and digital forensics. Cost of cyber crimes and IPR - Web threats for organizations - Security and privacy implications - Social media marketing - Incident handling - Forensics best practices for organization.

TOTAL: 45+15

TEXT BOOKS:

1.Introduction to Cyber Security,Guide to the world by Anand Shinde, Wiley Publisher, 2021

REFERENCES:

1. Harish Chander, "Cyber Laws and IT protection", First Edition, PHI Learning, 2012.
2. James Graham, Ryan Olson and Rick Howard, "Cyber Security Essentials", First Edition, CRC Press, 2010.

WEB REFERENCES:

1. www.lexology.com/library/
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/

CO, PO, PSO Mapping:

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

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

25BEHS202AG **SEMESTER-II**

GRAPH THEORY (THEORY) **4H-4C**

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

End Semester Exam: 3 Hours

(i) THEORY

Pre-Requisites: Matrices and Calculus

COURSE OBJECTIVES:

The goal of this course is for the students;

- To provide the basic concepts of graphs
- To impart the knowledge of trees and its properties.
- To afford the adequate knowledge on matrix representation of graphs, coloring and dominating sets.
- To 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 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.
4. J. P. Tremblay, R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, India, 1st Edition,1997

WEB REFERENCES:

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:

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

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

25BEHS202BG **SEMESTER-II**

COMPUTATIONAL METHODS FOR ENGINEERS (THEORY) **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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students:

- To provide the knowledge of Vector differentiation and Integration.
- To inculcate the concepts of Number Theory.
- To introduce the concepts of graphs and algorithms on spanning trees.
- To afford adequate knowledge of Linear Programming Problems.

COURSE OUTCOMES:

Upon completion of this course, the student 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**

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

UNIT V LINEAR PROGRAMMING PROBLEM **12**

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

TOTAL: 45+15

TEXT BOOKS:

1. Jonathan L. Gross, Jay Yellen, Mark Anderson, "Graph Theory and Its Applications", 3rd Edition, Chapman and Hall, 2023.
2. Satyabrota Kundu, SupriyoMazumder, "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.

WEB REFERENCES:

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:

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

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

25BEHS202CG **SEMESTER-II**

TRANSFORMS AND ITS APPLICATIONS (THEORY) **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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students:

- To understand the concept of periodic functions and represent it as Fourier series.
- To provide knowledge of Fourier series techniques in solving heat flow problems and wave equations.
- To acquaint Fourier transforms techniques used in various applications.
- To 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**

Fourier 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: 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.

WEB REFERENCES:

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:

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

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

SEMESTER-II

25BECY241G WEB TECHNOLOGY 5H-4C

(THEORY & LABORATORY)

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 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.

REFERENCES:

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.

WEB REFERENCES:

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	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	**2.6**	**1.6**	**1**	**-**	**1**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

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

SEMESTER-II

25BECS241G DATA STRUCTURES AND ALGORITHMS (THEORY & LABORATORY) 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: Programming in C

(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. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2019.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", 4th Edition, MIT Press, 2022.

REFERENCES:

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

WEB REFERENCES:

1. https://nptel.ac.in/courses/106102064
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	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-II

25BTAD241G PYTHON PROGRAMMING (THEORY & LABORATORY) 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, the student 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.

REFERENCES:

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.

WEB REFERENCES:

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	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-II

25BEEC243G DIGITAL LOGIC CIRCUITS (THEORY & LABORATORY) 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 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. **K3**

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.

REFERENCES:

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

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

25BEHS246G **YOGA** **3H-2C**

Instruction Hours/week: L:1 T:0 P:2 **Marks: Internal:100 External: - TOTAL:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES:

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

- Understand the concepts of Yoga and Physical Health
- Provide value education to improve the students character, understanding greatness of life force and Mind.
- Learning introspection practices like analysis of Thought, Moralization of Desires, Neutralization of Anger and Eradication of Worries

COURSE OUTCOMES:

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

- Practice physical activities and yoga for strength, flexibility and relaxation. **K1**
- 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. **K4**
- Follow sound nutritional practices for maintaining good health and physical performance. **K4**

UNIT I INTRODUCTION TO PHYSICAL FITNESS **15**

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 **15**

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 **15**

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

TOTAL: 45

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

3. V.K.Sharma, Health and Physical Education, NCERT Books; Class11,12 Saraswati House Publication, New Delhi
4. Acharya Yatendra, Yoga and Stress Management, Fingerprint Publishing ISBN: 938905303X
5. Swami Vivekanand, Patanjali Yoga Sutras, Fingerprint Publishing ISBN 9389567351.
6. Ramdev, Pranayam Rahasya, Patanjali-Divya Prakashan, Haridwar ISBN: 9788189235017
7. Ramdev, Yoga its Philosophy & Practice, Divya Prakashan, Haridwar.

CO, PO, PSO Mapping:

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

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

SEMESTER-II

25BEMC251G VEDIC MATHEMATICS 1H-0C

Instruction Hours/week: L:1 T:0 P:0 **Marks: Internal:100 External:- TOTAL:100**

End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is;

- To overcome the fear of maths, acquire knowledge in Logical thinking, increase concentration and improve critical thinking.
- To build the skill to perform basic math fast and accurately with confidence.
- To enhance computation skills through Vedic Mathematics

COURSE OUTCOMES:

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

- Apply Vedic sutras for arithmetic computation. **K3**
- Utilize UrdhvaTiryagbhyam for solving complex multiplication problems. **K3**
- Make use of Vedic division method for basic word problems. **K3**

UNIT I **5**

Application of vedic sutras, Arithmetic computation, Shudh method for a list of number, Rapid Addition- Single to Double-Digit, Subtraction using Nikliam 3 Digit

UNIT II **5**

Multiplication by Thumb Rule, Multiplication Vertically and cross wise, Urdhvatiryagbhyam, Anurupyena

UNIT III **5**

Squaring numbers, Traditonal Division, Straight Division, Facts of Division, Basic Word Problems.

TOTAL: 15

REFERENCES:

1. Jagadguru swami sri Bharathi krsnatirthaji maharaja,"Vedic Mathematics", International Bestseller, New RevisedEdition.
2. Sri Bharati Krsna Tirthaji, "Vedic Mathematics", published by Motilal Banarsidass, 1965.
3. Williams K.R. "Discover Vedic Mathematics." Vedic Mathematics Research Group, 1984.
4. Rajesh Kumar Thakur, "Advanced Vedic Mathematics", Rupa Publications India Pvt. Ltd 2019.

WEB REFERENCES:

1. www.nptel.ac.in/courses/111101080
2. www.https://vedicmathworld.com/

SEMESTER-II

25BECY291 APPLICATION DEVELOPMENT- I 2H-1C

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

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

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

SEMESTER-III

25BECS301G COMPUTER ARCHITECTURE (THEORY) 3H-3C

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

End Semester Exam:3 Hours

PREREQUISITES: Digital Logic Circuits

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for students is to:

- Be familiar with fundamentals of computer system
- Understand the concepts of RISC, CISC instructions and pipelining
- Learn binary arithmetic operations and memory management systems

COURSE OUTCOMES:

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

- Infer the instruction sets and memory operations to understand the fundamentals of computer **K2**
- Interpret the basic organization, design, and specification of computer operations **K2**
- Solve the design issues related to clock periods, performance, and instruction throughput for processors to optimize the processing efficiency **K3**
- Develop an arithmetic processing unit with pipelining and memory management to enhance computational capabilities and system performance **K3**
- Make use of memory hierarchy design and performance improvement techniques for sophisticated computer architecture **K3**

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Functional units – Basic operational concepts – Number representation and arithmetic and operations – Character representation – Performance – Historical perspective – The assembly process – Linker – Compiler – Debugger –Operating System.

UNIT II ARITHMETIC FOR COMPUTERS 9

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of unsigned numbers –Multiplication of signed numbers – Fast Multiplication – Integer division – Floating point numbers and operations.

UNIT III BASIC PROCESSING UNIT AND PIPELINING 9

Basic Processing units – Fundamentals concepts –Instruction execution – Hardware components – Instruction fetch and execution steps – Control Signals – Hardware Control – CISC instruction

sets – RISC and CISC styles – processors – Basic concepts of Pipelining – Pipeline Organization – Pipelining issues – Data Dependencies – Pipelining in CISC Processor.

UNIT IV MEMORY AND I/O **9**

Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Stacks-Subroutines – Additional instructions – Dealing with 32 – Bit immediate values –Memory System – Basic concepts – Semiconductor Ram memories – Direct memory access – Memory hierarchy –Cache memories –Virtual Memory – Memory Management requirements – Secondary storage.

UNIT V ADVANCED COMPUTER ARCHITECTURE **9**

RAID architecture – Storage systems – Parallel processing – Hardware multithreading – Vector (SIMD) processing –Shared-Memory multiprocessors – Cache coherence– Message-passing multicomputer – Introduction to Graphics Processing Units – Clusters and Warehouse scale computers – Introduction to Multiprocessor network topologies.

TOTAL: 45

TEXT BOOKS:

1. Jim Ledin, "Modern Computer Architecture and Organization - Learn x86, ARM, and RISC-Architectures and the design of smartphones, PCs, and cloud servers", 2nd Edition, Kindle, 2022.
2. Smruti R Sarangi, "Advanced Computer Architecture", 1st Edition, McGraw Hill Education, 2021.

REFERENCES:

1. David A Patterson and John L Hennessy, "Computer Organization and Design: The Hardware /Software Interface, 6th Edition, Morgan Kaufmann Publishers In, 2020.
2. John Aravindhar D, Veena S and Mohandas R, "Computer Architecture and Organization", 1st Edition, Notion Press, 2022.

WEB REFERENCES:

1. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
2. www.https://onlinecourses.nptel.ac.in/noc23_cs67/preview
3. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	2	2	-
CO2	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	-	2	2	-
AVG	**2.6**	**1.8**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**	**2**	**-**

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

DISCRETE MATHEMATICS AND STOCHASTIC PROCESS (THEORY) **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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students:

- To inculcate the concepts of Number theory.
- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To synthesize methods of solving problems in summation of series and recurrence relations.
- To introduce the concept of Theoretical Distributions 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,5t Edition, Pearson New International Edition,2019.
2. Kenneth H. Rosen and Dr. Kamala Krithivasan, "Discrete Mathematics an Applications",8th Edition, Mcgraw Hill, Education,2021.
3. Roy D Yates and David J Goodman, "Probability and Stochastic processes",3rd Editior Wiley India Pvt Ltd,2021.

REFERENCE BOOKS:

1. Kenneth H Rosen, "Discrete Mathematics and its Applications with Combinatorics an Graph Theory",7th Revised Edition, Tata McGraw – HillPub Co Ltd,2017.
2. Randolph Nelson, "A Brief Journey in Discrete Mathematics", Springer Nature Switzerlan AG; 1st Edition, 2020.
3. Oscar Levin, "Discrete Mathematics: An Open introduction",3rd Edition, Createspac Independent Pub,2019.
4. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5t Edition, Pearson Education Asia, Delhi, 2013

WEB REFERENCES:

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

CO,PO,PSO Mapping:

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

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

SEMESTER-III

25BEHS302BG	**NUMERICAL METHODS (THEORY)**	**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 application

COURSE OBJECTIVES:

The goal of this course is for students:

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

UNIT I SOLUTION OF EQUATIONS **12**

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

UNIT II INTERPOLATION **12**

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

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION **12**

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

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **12**

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

UNIT V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

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

TOTAL:45+15

TEXT BOOKS:

1. Steven C.Chapra, Raymond P.Canale, Numerical Methods for Engineers,8th Edition , 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.

WEB REFERENCES:

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-6.html

CO, PO, PSO Mapping:

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

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

SEMESTER-III

25BECY341 PRINCIPLES OF OPERATING SYSTEMS 5H-4C
(THEORY & LABORATORY)

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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for students is to:

- Acquire knowledge about the functions, structure, and system calls of Operating Systems
- Understand the access control models, security policies and protection mechanisms in Operating systems
- Demonstrate the functioning of various operating system services and security aspects in UNIX and in Windows

COURSE OUTCOMES:

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

- Explain the basic concepts of operating systems and its structure, processes, threads **K2**
- Apply memory management strategies and CPU scheduling methods for process management. **K2**
- Utilize specific techniques and algorithms to address synchronization and deadlock issues. **K3**
- Apply disk management techniques for file systems **K3**
- Compare the security implementations of Windows and UNIX operating systems **K2**

UNIT I INTRODUCTION 9

Computer System – Elements and organization; Operating System Overview – Objectives and Functions – Evolution of Operating System; Operating System Structures – Operating System Services – User Operating System Interface – System Calls – System Programs – Design and Implementation – Structuring methods.

UNIT II PROCESS MANAGEMENT 9

Process Concept – Process Scheduling – Operation on Processes, Inter-process Communication – Threads – Overview – Multithreading models – Threading issues – CPU Scheduling – Scheduling criteria, Scheduling algorithms; Process Synchronization – critical-section problem, Synchronization hardware, Mutex locks, Semaphores. Deadlock – Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Detection, Recovery

UNIT III MEMORY MANAGEMENT AND FILE SYSTEMS 9

Main Memory – Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table – Segmentation, Segmentation with paging; Virtual Memory – Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing.

UNIT IV STORAGE MANAGEMENT **9**

Mass Storage system – Disk Structure – Disk Scheduling and Management; File-System Interface – File concept – Access methods – Directory Structure – Directory organization – File system mounting – File Sharing and Protection; File System Implementation – File System Structure – Directory implementation Allocation Methods – Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V PROTECTION AND SECURITY **9**

Principles of Protection – Domain of Protection – Access Matrix – Implementation of the Access Matrix – Access Control – Revocation of Access Rights – Capability – Based Systems – Language – Based Protection – The Security Problem – Program Threats – System and Network Threats – Cryptography as a Security Tool – User Authentication – Implementing Security Defenses – Firewalling to Protect Systems and Networks – Computer -Security – Classifications - An Example: Windows 7

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Basics of UNIX commands, Understand and practice Linux permissions, special permissions and authentication (various options of chmod, setuid, setgid)
2. Implementation of System calls of UNIX operating system (fork, exec, getpid, exit, wait, close, stat, opendir, readdir)
3. Implementation of Semaphores
4. Implementation of Shared memory
5. Implementation of Bankers Algorithm for Deadlock Avoidance
6. Develop programs to demonstrate the Memory Allocation Methods for fixed partition
    a) First Fit
    b) Worst Fit
    c) Best Fit
7. Implementation of the following Page Replacement Algorithms
    a) FIFO
    b) LRU
    c) LFU

TOTAL: 30

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10th edition, John Wiley & Sons, Inc., 2021.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New
3. Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.

2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition,Prentice Hall, 2018.
3. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

WEB REFERENCES:

1. https://www.coursera.org/learn/cybersecurity-roles-processes-operating-system-security
2. https://www.javatpoint.com/operating-system-security
3. https://www.udemy.com/course/cyber-security-os-security

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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-III

25BECS341AG DATA STRUCTURES AND ALGORITHMS (THEORY & LABORATORY) 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: Programming in C

(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. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2019.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", 4th Edition, MIT Press, 2022.

REFERENCES:

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

WEB REFERENCES:

1. https://nptel.ac.in/courses/106102064
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	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

25BECS341BG DESIGN AND ANALYSIS OF ALGORITHMS 5H-4C
(THEORY & LABORATORY)

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 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 student 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 AVG 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 a 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 a solution for the 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.

REFERENCES:

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

4. Algorithms: Design and Analysis Oxford higher education, Harsh Bhasin, Oxford University, 2015.

WEB REFERENCES:

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	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

25BECS343G DATABASE MANAGEMENT SYSTEMS (THEORY & LABORATORY) 5H-4C

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

End Semester Exam:3 Hours

PREREQUISITES: NIL

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for 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 student will be able to:

- Illustrate the fundamental principles of database management systems and sketch an ER model for a real-world context **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**
- Interpret the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes and security schemes **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.

TOTAL: 30

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, A press 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.

WEB REFERENCES:

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	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-III

25BECS344G JAVA PROGRAMMING 5H-4C

(THEORY & LABORATORY)

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

End Semester Exam:3 Hours

PREREQUISITES: C Programming

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for 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 student 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 and lambda expressions 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.

REFERENCES:

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.

WEB REFERENCES:

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	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

25BEMC351G **SEMESTER-III**

APTITUDE AND REASONING **1H - 0C**

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:100 External:-TOTAL:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students 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.
- Understand and solve logical reasoning questions and clear competitive exams.

COURSE OUTCOMES:

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

- Understand the basic concepts of quantitative ability
- Understand the basic concepts of logical reasoning Skills
- Acquire satisfactory competency in the use of reasoning
- Solve campus placements aptitude papers covering Quantitative Ability, Logical
- Gaun Reasoning Ability Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

UNIT - I 1. Quantitative Ability (Basic Mathematics) **5**

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) **5**

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 **5**

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

Textbooks:

1. A Modern Approach to Verbal & Non-Verbal Reasoning By R S Agarwal
2. Analytical and Logical Reasoning By Sijwali 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 Abhijit Guha 4th edition

WEB REFERENCES:

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

Instruction Hours/week: L:0 T:0 P:2 **Marks: Internal:100 External:-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 **K4**
- 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:

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

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

SEMESTER-III

25BECY392 INTERNSHIP - I 2H-1C

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

End Semester Exam:3 Hours

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. **K4**
- Develop innovative solutions to real world problems. **K4**
- Analyse the diverse engineering disciplines to dynamic projects environments **K4**

CO, PO, PSO Mapping:

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

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

SEMESTER-IV

25BECY401 INFORMATION SECURITY (THEORY) 3H-3C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is to:

- Understand the basic concepts of information security and risk management.
- Familiarize policy standards and practices in information security
- Apply the concept of security technologies, intellectual property rights and patents in information system.

COURSE OUTCOMES

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

- Outline the concept of security model, component and need for security **K2**
- Explain the risk associated with security and security planning practices. **K2**
- Illustrate Firewall and VPNs. **K2**
- Identify Legal, Ethical and Professional issues in information security. **K3**
- Apply procedural knowledge to legal system to solve the problem related to intellectual property rights. **K3**

UNIT I INTRODUCTION 9

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

.

UNIT II RISK MANAGEMENT 9

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

UNIT III SECURITY TECHNOLOGY 9

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

UNIT IV PROJECT MANAGEMENT **9**

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

UNIT V INTELLECTUAL PROPERTY RIGHTS **9**

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

TOTAL: 45

TEXT BOOKS

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

REFERENCES

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

CO, PO, PSO Mapping

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

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

25BEHS402AG **SEMESTER-IV**

STATISTICS AND OPTIMIZATION TECHNIQUES (THEORY) **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: Discrete Mathematics and Stochastic Process

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for students:

- To understand the concept of statistical tools and statistical techniques from both applied and theoretical points of view.
- To solve the linear programming problem using Graphical method, Simplex method and Dual simplex method.
- To 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

WEB REFERENCES:

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:

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

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

25BEHS402BG **SEMESTER-IV**

PROBABILITY AND STATISTICS (THEORY) **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:

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

COURSE OUTCOMES:

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 DESCRIPTIVE STATISTICS **12**

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

UNIT IV CORRELATION AND REGRESSION **12**

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

UNIT V TESTING OF HYPOTHESIS **12**

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

TOTAL: 45+15

TEXT BOOKS:

1. Geoffrey Grimmett and David Stirzaker, "Probability and Random Processes", Oxford University Press, 4th Edition, 2020.
2. Allen Craig Rober V Hogg,JosephWMckean, "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:

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

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

SEMESTER-IV

25BECY441AG WEB APPLICATION DEVELOPMENT (THEORY & LABORATORY) 5H-4C

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

End Semester Exam:3 Hours

PREREQUISITES: **JAVA PROGRAMMING**

(i) THEORY

COURSE OBJECTIVES:

The goal of this course 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 student 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 development. **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 Dispatcher - sendRedirect - Session Tracking: Cookies – HTTP Session - 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.

REFERENCES:

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.

WEB REFERENCES:

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	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

SEMESTER-IV

25BECY441BG LOW CODE APPLICATION DEVELOPMENT 5H-4C
(THEORY & LABORATORY)

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

PREREQUISITES: **Nil**

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to:

- Identify and explain key low code development components
- Proficiently use low code platforms/tools for app creation and publication
- Analyze data with machine learning tools and present insights

COURSE OUTCOMES:

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

- Interpret the functionality and application of low code tools for web scraping, API integration, automation, and UI/UX design. **K2**
- Infer low code platforms like Zapier, VoiceFlow, and Figma for effective publishing of applications. **K2**
- Utilize data scraping, API manipulation, and data analysis using machine learning tools. **K3**
- Build voice applications and bots, integrating services like Giphy and twitter. **K3**
- Develop user interfaces and experiences with basic UI/UX principles using low code solutions. **K3**

UNIT I WEB SCRAPING AND API PARABOLA WITH LOW CODE 9

NoCode Stacks - NoCode Fundamentals. Web Scraping: Scrape Data from WEB REFERENCES Initial Scraper Setup- Defining our data- Using our Scraped Data. APIs: Filtering Data- Numerical Formatting - Exporting – Publishing data.

UNIT II BUILD AUTOMATIONS AND CREATE BOTS WITH LOW CODE 9

Automations using Zapier: Introduction - Connecting Google sheets - Connecting twitter- Publishing Zapier Automation. Bots: Configuring Slack - Creating First bot using slack - Including conditional and helper functions - Connecting Giphy -Connecting slack to bot - Publishing our bot.

UNIT III DATA SCIENCE 9

Introduction - Data flow- Machine learning. Obviously AI: Introduction- Sourcing -Upload -Analyze- Publish using Obviously AI.

UNIT IV VOICE APP **9**

Introduction-VoiceFlow-Initial setup- launch sequence -Querying the user-Calling AP for data-Returning Data to the user-Testing the application-Publish the voice app.

UNIT V UI / UX DESIGN FOR APPLICATION **9**

Introduction-Business Use case-Tools. Figma: Introduction-File setup - Placing Images - Frame-Building Forms- Profile Image- Proportions- Project.

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Set up an automation in Parabola to integrate data from a public API (e.g., weather or news API) and format it for easy analysis.
2. Configure a Zapier automation that connects Google Sheets with Slack, automatically posting updates or notifications.
3. Build a Slack bot using Zapier that responds to user queries with relevant information sourced from an external API (e.g., Giphy).
4. Upload a dataset to Obviously AI, analyze it using machine learning models, and generate predictive insights without coding.
5. Develop a VoiceFlow application that interacts with users to provide real-time information (e.g., weather forecasts) via voice commands.
6. Design a mobile app interface prototype in Figma, focusing on intuitive navigation and user-friendly interactions.
7. Create an interactive dashboard prototype in Figma that visualizes data insights and allows for customizable widgets and filters.

TOTAL: 30

TEXT BOOKS:

1. David Wilson, " Low-Code Application Development: A Practical Guide ", 1st Edition, ABC Press, 2021
2. Paul E Love, " Mastering No-Code: Create Professional Quality Apps Without Coding
3. (Vol. 1) ", 1st Edition, Independent Publication, 2021.
4. Mikhail Zhilkin, " Data Science Without Makeup", 1st Edition, CRC Press, 2022.

REFERENCES:

1. Mittal Akhil, " Getting Started with Chatbots ", 1st Edition, BPB Publications, 2019.
2. Fabio staiano, " Designing and Prototyping Interfaces with Figma ", 1st Edition, Packt Publishing, 2022.

WEB REFERENCES:

1. https://www.udemy.com/courses/development/no-code-development/
2. https://www.nocode.tech/academy
3. https://www.coursera.org/courses?query=mobile%20app%20development

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	2	-	-	2	2	-	2	-	2
CO2	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	**2.6**	**1.8**	**1**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**2**

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

SEMESTER-IV

25BECS441AG ADVANCED ALGORITHMS (THEORY & LABORATORY) 5H-4C

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

End Semester Exam:3 Hours

PREREQUISITES: Design Structures and Algorithms

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to:

- Learn programming and mathematical backgrounds for design and analysis of algorithm
- Study the concept of designing an algorithm and pattern matching
- Have a complete understanding of the various advanced graph algorithms and applications

COURSE OUTCOMES:

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

- Outline the mathematical properties involved in algorithmic design **K2**
- Apply the number theory approaches for advanced algorithms **K3**
- Identify the role of efficient problem solving techniques **K3**
- Construct optimal algorithms used in competitive programming **K3**
- Determine the working principles involved in string algorithms for pattern matching, searching, and manipulation tasks **K4**

UNIT I INTRODUCTION **9**

Programming Language Backgrounds: STL in C++ – Data Structure support in python – Mathematical Backgrounds – Logarithmic Exponentiation – Efficient Prime Factorization – Combinatorics – Sieve of Eratosthenes – Geometry – Co-ordinate Compression Binomial Coefficients – Euclid's extended Algorithm – Line intersections.

UNIT II MATHEMATICAL APPROACHES **9**

Probability – Modular Multiplicative inverse – Matrix Exponentiation – Miller rabin Primality Test – Heavy light Decomposition – Convex hull – Hungarian Algorithm – Sweep line Algorithm – Gaussian Algorithm – Pollard Rho Factorization – Euler's Totient Function – Burnside lemma.

UNIT III ADVANCED ALGORITHM DESIGN TECHNIQUES **9**

Recursion – Dynamic Programming – Backtracking – Branch and Bound – Suffix Automata – Game Theory – Meet in the middle – arbitrary precision integer – Square root

decomposition. Knapsack problem – Stable Marriage Problem – N-Queen Problems – Tug of wars – Sudoku problem – Advanced Trees: Binary Indexed Tree – Segment Tree – Lowest common ancestors – Counting Inversions – Suffix Tree – Interval Tree – Sparse table – k-d tree – Treap – Link/cut tree.

UNIT IV ADVANCED GRAPH ALGORITHMS **9**

Advanced Graph Algorithms: Z-algorithm – Union find/Disjoint Set – Cycle Detection – Bellman Ford – Maxflow – Ford – Fulkerson Min cut – min cost flow – Dinic's Algorithm – Edmonds Karp algorithm – Maximum Bipartite Matching – Topological Sorting – Eulerian & Hamiltonian Paths – Graph Coloring – Blossom's Algorithm – Jarvis algorithm – Graham Scan – Johnson's Algorithm.

UNIT V PATTERN MATCHING AND SEARCHING **9**

Searching and Pattern Matching: Rabin-Karp Algorithm – Aho-Corasick String Matching Algorithm – Manacher's Algorithm – Kasai's Algorithm – Levenshtein distance – Sorting – Quick Select.

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement algorithms to solve geometric problems.
2. Develop solutions using dynamic programming.
3. Implement algorithms using backtracking methods.
4. Detect cycles in a graph using appropriate algorithms.
5. Develop algorithms for topological sorting.
6. Implement graph coloring algorithms.
7. Implement pattern matching algorithms.

TOTAL: 30

TEXT BOOKS:

1. Cormen T H, Leiserson C E, Rivest RL, Stein C, “Introduction to Algorithms”, 4th Edition, MIT Press, 2022.
2. Yonghui Wu, Jiande Wang, “Data structure Practice for Collegiate Programming Contests and Education”, 1st Edition, CRC Press, 2020.

REFERENCES:

1. Steven S. Skiena “The Algorithm Design Manual”, 3rd Edition, Springer, 2020.
2. Michael T. Goodrich, Roberto Tamassia, “Design and Analysis of Algorithms, An Indian Adaptation”, 1st Edition, Wiley, 2021.
3. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education, 2019.

WEB REFERENCES:

1. https://ocw.mit.edu/courses/6-854j-advanced-algorithms-fall-2005/
2. https://www.coursera.org/learn/advanced-algorithms-and-complexity
3. https://www.geeksforgeeks.org/advanced-data-structures/

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

25BECS441BG DESIGN AND ANALYSIS OF ALGORITHMS (THEORY & LABORATORY) 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 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 student 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 AVG 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.

REFERENCES:

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

4. Algorithms: Design and Analysis Oxford higher education, Harsh Bhasin, Oxford University, 2015.

WEB REFERENCES:

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

CO, PO, PSO Mapping

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CO1	3	2	1	-	-	-	-	2	2	-	2	3	-
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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-IV

25BECS442G COMPUTER NETWORKS (THEORY & LABORATORY) 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 for the students is 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, the student 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**
- Differentiate between routing techniques using TCP and UDP protocols to understand their impact on data transmission efficiency and reliability. **K3**
- Identify the purpose of protocols and standards to ensure interoperability and efficiency **K3**
- Apply public key cryptosystems to encrypt and decrypt process. **K3**

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 – SNMP Application 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

(ii) 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.

REFERENCES:

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.

WEB REFERENCES:

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	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

25BECY411 SKILL DEVELOPMENT- I 2H-1C

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

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

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

SEMESTER-IV

25BEMC451G FOUNDATION OF ENTREPRENEURSHIP 1H-0C

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

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to:

- Equip and develop the learners' entrepreneurial skills and qualities essential to undertake business.
- Impart the learners entrepreneurial competencies needed for managing business efficiently and effectively.
- Understand basic concepts in the area of entrepreneurship
- 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.
- Undertake businesses in the entrepreneurial environment
- Prepare business plans and undertake feasible projects.
- Be efficient in launching and develop their business ventures successfully
- Monitor the business effectively towards growth and development

UNIT I ENTREPRENEURIAL COMPETENCE

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

UNIT II ENTREPRENEURIAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development

UNIT III BUSINESS PLAN PREPARATION

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

UNIT IV LAUNCHING OF SMALL BUSINESS

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

UNIT V MANAGEMENT OF SMALL BUSINESS

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

TOTAL:15 Hours

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.

25BEMC452G **SEMESTER - IV**

ESSENCE OF TRADITIONAL INDIAN KNOWLEDGE AND HERITAGE **1H - 0C**

Instruction Hours/week: L:1 T:0 P:0 **Marks:** Internal**:100 External:-**TOTAL**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students to;

- Impart a holistic understanding about Indian Culture and Thoughts from a Historical perspective.
- Encourage critical appreciation of the Indian thoughts and cultural manifestations.
- Gain knowledge of Indian heritage and cultural heritage on various epistemological inquiries.

COURSE OUTCOMES:

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

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

UNIT I Introduction to Indian Thought and Culture **5**

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 **5**

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

UNUI III Protection of Traditional Knowledge **5**

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

TOTAL:15

Textbooks:

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

SEMESTER-IV

25BECY491 APPLICATION DEVELOPMENT- III 2H-1C

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

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

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

SEMESTER-V

25BECY501 AUTOMATA AND COMPILER DESIGN 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: Nil

COURSE OBJECTIVES:

The goal of this course for students is to

- Understand the basic concepts of languages which are formal and regular and also deals with grammar present in the machine
- Accepts a program in source language and converts into a machine understandable format
- Learn about code generation based on compiler design concepts

COURSE OUTCOMES:

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

- Explain concepts of abstract machines and their power to recognize the languages. **K2**
- Apply the knowledge of language classes & grammars relationship among them with the help of Chomsky hierarchy. **K3**
- Illustrate the design of a compiler based on given features of the languages. **K2**
- Make use of practical aspects of automata theory for real time applications. **K3**
- Apply compiler generation tools for developing advanced compilers. **K3**

UNIT I INTRODUCTION TO AUTOMATA 9

Fundamentals of Automata: Chomsky Hierarchy of languages- Finite automata - Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA)- NFA to DFA Conversion- Minimization of DFA.

UNIT II LEXICAL ANALYZER 9

Introduction to Compilers: Language processors - Phases of Compiler- Compiler Construction Tools - Role of a lexical analyzer – Input buffering – Specification and recognition of tokens —Regular Expressions - Regular expression to finite automata .

UNIT III SYNTAX ANALYZER 9

Role of a parser – Context-free grammars – Ambiguous Grammar -Top-down parsing – Left Recursion – Left Factoring -Predictive LL(1) parser- Bottom-up parsing – Shift Reduce Parser- SLR (1)- CLR(1)- LALR(1) parsers.

UNIT IV INTERMEDIATE CODE GENERATION 9

Intermediate languages – Variants of Syntax Trees, Three-Address Code. Declaration – Assignment statements – Boolean expressions – Flow control statements – Back patching.

UNIT V CODE GENERATION **9**

Introduction to optimization techniques – Issues in the design of a code generator – Runtime storage management – Design of a simple code generator.

TOTAL: 45+15

TEXT BOOKS:

1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson. 2009.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India, 2007.

REFERENCES:

1. K. L. P Mishra, N. Chandrashekaran, Theory of computer science- Automata Languages and computation, 2nd edition, Prentice Hall of India, New Delhi, India, 2003.
2. Modern Compiler Construction in C, Andrew W.Appel Cambridge University Press.
3. Kenneth C. Louden (1997), Compiler Construction– Principles and Practice, 1st edition,PWS Publishing.
4. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group,
5. Principles of Compiler Design, V. Raghavan, TMH.

WEB REFERENCES:

1. https://www.javatpoint.com/automata-tutorial
2. https://www.tutorialspoint.com/automata_theory/index.htm
3. https://www.geeksforgeeks.org/compiler-design-tutorials/
4. https://www.javatpoint.com/compiler-tutorial

CO, PO, PSO Mapping

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

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

SEMESTER-V

25BECY541 CRYPTOGRAPHY AND CYBER SECURITY (THEORY & LABORATORY) 5H-4C

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

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course for the students is to:

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

COURSE OUTCOMES

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

- Explain concepts of substitution and transposition techniques used in traditional encryption. **K2**
- Apply the symmetric key cryptography for encryption and decryption process. **K3**
- Illustrate about the public key cryptography for encryption and decryption process. **K2**
- Make use of Authentication schemes to simulate different applications. **K3**
- Analyze cybercrimes and attacks in cyber security. **K4**

UNIT I INTRODUCTION TO SECURITY 9

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

UNIT II SYMMETRIC CIPHERS 9

Number theory – Algebraic Structures – Modular Arithmetic - Euclid‘s algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields

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

UNIT III ASYMMETRIC CRYPTOGRAPHY 9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm.

ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 9

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

UNIT V CYBER CRIMES AND CYBER SECURITY 9

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

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implementation of Caesar Cipher technique
2. Implement the Play fair Cipher
3. Implement the Pure Transposition Cipher
4. Implement DES Encryption and Decryption Lab
5. Implement the AES Encryption and decryption
6. Implement RSA Encryption Algorithm
7. Implementation of Hash Functions

TOTAL: 30

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2. https://www.geeksforgeeks.org/cryptography-and-network-security-principles/

3. https://www.tutorialspoint.com/data_communication_computer_network/computer_network_security.html
4. https://www.techtarget.com/searchnetworking/definition/network-security

CO, PO, PSO Mapping:

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

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

SEMESTER-V

25BTAD545G	ARTIFICIAL INTELLIGENCE (THEORY & LABORATORY)	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: Probability and Statistics

(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. Bratko, Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc, 2011

REFERENCES:

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.

WEB REFERENCES:

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'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**	**2.2**	**1.5**	**1**	-	-	-	**2**	**2**	**-**	**3**	**3**	**-**

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

SEMESTER-V

25BECY511 SKILL DEVELOPMENT -II 2H-1C

Instruction Hours/week: L:0 T:0 P:2 Marks: Internal:100 External: - TOTAL:100

End Semester Exam:3 Hours

Students have to undergo skill-oriented courses offered in latest engineering trends from reputed industries

PRE- REQUISITES: Nil

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

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

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

25BECY512 COMMUNITY ENGAGEMENT AND SOCIAL RESPONSIBILITY 3H-2C

Instruction Hours/week: L:1 T:0 P:2 **Marks: Internal:100 External:- TOTAL:100**
End Semester Exam:3 Hours

PRE-REQUISITE: Nil

COURSE OBJECTIVES:

The goal of this course for students is to:

- Achieve socio economic development through active community engagement.
- Improve the quality of research for better understanding of issues in the society.
- Create awareness on the role of a citizen in improving the community and hence the nation

COURSE OUTCOMES:

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

- Interpret the role of community engagement in the development of the nation.
- Infer the role of rural institutions and community involvement
- Explain the social problems, social contribution of community networking and various government schemes supporting the community engagement.
- Analyze the factors that mitigate the distress & disasters
- Understand the role of Indian citizens towards community development by adopting a village and carrying out the field work

UNIT I **5**

Concept, Ethics and Spectrum of Community Engagement-Local community, Rural culture and Practice of community engagement. Stages, Components and Principles of community development, Utility of public resources – Contributions of self-help groups

UNIT II **5**

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

UNIT III **5**

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

UNIT IV **5**

Community Engaged Research and Ethics in Community Engaged Research- Rural Distress, Rural

Poverty, Impact of COVID-19 on Migrant Laborers, Mitigation of Disaster.

UNIT V (Field Work) **25**

Service-learning: address the challenges of a specific community, Community-based Participatory Research (CBPR) approaches, Knowledge sharing and knowledge mobilization to the local community, social innovations by students

REFERENCE BOOKS:

1. Principles of Community Engagement, 2nd Edition, NIH Publication No. 11-7782, Printed June 2011

WEB SITES:

1. https://onlinecourses.swayam2.ac.in/ugc23_ge04/preview

CO, PO, PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	3	1	1	-	-	3	1	-
CO2	-	-	-	-	-	3	1	1	-	-	3	1	-
CO3	-	-	-	-	-	3	1	1	-	-	3	1	-
CO4	-	-	-	-	-	3	1	1	-	-	3	1	-
CO5	-	-	-	-	-	3	3	3	3	3	3	1	-
AVG	**-**	**-**	**-**	**-**	**-**	**3**	**1.4**	**1.4**	**3**	**3**	**3**	**1**	**-**

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

SEMESTER V

25BECY551 MOBILE APPLICATION DEVELOPMENT 1H- 0C

Instruction Hours/week: L:1 T:0 P:0 Marks: Internal:100 External: - TOTAL:100

End Semester Exam:3 Hours

PRE-REQUISITES: Web Technology

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 5

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 5

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 5

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.

TOTAL: 15

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.

REFERENCES:

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

SEMESTER-V

25BECY591 INTERNSHIP- II 2H-1C

Instruction Hours/week: L:0 T:0 P:2 Marks: Internal:100 External:- TOTAL:100

End Semester Exam:3 Hours

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**
- Analyse the diverse engineering disciplines to dynamic projects environments **K4**

CO, PO, PSO Mapping

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

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

25BEHS601G **SEMESTER -VI**

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

Instruction Hours/week: L:2 T:0 P:0 **Marks: Internal:100 External:- TOTAL:100**
End Semester Exam:3 Hours

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 and distinguish between values and skills.
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- To help students to understand the meaning of happiness within their selves and the meaning of 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 **10**

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 **10**

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 **10**

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: 30

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.

Website URLs:

1. https://fdp-si.aicte-india.org/
2. https://uhv.org.in/UHV-I_Course_Material
3. https://uhv.org.in/

CO, PO, PSO Mapping:

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

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

SEMESTER-VI

25BECY641 VULNERABILITY ASSESSMENT AND PENETRATION TESTING (THEORY & LABORATORY) 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 Networks

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the fundamental concepts of vulnerability assessment and penetration testing.
- Develop skills to identify, analyze, and mitigate vulnerabilities in systems and networks.
- Gain hands-on experience with tools and techniques used in penetration testing and ethical hacking.

COURSE OUTCOMES:

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

- Classify techniques in penetration testing process. **K2**
- Demonstrate approaches and tools used in information gathering. **K2**
- Make use of vulnerability scanner to perform host discovery and evading techniques. **K3**
- Examine the Key Challenges in Securing Mobile Devices. **K4**
- Establish a Testing Procedure for Evaluating SSI Injection Vulnerabilities in web references. **K4**

UNIT I INTRODUCTION AND TESTING PROCESS 9

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

UNIT II INFORMATION GATHERING 9

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

UNIT III HOST DISCOVERY AND EVADING TECHNIQUES 9

Vulnerability scanner function – Pros and cons – Vulnerability assessment with NMAP – Testing SCADA environment with NMAP – Nessus vulnerability scanner – Safe check – Silent dependencies

– Port range vulnerability data resources. Vulnerability scanner: SDN data plane – Control plane – Application plane. SDN security attack vectors and SDN hardening – Overlay model and network model for cloud computing

UNIT IV MOBILE APPLICATION SECURITY 9

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

UNIT V VULNERABILITY ANALYSIS 9

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

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Set up of Kali Linux in a virtual machine and setup with DNS info and collection of local networks.
2. Network Scanning with Nmap
3. Network Traffic Analysis with Wireshark
4. Exploitation with Metasploit
5. Web Application Testing with Burp Suite
6. Automated Web Vulnerability Scanning
7. Custom Scripting for Penetration Testing

TOTAL: 30

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCES:

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

3. https://www.softwaretestinghelp.com/vulnerability-assessment-tools/
4. https://www.veracode.com/security/vulnerability-assessment-and-penetration-testing
5. https://www.hackingarticles.in/penetration-testing/

CO, PO, PSO Mapping:

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	-	-	2	-	2
CO2	3	2	1	-	2	-	-	-	-	-	2	-	2
CO3	3	2	2	1	2	-	-	-	-	-	2	-	2
CO4	3	2	1	-	2	-	-	-	-	-	2	-	2
CO5	3	2	1	-	2	-	-	-	-	-	2	-	2
Avg	**2.8**	**1.8**	**1.25**	**1**	**2**	-	-	-	-	**-**	**2**	**-**	**2**

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

25BECY642 **SEMESTER-VI**

MACHINE LEARNING FOR CYBER SECURITY 5H-4C
(THEORY & LABORATORY)

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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Study the basic concepts of cyber threats and cyber security.
- Learn anomaly detection and malware analysis using machine learning.
- Obtain the knowledge in applying machine learning for predicting network attacks.

COURSE OUTCOMES:

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

- Understand the concepts of machine learning applied in security domain. **K2**
- Apply classification and clustering algorithms for automated decision making. **K3**
- Analyze the predictive model for detecting cyber security threats. **K4**
- Experiment with cyber security principles using machine learning. **K3**
- Build a predictive model for network attacks. **K3**

UNIT I INTRODUCTION TO MACHINE LEARNING AND CYBER SECURITY 9

Introduction to Machine learning and Cyber security – Cyber threat landscape – The cyber attacker's economy – AI and machine learning – Real-world uses of machine learning in security – Classifying and clustering - Machine learning: Problems and approaches – Examples of machine learning models – Training algorithms to learn – Model families – Loss functions – Optimization

UNIT II SUPERVISED CLASSIFICATION ALGORITHMS 9

Supervised classification algorithms: Logistic regression – Decision trees – Support vector machines – Naive Bayes – k-Nearest neighbors – Neural networks – Practical considerations in classification – Selecting a model family

UNIT III TRAINING DATA CONSTRUCTION 9

Training data construction – Feature selection – Overfitting and underfitting – Clustering – Different clustering algorithms – Evaluating clustering results- Anomaly detection – Anomaly detection with data and algorithms – Challenges of using machine learning in anomaly detection

UNIT IV MALWARE ANALYSIS 9

Practical system design concerns-Malware analysis – Understanding malware – Machine learning in malware classification – Implementation code – Network traffic analysis – Theory of network defense

UNIT V MACHINE LEARNING AND NETWORK SECURITY **9**

Machine learning and network security – Building a predictive model to classify network attacks – Adversarial machine learning – Example models.

TOTAL: 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Intrusion detection model using machine learning.
2. Detecting credit card fraud using machine learning.
3. E-mail spam detection.
4. Anomaly detection using machine learning.
5. Predicting DDoS attacks.
6. Using machine learning to detect malicious URLs.
7. Decision tree and context-based malicious event detection.

TOTAL: 30

TEXT BOOKS:

1. Clarence Chio and David Freeman," Machine Learning and Security: Protecting Systems with Data and Algorithms", O'Reilly Media, First Edition,2019
2. Brij B Gupta and Quan Z Sheng," Machine Learning for Computer and Cyber Security: Principle, Algorithms, and Practice", CRC Press, First Edition,2019

REFERENCES:

1. Sumeet Dua and Xian Du," Data Mining and Machine Learning in Cybersecurity", CRC Press, First edition,2011.
2. Joshua Saxe and Hillary Sanders," Malware Data Science: Attack Detection and Attribution", No Starch Press, First Edition,2018

WEB REFERENCES:

1. www.kdnuggets.com/2017/01/machine-learning-cyber-security.html
2. www.wp.nyu.edu/ensure_group/el-gy-9163-machine-learning-for-cyber-security/
3. www.towardsdatascience.com/machine-learning-for-cybersecurity-101-7822b802790b
4. www.deepmlblog.wordpress.com/2016/01/03/how-to-break-a-captcha-system/
5. www.onlinecourses.swayam2.ac.in/nou21_cs01/preview

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	-	-	2
CO2	3	2	1	-	-	-	-	2	2	-	-	-	2
CO3	3	2	2	1	-	-	-	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	2	2	-	-	-	2
CO5	3	2	1	-	-	-	-	2	2	-	-	-	2
Avg	**2.8**	**1.8**	**1.25**	**1**	-	-	-	**2**	**2**	**-**	**-**	**-**	**2**

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

SEMESTER-VI

25BECY643 DIGITAL AND MOBILE FORENSICS (THEORY & LABORATORY) 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: Basics of Cyber Security

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the fundamental concepts of vulnerability assessment and penetration testing.
- Develop skills to identify, analyze, and mitigate vulnerabilities in systems and networks.
- Gain hands-on experience with tools and techniques used in penetration testing and ethical hacking.

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 9

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

UNIT II DIGITAL CRIME AND INVESTIGATION 9

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

UNIT III DIGITAL FORENSIC READINESS 9

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

UNIT IV iOS FORENSICS 9

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

UNIT V ANDROID FORENSICS 9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security

– Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL: 45

(ii) LABORATORY
LIST OF EXPERIMENTS:

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2. Data extraction from call logs using Sleuth Kit.
3. Data extraction from SMS and contacts using Sleuth Kit.
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
5. 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 BOOKS:

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

REFERENCES:

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 Edition, 2018.

WEB REFERENCES:

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’S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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 - Low, 2 - Medium, 3 - High, ‘-' - No Correlation

25BECY691 MINI PROJECT 2H-1C

Instruction Hours/week: L:0 T:0 P:2 Marks: Internal:100 External: - TOTAL:100
End Semester Exam:3 Hours

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:

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

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

SEMESTER-VII

25BECY701 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 the students is to

- 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

Upon completion of the course, 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

TEXTBOOKS:

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.

WEBSITES:

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

CO, PO, PSO Mapping:

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

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

SEMESTER-VII

25BECY791 PROJECT WORK PHASE- I / FIELD PROJECT 8H-4C

Instruction Hours/week: L:0 T:0 P:8 **Marks: Internal:40 External:60 TOTAL:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

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**
- Analyse products, processes for sustainable and socially relevant applications **K4**

CO, PO, PSO MAPPING:

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

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

SEMESTER-VIII

25BECY891 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

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:

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

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

25BTAD4E41G **BIG DATA ANALYTICS (THEORY & LABORATORY)** **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: Database Management Systems

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to

- Provide 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**
- Analyze 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 **6**

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 **6**

About Pig – Map Reduce 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 **6**

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 **6**

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 **6**

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: 30

(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.

REFERENCES:

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.

WEB REFERENCES:

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	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-		3	-
CO2	2	2	1	-	-	-	-	2	2	-		3	-
CO3	3	3	2	1	-	-	-	2	2	-		3	-
CO4	3	3	2	1	-	-	-	2	2	-		3	-
CO5	3	3	2	1	-	-	-	2	2	-		3	-
AVG	**2.8**	**1.6**	**1.3**	1	**-**	**-**	**-**	**2**	**2**	**-**		**3**	-

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

25BECY4E42G **SEMESTER-VI**

HUMAN COMPUTER INTERACTION 4H-3C
(THEORY & LABORATORY)

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

End Semester Exam:3 Hours

PREREQUISITE: Computer Architecture

(i) THEORY

COURSE OBJECTIVES:

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

- Learn the foundations of Human Computer Interaction.
- Apply an interactive design process and universal design principles in designing HCI systems.
- Be aware of mobile HCI.

COURSE OUTCOMES:

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

- Demonstrate effective HCI for individuals and persons with disabilities. **K2**
- Interpret the HCI implications for designing multimedia, ecommerce and e-learning Web sites. **K2**
- Outline the fundamentals of Human Computer Interaction. **K3**
- Build effective dialog for HCI. **K3**
- Develop web and mobile user interface in HCI. **K3**

UNIT I FOUNDATION OF HCI **6**

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

UNIT II DESIGN AND SOFTWARE PROCESS **6**

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

UNIT III INTERACTION STYLES **6**

Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration.

UNIT IV MODELS AND THEORIES **6**

Cognitive models - Socio-Organizational issues and stakeholder requirements – Communication and collaboration models - Task Analysis - Hypertext, Multimedia and WWW.

UNIT V WEB INTERFACE DESIGN AND MOBILE HCI **6**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages. Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture.

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Design a system based on a user-centered approach.
2. Design the existing GUI with screen complexity.
3. Design web user interface based on Gestalt theory.
4. Implementation of various kinds of menus.
5. Implementation of various kinds of windows.
6. Implementation of various kinds of icons

TOTAL: 30

TEXT BOOKS:

1. Alan Dix, Janet Finlay, G D Abowd, R Beale, “Human Computer Interaction”, Pearson Education, 3rd Edition, 2009 (Unit 1,2,3,4)
2. Ben Shneiderman “Designing the User Interface - Strategies for Effective Human Computer Interaction”, Pearson Education, 3rd Edition, 2010. (Unit 3)

REFERENCES:

1. Brian Fling, “Mobile Design and Development”, First Edition, O‟Reilly Media Inc., 2009
2. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O‟Reilly, 2009.
3. Jenifer Tidwell, Designing Interfaces, Second Edition, O′Reilly publishers, 2011.
4. David Benyon, Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design, Third Edition, Pearson, 2013.

WEB REFERENCES:

1. https://www.coursera.org/courses?query=human%20computer%20interaction
2. https://hcibib.org/
3. https://uxdesign.cc/

4. https://uxbooth.com/
5. https://uxplanet.org/

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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-IV

25BECY4E43G	ETHICAL HACKING (THEORY & LABORATORY)	4H-3C

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

End Semester Exam:3 Hours

PREREQUISITE: COMPUTER NETWORKS

(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. **K3**
- Apply the enumeration and vulnerability analysis methods in ethical hacking **K3**
- 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 NETWORK **6**

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

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 PROTECTI ON 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 and use the networking commands
2. Install Metasploit and apply its tools
3. Practice the basics of reconnaissance.
4. Using FOCA / Search Diggity tools, extract metadata and expanding the target list
5. Information gathering using the tool- Robtex.
6. Scan the target using the tool -Nessus.

TOTAL: 30

TEXT BOOKS:

1. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
2. The Web Application Hacker’s Handbook: Finding and Exploiting SecuritFlaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz, 2014.
2. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
3. Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers, 2007

WEB REFERENCES:

1. https://www.geeksforgeeks.org/ethical-hacking-tutorial/
2. https://www.tutorialspoint.com/ethical_hacking/index.htm
3. https://www.javatpoint.com/ethical-hacking

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	2	3	-
CO2	2	1	-	-	-	-	-	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	**2.6**	**2**	**1**	**-**	-	-	**2**	**2**	**2**	-	**2**	**3**	-

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

SEMESTER-IV

25BTAD4E44G DISTRIBUTED AND CLOUD 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: Big Data Analytics

(i)THEORY:

COURSE OBJECTIVES:

The goal of this course for the students is to:

- Provide a fundamental concept 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 **6**

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 **6**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish Subscribe Model – Basics of Virtualization – Implementation Levels of Virtualization- Virtualization Structures – Virtualization of CPU, Memory, I/O Devices.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE **6**

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.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD **6**

Distributed File Systems - Inter Cloud Resource Management – Resource Provisioning and Resource

Provisioning Methods – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 6

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack –Federation in the Cloud.

TOTAL: 30

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 Virtualizations
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.

WEB REFERENCES:

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	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

25BECY4E45G MERN STACK DEVELOPMENT (THEORY & LABORATORY) 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 students 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.

REFERENCES:

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.

WEB REFERENCES:

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	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

25BEEC4E46 **Semester-IV**

EMBEDDED SYSTEMS AND IOT (THEORY & LABORATORY) **4H-3C**

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

End Semester Exam:3 Hours

(i)THEORY

COURSE OBJECTIVES:

The goal of this course for students is to:

- Study and familiarize the fundamental concepts of real time operating system
- Learn the architecture of embedded microcontrollers embedded design processes and embedded applications
- Apply the knowledge of serial communication protocols and internet of things

COURSE OUTCOMES:

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

- Outline the architecture & functional flow of Embedded Systems **K2**
- Explain the concepts of Cortex M3 Microcontroller **K2**
- Utilize the various protocols used for serial data communication applications **K3**
- Develop an RTOS based (framework) application for embedded systems **K3**
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications **K3**

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS AND INTERNET OF THINGS 6

Introduction to Embedded systems: Definition – Classifications – Components of Embedded systems: Reset Circuit - Brown-out Protection Circuit - Oscillator Unit - Real Time Clock - Introduction to IoT: Overview of IoT - architecture – Communication.

UNIT II STUDY OF CORTEX M3 MICROCONTROLLER 6

Cortex-M3 Basics: Registers- Operation Modes - Exceptions and Interrupts - Vector Tables - Stack Memory Operations - Reset Sequence-Pipeline - Block Diagram, Bus Interfaces on Cortex-M3: I-Code Bus - D-Code Bus - System Bus.

UNIT III COMMUNICATION STANDARDS AND PROTOCOLS 6

Serial wired communication standards and protocols: SCI - I^2C - SPI - RS485- USB and CAN Bus, PC Parallel port programming, Wireless Protocols: Wi-Fi – Bluetooth - BLE - NFC.

UNIT IV REAL TIME OPERATING SYSTEM 6

Overview of RTOS: scheduler –dispatcher - objects - services - characteristics of an RTOS - difference between general purpose OS and RTOS - Task - Threads – Context Switching –

Operating Systems Scheduling policies and Inter Process Communication - Synchronization mechanisms.

UNIT V DESIGN METHODOLOGIES AND CASE STUDIES **6**

Overview of Design Methodologies – Testing and debugging Methodologies – Applications and Case study of embedded systems (Elevator Control system, Biometric authentication system).

TOTAL: 30

(ii)LABORATORY

LIST OF EXPERIMENTS:

1. Interfacing of LED and Switch with ARM Cortex M-microcontroller
2. Interfacing Relay and Buzzer with ARM Cortex M-microcontroller
3. Interfacing a 4x4 matrix keypad with ARM Cortex M-microcontroller
4. Interfacing of Temperature Sensor and LDR with ARM Cortex M-microcontroller
5. Generate PWM and vary its duty cycle using the internal PWM module of ARM Cortex-M controller
6. Demonstrate the use of an external interrupt to toggle an LED ON/OFF

TOTAL: 30

SUGGESTED READINGS:

1. Rajkamal,"Embedded Systems –Architecture, Programming and Design", 3rd Edition, Tata McGraw Hill, 2017.
2. Alexander G Dean,"Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach", 2nd Edition, Arm Education Media,2021.
3. Daniel W. Lewis, "Fundamentals Of Embedded Software With The Arm Cortex - M3", 2nd Edition, Pearson,2015
4. Peckol, James K.," Embedded Systems-A Contemporary Design Tool", 2nd Edition, Wiley & Sons Ltd, 2019.
5. Sriram V Iyer,Pankaj Gupta, :Embedded Real time Systems Programming" ,1st Edition, Tata McGraw Hill, 2017.

WEB REFERENCES:

1. https://archive.nptel.ac.in/courses/106/105/106105193/
2. https://documentation-service.arm.com/static/62053c120ca305732a3a5c14?token=
3. www.arm.com/products/silicon-ip-cpu?families=cortex-m&showall=true

CO, PO, PSO Mapping:

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

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

SEMESTER-V

25BECS5E41G PROCESS MINING 4H-3C

(THEORY & LABORATORY)

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**:**

- Learn the fundamentals of process mining and how to perform data ingestion, transformation, and modelling in business process improvement.
- Gain hands-on skills in creating analysis dashboards and action flows.
- Apply knowledge to real-world scenarios in the fields of finance, logistics, and customer service.

COURSE OUTCOMES:

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

• Explain the historical evolution, architecture, and core components of process mining platforms.	**K2**
• Make use of PQL to transform, filter, and refine event data in preparation for process analysis.	**K3**
• Build dynamic and responsive dashboards by implementing user interaction elements.	**K3**
• Examine how condition-based automation improves process efficiency and responsiveness.	**K4**
• Analyze findings from industry case studies to derive best practices for process mining applications.	**K4**

UNIT I INTRODUCTION TO PROCESS MINING AND CELONIS 6

Process Mining Overview: Definition, Benefits, Applications, Comparison with Traditional Data Analytics and BI, Introduction, History, Architecture, Components (EMS, IBC, Studio, etc.) Installation and Access: Snap and Enterprise Editions-Key Terminology: Event Logs, Activities, Cases, Timestamps.

UNIT II DATA INGESTION AND MODELING **6**

Data Sources and Integration Options (Databases, SAP, CSVs), Creating Data Models: Event Collection-Table Creation, Joins, Event Log Configuration and Case Mapping, Data Transformation using PQL (Process Query Language)-Best Practices in Event Data Preparation.

UNIT III ANALYSIS AND DASHBOARDS **6**

Creating and Customizing Analyses-KPIs, Charts-Tables in Filters, User Interaction Tools, Advanced PQL Functions for Process KPIs, Process Explorer and Conformance Checking, Performance Optimization with Explain Plan

UNITIV ACTION ENGINE AND AUTOMATION **6**

Introduction to Action Engine-Creating and Managing Action Flows-Condition, Based Alerts and Automation, Integration with External Systems (Slack, Email, SAP) Security Features and Access Control, Use Cases: Procurement, Order-to-Cash, Customer Support.

UNIT V ADVANCED TOPICS AND CASE STUDIES **6**

Root Cause Analysis and Bottleneck Detection, Variant Analysis and Rework Identification-Apps and App Store, Real Time Monitoring and Custom Apps, Case Studies: E-Commerce-Healthcare, Banking, Capstone Mini Project Discussion

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Create a data model by uploading CSV files into Snap.
2. Define case ID, activity, and timestamp fields to generate an event log.
3. Build a dashboard showing key process KPIs such as throughput time and variant frequency.
4. Use Process Explorer to visualize and analyse process variants.
5. Write PQL queries to filter and segment cases based on performance.
6. Create an Action Flow to notify when SLA is violated.
7. Perform conformance checking between the ideal model and actual process execution.

TOTAL: 30

TEXT BOOKS:

1. Steve Kaelble, Process Mining for Dummies, Celonis Special 2nd Edition, 2022.
2. Wil van der Aalst, Process Mining: Data Science in Action, Springer, Second Edition, 2016.

REFERENCE BOOKS:

1. Richard Aragon, Process Mining: Discovering and Improving Business Processes, Kindle Edition, 2024.
2. Thomas Hildebrandt, et al., Handbook of Process Automation and Process Control, Springer Vieweg, First Edition, 2020.
3. Jan Mendling, Metrics for Process Models: Empirical Foundations of Verification, Error Prediction, and Guidelines for Correctness, Springer, First Edition, 2008.

WEB URLS:

1. www.processmining.org
2. https://www.uipath.com/community-blog/tutorials/process-mining-demystified-step-by-step-guide-to-taking-action
3. https://learn.microsoft.com/en-us/power-automate/process-mining-tutorial
4. www.celonis.com/academic-alliance/
5. https://www.coursera.org/learn/process-mining

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	3	2	1	-	-	-	2	2	-	2	-	2
CO5	3	3	2	1	-	-	-	2	2	-	2	-	2
AVG	**2.8**	**2.2**	**1.2**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**2**

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

25BTAD5E42G IMAGE AND VIDEO ANALYTICS (THEORY & LABORATORY) 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. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

WEB REFERENCES:

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’S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO 11	PS O1	PSO 2
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-V

25BECY5E43 NETWORK SECURITY (THEORY & LABORATORY) 4H-3C

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

End Semester Exam:3 Hours

PREREQUISITE: Computer Networks

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the concept of authentication protocols and digital signatures.
- Learn various methods and protocols to understand the cryptography.
- Learn various network security attacks.

COURSE OUTCOMES:

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

- Interpret the computer network security concepts and principles. **K2**
- Apply authentication protocols, key exchange mechanism and digital certificates for secure communication **K2**
- Make use of cryptographic algorithms and hashing techniques for message authentication **K3**
- Identify the threats and attacks in middle ware and web applications **K3**
- Build network defence tools using security protocols **K3**

UNIT I FUNDAMENDALS OF NETWORKING SECURITY 6

Overview of networking security- Security Services -Confidentiality, Authentication, Integrity, Nonrepudiation, access Control - Availability and Mechanisms- Security Attacks -Interruption, Interception, Modification and Fabrication.

UNIT II AUTHENTICATION AND SECURITY 6

Authentication overview - Authentication protocols - Authentication and key establishment – key exchange - mediated key exchange - User Authentication –password-based authentication - password security - Certificate Authority and key management - digital signatures – digital Certificates.

UNIT III PUBLIC-KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION6

Basics of cryptography -cryptographic hash functions - symmetric and public-key encryption - public key cryptography principles & algorithms - cipher block modes of operation - Secure Hash Functions – HMAC

UNIT IV SECURITY ATTACKS 6

Buffer overflow attacks & format string vulnerabilities - Denial-of-Service Attacks -Hijacking attacks: exploits and defenses - Internet worms – viruses – spyware –phishing – botnets - TCP session hijacking - ARP attacks - route table modification - UDP hijacking - man-in-the-middle attacks.

UNIT V IP SECURITY AND WEB SECURITY 6

Network defense tools: Firewalls, VPNs, Intrusion Detection, and filters - Email privacy: Pretty Good Privacy (PGP) and S/MIME - Network security protocols in practice - Introduction to Wireshark – SSL - IPsec, and IKE - DNS security- Secure Socket Layer (SSL) and Transport Layer Security (TLS) - Secure Electronic Transaction (SET)

TOTAL:30

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Using Wireshark explore the different layer protocol headers.
2. Demonstrate two different Certificates producing the same MD5 hash
3. Computing MACs, HASH and HMAC for messages
4. Implement and demonstrate Denial of service attacks (DoS) and DDoS
5. Implement the ARP attack and MITM
6. Explore and install Snort intrusion detection tool

TOTAL: 30

TEXT BOOKS:

1. Network Security Essentials (Applications and Standards) by William Stallings ,Pearson,2018
2. William Stallings and Lawrie Brown ,Computer Security: Principles and Practice" **,**Pearson, 2017

REFERENCES:

1. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech

2. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
3. A look back at Security Problems in the TCP/IP Protocol Suite, S. Bellovin, ACSAC 2004
4. Dafydd Stuttard and Marcus Pinto ,"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws",Wiley, 2011
5. Charlie Kaufman, Radia Perlman, and Mike Speciner,"Network Security: Private Communication in a Public World" ,Prentice Hall, 2002

WEB REFERENCES:

1. https://www.potaroo.net/t4/pdf/security.pdf
2. https://www.cisco.com/c/dam/global/fr_ca/training- Events/ pdfs/Introduction_to_Network_Security,pdf
3. http://williamstallings.com/NetworkSecurity/NetSec6e-Student/
4. https://www.beiruteyecenter.com/uploads/3794_1008_4334.pdf
5. https://www.cs.unibo.it/babaoglu/courses/security/resources/documents/Computer_Security_Principles_and_Practice_(3rd_Edition).pdf

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	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**	**1.25**	**1**	-	-	**2**	**2**	-	**2**	**2**	-

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

SEMESTER-V

25BECS5E44G	**IT INFRASTRUCTURE SERVICES I (IT NETWORKING AND CLOUD) (THEORY & LABORATORY)**	**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:

- Gain the fundamentals of IT Networking and cloud infrastructure management.
- Know the key features, functions, and administration tasks of various operating systems.
- Impart knowledge on virtualization concepts and security principles for real world problems.

COURSE OUTCOMES:

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

- Explain the fundamentals of computer networking and networking topologies. **K2**
- Illustrate proficiency in operating system concepts and system administration tasks across various platforms. **K2**
- Apply cloud computing models, services, and infrastructure management using popular cloud providers. **K3**
- Develop hands-on skills with virtualization tools for managing virtual machines and configuring network resources. **K3**
- Analyze the network security, cloud platform management, and deployment of basic applications. **K4**

UNIT I INTRODUCTION TO IT NETWORKING **6**

Networking Basics: Overview of computer networks and types: LAN, WAN, MAN-OSI Model: Layers and Functions-TCP/IP Protocol Suite-Basic Networking Concepts: IP Addressing, Subnetting, DNS, DHCP-Network Topologies: Star, Mesh, Ring, Bus-Introduction to Routing and Switching.

UNIT II BASICS OF OPERATING SYSTEM **6**

Operating Systems and System Administration: Types of operating systems: Windows, Linux, macOS-Key features of OS: File systems, User management, Security-Introduction to system administration tasks: Installing OS, managing users, basic troubleshooting.

UNIT III CLOUD, AND INFRASTRUCTURE MANAGEMENT **6**

Cloud Computing Basics: Overview of Cloud Computing: Types (Public, Private, Hybrid)-Cloud Service Models: IaaS, PaaS, SaaS-Introduction to Cloud Providers: AWS, Azure, Google Cloud-Basic cloud infrastructure management.

UNITIV INTRODUCTION TO VIRTUALIZATION **6**

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations. Compute Virtualization, Storage Virtualization Network Virtualization, Web Services.

UNIT V SECURITY OVERVIEW **6**

Physical Security- Account Security. SUID & SGID settings-File and Directory Permissions-Software Security: Performance monitoring and Tuning-Methods of Improving Performance-Swapping and Paging.

TOTAL: 30 Hours

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Configure IP addressing and subnetting on a simulated network.
2. Installation of Windows and Linux operating system.
3. Demonstrate cloud storage usage (S3 bucket creation in AWS or blob storage in Azure).
4. Deploy a simple web application using PaaS and SaaS platforms.
5. Installation and configuration of VirtualBox/VMware Workstation.
6. Create and configure a virtual machine with different operating systems.
7. Create secure passwords, enable multi-factor authentication on cloud accounts.

TOTAL: 30 Hours

TEXT BOOKS:

1. James Kurose & Keith Ross, ”Computer Networking: A Top-Down Approach” , 8th Edition, Pearson, 2020.
2. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne ,”Operating System Concepts”,

10th Edition, 2018.
3. Michael E. Whitman & Herbert J. Mattord ,"Principles of Information Security", 6th Edition, 2017.
4. Sjaak Laan, "IT Infrastructure Architecture: Infrastructure Building Blocks and Concepts",3rd Edition, 2017.

REFERENCE BOOKS:

1. Behrouz A. Forouzan,"Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.
2. Thomas Erl ,"Cloud Computing: Concepts, Technology & Architecture",1st Edition, Prentice Hall, 2013.
3. Andrew S. Tanenbaum , " Modern Operating Systems",4th Edition, Pearson, 2014.
4. Shakuntala Choudhary ,"IT Infrastructure and Its Management",1st Edition, 2015.
5. Service Support (IT Infrastructure Library Series), Office of Government Commerce, 3rd Edition, 2000.

WEB REFERENCES:

1. Cisco Networking Academy (https://www.netacad.com)
2. Microsoft Learn (https://learn.microsoft.com/en-us/training/)
3. AWS Training and Certification (https://aws.amazon.com/training/)

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	3	2	1	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	-	-	-	2	2	-	2	2	-
AVG	**2.8**	**2.2**	**1.5**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

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

25BECY5E45G CATALYST PRODUCT DEVELOPMENT (THEORY & LABORATORY) 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**:**

- Understand the fundamentals of the Catalyst Product Development.
- Develop applications using Apex, Visualforce, and Lightning components.
- Learn data modelling, security, logic, and automation tools.

COURSE OUTCOMES:

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

• Explain the architecture, data model, and development tools of the Cloud-based CRM solution platform	K2
• Apply data modeling techniques and declarative tools to configure Cloud-based CRM solution applications.	K3
• Develop Apex classes, triggers, and queries to implement business logic and data manipulation.	K3
• Analyze the use of automation tools and programmatic logic to meet business process requirements.	K4
• Analyze testing strategies and security controls in Cloud-based CRM solution to ensure robust application deployment.	K4

UNIT I INTRODUCTION TO CATALYST PRODUCT DEVELOPMENT AND PLATFORM FUNDAMENTALS 6

Catalyst Product Development Overview, Multitenant Architecture & Cloud Computing, MVC Architecture, Development Tools (Developer Console, VS Code, GitHub), Declarative vs Programmatic Development.

UNIT II DATA MODELING AND MANAGEMENT 6

Custom Objects and Fields, Relationships (Lookup, Master, Detail, Many to Many), Schema Builder, Field Types and Data Types, Validation Rules and Formula Fields.

UNIT III APEX PROGRAMMING BASICS **6**

Apex Class and Triggers, Data Types, Variables, and Operators, Control Flow Statements (if, switch, loops), SOQL and SOSL, DML Operations, Exception Handling

UNIT IV LOGIC AND PROCESS AUTOMATION **6**

Process Builder and Flows, Workflow Rules vs Triggers, Governor Limits and Best Practices, Apex Trigger Scenarios and Bulk, Safe Coding.

UNIT V USER INTERFACE AND TESTING **6**

Visualforce Basics and Lightning Components Overview, Aura vs LWC (Introductory level), Apex Testing and Code Coverage,Deployment Tools and Sandboxes, Security: CRUD/FLS, Sharing Rules.

TOTAL: 30 Hours

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Setup - Create a dev org, navigate UI, set up users and permissions
2. Data Modeling - Create objects, fields, relationships, schema builder
3. SOQL & SOSL - Write queries to fetch and manipulate data
4. Apex Basics - Write classes, methods, and control flow
5. DML Operations - Insert, update, delete records programmatically
6. Triggers - Develop before and after triggers with bulk-safe logic
7. Exception Handling - Handle exceptions and debug with logs

TOTAL: 30 Hours

TEXT BOOKS

1. Paul Battisson, “Mastering Apex Programming: A Salesforce Developer’s Guide to Advanced Techniques and Best Practices”, Second Edition, Packt Publishing, 2023.
2. Cihan Fethi Hizar, “Ultimate Salesforce LWC Developers’ Handbook”, First Edition, Independently Published, 2023.

REFERENCE BOOKS

1. Dan Appleman, “Advanced Apex Programming in Salesforce”, Latest Edition (2024), Salesforce Press.
2. Sharif Shaalan, “Learning Salesforce Development with Apex”, First Edition, Apress, 2023.
3. Paul Goodey, “Salesforce Data Architecture and Management”, First Edition, Packt Publishing, 2023.

WEB REFERENCES:

1. https://trailhead.salesforce.com
2. https://developer.salesforce.com/docs/atlas.enus.apexcode.meta/apexcode/apex_dev_guide.htm
3. https://developer.salesforce.com/docs/atlas.enus.pages.meta/pages/pages_intro.htm

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	3	2	1	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	-	-	-	2	2	-	2	2	-
AVG	**2.8**	**2.2**	**1.5**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

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

SEMESTER-V

25BECS5E46G BUSINESS ANALYSIS (THEORY & LABORATORY) 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**:**

- Understand the foundational concepts and role of a Business Analyst within the Salesforce ecosystem.
- Provide a comprehensive understanding of requirement gathering, process mapping, and stakeholder engagement.
- Explore various Salesforce tools used for designing business solutions and managing data effectively.

COURSE OUTCOMES:

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

• Infer the core responsibilities of a salesforce business analyst by exploring business analysis fundamentals along with the salesforce ecosystem	K2
• Model stakeholder-driven requirement gathering techniques by creating user stories with clear acceptance criteria.	K3
• Make use of business process mapping tools to represent current-state workflows along with proposed improvements.	K3
• Examine the salesforce data model using objects, relationships, flows, reports, or dashboards for effective data management.	K4
• Analyze agile collaboration practices to produce impactful business analysis deliverables with proper stakeholder communication.	K4

UNIT I BUSINESS ANALYSIS FUNDAMENTALS **6**

Introduction to Business Analysis – Role and Responsibilities of a Salesforce Business Analyst – Core Competencies: Analytical Thinking, Communication, Relationship Building – Understanding Stakeholders – Introduction to the Salesforce Ecosystem and Overview of Salesforce Products and Solutions.

UNIT II REQUIREMENTS GATHERING AND USER STORY DEVELOPMENT 6

Requirement Gathering Techniques – Conducting Stakeholder Interviews – Developing User Stories – Defining Acceptance Criteria – Creating Personas – Mapping User Journeys.

UNIT III BUSINESS PROCESS ANALYSIS AND DECLARATIVE AUTOMATION 6

Analyzing Current-State vs. Future-State Processes – Business Process Mapping Techniques – Creating Flowcharts and Diagrams – Identifying Improvement Opportunities – Introduction to Declarative Automation Features.

UNIT IV SALESFORCE DATA ANALYTICS WITH DECLARATIVE TOOLS 6

Understanding Salesforce Data Model – Standard and Custom Objects – Fields and Relationships – Report and Dashboard Fundamentals – Use of Declarative Tools: Flows, Validation Rules.

UNIT V AGILE COLLABORATION AND ML-BASED BUSINESS ANALYSIS 6

Working in Agile and Scrum Environments – Participating in Sprints and Stand-ups – Collaborating with Admins, Developers, and Product Owners – Preparing and Presenting Business Analyst Deliverables.

TOTAL: 30 Hours

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Exploring the Salesforce Ecosystem
2. Role Mapping and Stakeholder Analysis
3. Competency Mapping Activity
4. Requirement Elicitation via Interview Simulation
5. Developing User Stories and Acceptance Criteria
6. Salesforce Schema Builder Exploration
7. Report and Dashboard Creation

TOTAL: 30 Hours

TEXT BOOKS

1. Srini Munagavalasa, "The Salesforce Business Analyst Handbook: Proven Business Analysis Techniques and Processes for a Superior User Experience and Adoption", 1st Edition, Packt Publishing, 2022
2. Galit Shmueli, Peter C Bruce, Mia L Stephens, Muralidhara Anandamurthy & Nitin R Patel, "Machine Learning for Business Analytics: Concepts, Techniques & Applications", 4th Edition, Wiley, 2023.

REFERENCE BOOKS

1. Foster Provost & Tom Fawcett, "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking", 2nd Edition, O'Reilly, 2023.
2. Chirag Shah, "A Hands-On Introduction to Machine Learning", Cambridge University Press, 2023
3. Stuart J Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Prentice Hall, 2020

WEB REFERENCES:

1. www.trailhead.salesforce.com/content/learn/trails/get-started-as-a-salesforce-business-analyst
2. www.asana.com/resources/process-mapping
3. https://training.galaxyproject.org/training-material/topics/statistics/tutorials/intro-to-ml-with-r/tutorial.html

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	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	2	1	2	-	-	2	2	-	2	-	3
CO5	3	3	2	1	2	-	-	2	2	-	2	-	3
AVG	**2.8**	**2**	**1.5**	**1**	**2**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**3**

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

SEMESTER-V

25BTAD5E47G DEEP LEARNING 4H-3C

(THEORY & LABORATORY)

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 is to

- Provide 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 6

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 – Feed forward neural networks – Output functions and loss functions – Back propagation – Activation function – Information content, Entropy, cross entropy

UNIT II OPTIMIZATION TECHNIQUES 6

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 6

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

UNIT IV CONVOLUTIONAL NEURAL NETWORKS 6

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 6

Language modeling – 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: 30

(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.

REFERENCES:

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.

WEB REFERENCES:

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'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
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

25BTAD5E48G AUGMENTED REALITY AND VIRTUAL REALITY (THEORY & LABORATORY) 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

- 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

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

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 **6**

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)

REFERENCES:

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.

WEB REFERENCES:

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	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

25BECY5E49 BIOMETRIC SECURITY (THEORY & LABORATORY) 4H-3C

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

PREREQUISITE: Basics of Cyber Security

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the fundamental approaches for biometric systems.
- Gain knowledge about biometric face and iris recognition.
- Learn about various attacks in biometric security systems.

COURSE OUTCOMES:

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

- Illustrate the design cycle of biometric systems **K2**
- Interpret the face recognition and detection techniques **K2**
- Develop algorithms for feature recognition using Iris verification **K3**
- Classify acquisition and processing architecture from multiple biometric sources **K3**
- Analyze security process in a biometric system **K4**

UNIT I INTRODUCTION TO BIOMETRICS 6

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

UNIT II FACE RECOGNITION 6

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

UNIT III IRIS RECOGNITION 6

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

UNIT IV MULTI-BIOMETRICS **6**

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

UNIT V SECURITY OF BIOMETRIC SYSTEMS **6**

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

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Perform Image transformation process
2. Perform Image enhancement process
3. Simulate Image segmentation
4. Simulate Morphological image processing
5. Implement the Feature extraction and recognition
6. Simulate Hand Geometry

TOTAL: 30

TEXT BOOKS:

1. Marcus Smith, Monique Mann and Gregor Urbas, Biometrics, Crime and Security, Taylor and Francis, First Edition, 2018.
2. Anil K Jain,Arun A Ross and Karthik Nanda kumar,"Introduction to Biometrics", Springer-Verlag New York Inc., 2014.

REFERENCES:

1. Ravindra Das, The Science of Biometrics Security Technology for Identity Verification, Taylor and Francis, First Edition,2018
2. Samir Kumar Bandyopadhyay and Kunal Das ,Biometric Iris Recognition",CRC Press, 2017
3. Zhihua Zhou and Yong Xu ,"Face Recognition: From Theory to Applications", Springer, 2018
4. Nalini K. Ratha, Venu Govindaraju, and Sharath Pankanti,"Multibiometrics for Human Identification",Springer,2006
5. Tanya Ignatenko, Venu Govindaraju ,"Biometric System Security: Advances and Challenges", Springer, 2018

WEB REFERENCES:

1. www.m2sys.com/blog/education
2. www.idexbiometrics.com/what-does-the-future-hold-for-biometric-security-technology/

3. www.link.springer.com/chapter/10.1007/978-1-4471-0997-6_13
4. www.users.ece.cmu.edu/~jzhu/class/18200/F06/L10A_Savvides_Biometrics.pdf
5. www.slideshare.net/slideshow/biometric-systems-and-security/83243838

CO, PO, PSO Mapping

CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO 11	PSO1	PSO 2
CO1	2	1	-	-	-	-	-	2	2	-	2	3	-
CO2	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	**2.6**	**1.8**	**1.3**	**1**	-	-	-	**2**	**2**	-	**2**	**3**	-

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

SEMESTER-V

25BTAD5E410G INTEGRATION PLATFORM AS SERVICE (THEORY & LABORATORY) 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**:**

- Understand the fundamentals of enterprise integration and the evolution toward iPaaS.
- Learn about cloud service models and RESTful API design in the context of integration.
- Design and implement integration flows using pre-built connectors and real-time triggers.

COURSE OUTCOMES:

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

- Relate enterprise integration and iPaaS fundamentals. **K2**
- Explain cloud models and secure API integration. **K3**
- Design integration flows using connectors and data formats. **K3**
- Apply data transformation and message queuing **K4**
- Correlate deployment, CI/CD, monitoring, and security in iPaaS. **K4**

UNIT I INTRODUCTION TO INTEGRATION AND IPAAS **6**

Introduction to Enterprise Integration, Traditional integration approaches vs. Cloud integration, iPaaS Overview – Definition and Architecture, Benefits of iPaaS over on-premise integration, iPaaS use cases: Data integration, B2B integration, Application integration, Key iPaaS vendors: MuleSoft, Dell Boomi, Jitterbit, Informatica,& SnapLogic.

UNIT II CLOUD SERVICES AND APIS IN IPAAS **6**

Types of cloud services: SaaS, PaaS, IaaS, API-first design principles, RESTful APIs – Methods, URI, Headers, Status Codes, SOAP vs REST, Authentication mechanisms: OAuth 2.0, Basic Auth, API Keys, Introduction to API Gateways.

UNIT III DESIGNING INTEGRATION FLOWS AND CONNECTORS **6**

Integration flows: Trigger, processing, response, Event-driven vs scheduled integrations, Using pre-built and custom connectors (Salesforce, SAP, Database), Data formats: JSON, XML, CSV, EDI, Error handling and logging.

UNITIV DATA MAPPING AND TRANSFORMATION **6**

Data integration concepts, Mapping and transformation techniques, Flat file and hierarchical transformations, Data enrichment and cleansing, Message Queues and Publish/Subscribe patterns.

UNIT V MONITORING, DEPLOYMENT AND SECURITY **6**

Deployment models: Cloud, Hybrid, On-premise agents, Version control and CI/CD in iPaaS, Monitoring and analytics, Security in integration – Data encryption, access control, Best practices in iPaaS implementations.

TOTAL: 30 Hours

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Setup and Explore iPaaS Trial Environment
2. Build and Deploy a Hello World Integration Flow
3. Consume Data from a Public REST API
4. Develop Scheduled Integration for Data Sync
5. Perform Data Transformation: JSON to XML
6. Implement CI/CD Pipeline with Git Integration
7. Enable HTTPS and Secure Data Transmission

TOTAL: 30 Hours

TEXT BOOKS

1. Gina Smith & Mark Hornick, "Mastering MuleSoft Anypoint Platform: Integration and API-led Connectivity", First Edition, O'Reilly Media, 2024.
2. Rahul Sharma, "Dell Boomi Cookbook: Recipes for Data, B2B, and Application Integration", First Edition, Packt Publishing, 2023.
3.

REFERENCE BOOKS

1. Phil Parker, "The 2025–2030 World Outlook for Cloud-Based Integration Platform as a Service (iPaaS)", First Edition, ICON Group International, 2024
2. Gregor Hohpe & Bobby Woolf, "Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions", First Edition, Addison-Wesley, 2003.
3. Ugochukwu Ezenduka, "The Comprehensive Guide to iPaaS: Definitions, Benefits & Examples", First Edition, Exalate, updated 2025.

WEB REFERENCES:

1. https://developer.mulesoft.com/tutorials-and-howtos/
2. https://boomi.com/blog/get-trained-and-certified-on-the-boomi-platform-anytime-anywhere-for-free/
3. https://www.enterpriseintegrationpatterns.com/

CO, PO, PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	2	2	-
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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

25BECY5E411 MLOps 4H-3C

(THEORY & LABORATORY)

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

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Apply MLOps concepts to real-world machine learning projects.
- Interpret the machine learning workflows efficiently to handle large-scale data and models.
- Model the security of machine learning systems and compliance.

COURSE OUTCOMES:

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

- Infer MLOps principles, methodologies, and best practices for model reliability. **K2**
- Illustrate variety of MLOps tools and technologies to handle security in ML. **K2**
- Develop machine learning models to manage production environments. **K3**
- Apply machine learning validation systems for measuring the performance. **K3**
- Build the innovative solutions to reduce the risk in machine learning models. **K3**

UNIT I INTRODUCTION TO MLOPS 6

Overview of MLOps: Definition, importance, and benefits.- Understanding the machine learning lifecycle.- Challenges in deploying and managing machine learning models.- Role of MLOps in addressing these challenges.

UNIT II DATA MANAGEMENT FOR MLOPS 6

Data collection, preprocessing, and exploration for machine learning.- Data versioning and management strategies.- Data quality assessment and monitoring techniques.- Handling large-scale and streaming data for machine learning applications.- Tools and platforms.

UNIT III MODEL DEVELOPMENT AND DEPLOYMENT 6

Model development best practices: feature engineering, model selection, and evaluation.- Techniques for model training at scale.- Model versioning and artifact management.- Containerization and orchestration of machine learning models.- Continuous integration and deployment (CI/CD) pipelines for ML models.

UNIT IV MONITORING AND PERFORMANCE OPTIMIZATION 6

Importance of monitoring in MLOps: detecting concept drift, data drift, and model degradation.- Key performance metrics for evaluating machine learning models.- Techniques

for model performance optimization and tuning.- A/B testing and experimentation for model validation and improvement.- AutoML and hyperparameter optimization tools for efficiency.

UNIT V SCALABILITY, SECURITY, AND GOVERNANCE 6

Scalability considerations in MLOps: horizontal and vertical scaling.- Security best practices for protecting sensitive data and models.- Regulatory compliance and governance requirements in MLOps.- Ethical considerations in machine learning deployment.- Case studies.

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Develop an end-to-end machine learning pipeline that encompasses data collection, preprocessing, model training, evaluation, deployment, and monitoring.
2. Implement data versioning and management strategies using tools like Git-LFS or DVC (Data Version Control) to track changes to datasets, ensure reproducibility, and facilitate collaboration.
3. Containerize machine learning models using Docker and deploy them on Kubernetes for efficient orchestration and scalability.
4. Set up a CI/CD pipeline to automate testing, validation, and deployment of machine learning models, integrating tools like Jenkins or GitLab CI.
5. Implement security best practices to protect sensitive data and models, including encryption, access controls, and secure APIs.
6. Analyze real-world case studies and examples illustrating successful implementation of MLOps practices, identifying key lessons learned and best practices.

TOTAL: 30

TEXT BOOKS:

1. Emmanuel Ameisen -Building Machine Learning Powered Applications: Going from Idea to Product, Latest Edition, O'Reilly, 2020.
2. Andriy Burkov -Machine Learning Engineering, Latest edition, True positive inc, 2020

REFERENCES:

1. Hannes Hapke and Catherine Nelson, Building Machine Learning Pipelines: Automating Model Life Cycles with TensorFlow, O'Reilly Media, 2021.
2. Mark Treveil, MLOps: Continuous Delivery and Automation Pipelines in Machine Learning, Packt Publishing, 2020.
3. Andriy Burkov, Machine Learning Engineering: A Handbook for Systems Development, True Positive Inc, 2020.

WEB REFERENCES:

1. https://neptune.ai/blog/mlops
2. https://www.modelbit.com/blog/leading-mlops-tools-landscape-in-2024-complete-overview-and-guide

3. https://ml-ops.org/content/mlops-principles
4. https://mahajan-sameer.medium.com/mlops-series-introduction-to-mlops-data-drift-concept-drifts-and-how-to-handle-them-in-ml-e3821e05f948
5. https://www.arrikto.com/mlops-explained/

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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

25BECS5E412G ADVANCED NETWORKING AND AUTOMATION (THEORY & LABORATORY) 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**:**

- Understand the fundamental concepts of computer networks, OSI and TCP/IP models, and network addressing.
- Explain the functioning of switches, VLANs, and Layer 2 protocols for efficient data link layer communication.
- Demonstrate knowledge of IP routing methods and the implementation of core network services.
- Identify basic network security mechanisms and access control features in enterprise networks.

COURSE OUTCOMES:

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

- Explain fundamental networking concepts, network devices, addressing schemes **K2**
- Apply subnetting techniques, static and dynamic routing protocols and implement IPv6 addressing. **K3**
- Experiment with VLANs and static routing to enable communication across LANs using appropriate CLI tools. **K3**
- Apply NAT, DHCP, ACLs, wireless security, and port security to enhance network functionality and security. **K3**
- Analyze Layer 2 security threats, cloud/virtualization technologies, and automation concepts using tools like REST APIs and CLI scripting. **K4**

UNIT I INTRODUCTION TO NETWORKING & IP ADDRESSING 6

Definition and Types of Networks, Network Topologies, Network Devices (Routers, Switches, APs, Firewalls, etc.), Broadcast and Collision Domains, MAC Address, Ethernet & Cable Types (UTP, STP, Fiber), Communication Modes (Simplex, Half/Full Duplex), OSI and TCP/IP Models. IP Addressing Basics: IPv4 Addressing, Subnet Masks, Classes, Public/Private.

UNIT II SUBNETTING, ROUTING & IPV6 6

Subnetting Concepts, VLSM and CIDR, Summarization, IPv6 Addressing and Types, ICMPv6 and NDP, Routing Fundamentals, Static and Dynamic Routing, Routing Protocols: OSPFv2/v3.

UNIT III SWITCHING, VLANS & SPANNING TREE **6**

Switching Concepts and MAC Learning, VLANs and Inter, VLAN Routing, VLAN Tagging, Trunks, and DTP, Discovery Protocols: CDP, LLDP, Ether Channel & LACP/PAgP, STP & RSTP Concepts.

UNITIV WIRELESS, NAT, ACLS &NETWORK SERVICES **6**

Wireless Concepts and Architectures, AP Modes and WLAN Security, DHCP Configuration and DORA Process, ACLs: Standard/Extended, NAT & PAT, FHRP, Syslog and SNMP.

UNIT V SECURITY, CLOUD, AUTOMATION & SDN **6**

Security Concepts (Threats, Firewalls, IPS, IDS), AAA and VPN, Layer 2 Security: DHCP Snooping, DAI, Port Security, Cloud Concepts and Architectures, Server Virtualization & Containers, Automation and Programmability.

TOTAL: 30 Hours

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Identify and connect network devices; Crimp and test Ethernet cables; Verify connectivity.
2. Perform subnetting (Class A, B, C); Allocate subnets to departments/branches.
3. Access devices via console; Explore CLI modes; Set hostname, passwords, and IP addresses.
4. Configure static routes using IPv4 and IPv6; Test end-to-end connectivity. Configure single-area OSPF; Verify routing tables and neighbour adjacencies.
5. Create VLANs for Data & Voice; Configure trunk ports; Implement router-on-a-stick.
6. Configure a DHCP server on a router; Verify address assignment using clients.
7. Create standard and extended ACLs; Apply and test filtering based on IP, port, or protocol

TOTAL: 30 Hours

TEXT BOOKS

1. Troy McMillan, Cisco Networking Essentials, 2nd Edition, Cisco Press/Wiley, 2015.
2. Wendell Odom, CCNA 200 301 Official Cert Guide, Volume 1 & 2, 2nd Edition, Cisco Press, 2019.

REFERENCES BOOKS

1. James Kurose F & Keith W Ross, Computer Networking: A Top-Down Approach, 8th Edition, Pearson, 2020.
2. Jason Gooley, Dana Yanch, Dustin Schuemann, John Curran, Cisco Software-Defined Networking (SDN) Solution Guide, 1st Edition, Cisco Press, 2020.
3. Jason Edelman, Scott Lowe, Matt Oswalt, Network Programmability and Automation: Skills for the Next-Generation Network Engineer, 1st Edition, O'Reilly Media, 2018.

WEBSITES

1. https://skillsforall.com
2. https://www.netacad.com
3. https://www.gns3.com
4. https://www.cisco.com
5. https://developer.cisco.com/
6. https://www.geeksforgeeks.org/network-automation-using-python/

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**	**1.2**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

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

SEMESTER-VI

25BTAD6E41G NATURAL LANGUAGE PROCESSING (THEORY & LABORATORY) 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: 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**
- Make use of pointers, structures, unions and arrays in C **K3**
- Apply evaluation strategies to assess the effectiveness and accuracy of NLP models in real-world scenarios. **K3**

UNIT I INTRODUCTION AND WORDS ANALYSIS 6

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 **6**

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 **6**

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 **6**

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 **6**

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

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement algorithms for text tokenization, including techniques such as word
2. tokenization, sentence segmentation, and stemming.
3. Develop language models using Ngrams and explore their application in predicting the next word in a sentence.
4. Implement POS tagging algorithms such as Hidden Markov Models (HMMs) or Maximum Entropy Markov Models (MEMMs) and evaluate their accuracy.
5. Design and implement NER systems to identify and classify named entities (e.g., persons, organizations, locations) in text data.
6. Explore syntactic parsing techniques such as constituency parsing or dependency parsing and analyze their performance on various text corpora.
7. Develop algorithms for WSD to determine the correct sense of ambiguous words in context and evaluate their effectiveness.
8. 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.

REFERENCES:

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.

WEB REFERENCES:

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	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

25BTAD6E42G GENERATIVE ARTIFICIAL INTELLIGENCE (THEORY & LABORATORY) 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

(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.

REFERENCES:

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.

WEB REFERENCES:

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'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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-VI

25BECY6E43G MALWARE ANALYSIS 4H-3C

(THEORY & LABORATORY)

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

End Semester Exam:3 Hours

PREREQUISITE: Principles of Operating Systems

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Learn the fundamentals of malware, types and its effects
- Identify and analyze the malware types by static analysis and dynamic analysis
- Know detection, analysis, understanding, controlling, and eradication of malware

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**
- Apply the enumeration and vulnerability analysis methods in ethical hacking **K3**
- 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 AND BASIC ANALYSIS 6

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots

UNIT II ADVANCED STATIC ANALYSIS 7

The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

UNIT III ADVANCED DYNAMIC ANALYSIS 7

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, API calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion

techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching

UNIT IV MALWARE FUNCTIONALITY **5**

Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection

UNIT V ANDROID MALWARE ANALYSIS **5**

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Experiment on Sandboxing Malware and Gathering Information from Runtime Analysis
2. Set up an Experiment on Portable Executable (PE32) File Format
3. Apply ProGuard to an Obfuscation APK
4. Install MobSF to identify potential code vulnerabilities
5. Install APKTool for decompiling and recompiling APK files
6. Experiment on Malware traffic analysis for a scenario

TOTAL: 30

TEXT BOOKS:

1. Dylan Barker, “Malware Analysis Techniques”, Packt Publishing, 2021.
2. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O’Reilly, 2015.
3. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press,2012.
4. Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System”, Second Edition, Jones & Bartlett Publishers, 2009.

REFERENCES:

1. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis",CRC Press, Taylor & Francis Group, 2015.
2. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015.
3. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/introduction-to-malware-analysis/
2. https://www.udemy.com/course/basic-introduction-to-malware-analysis/

3. https://intellipaat.com/blog/malware-analysis/

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**2**

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

25BECY6E44G SOCIAL NETWORK SECURITY (THEORY & LABORATORY) 4H-3C

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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Develop semantic web related simple applications
- Explain Privacy and Security issues in Social Networking
- Discuss the prediction of human behavior in social communities

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Illustrate the Privacy and Security issues in Social Networking **K2**
- Identify key concepts and terminology related to social network security. **K3**
- Utilize visualization tools to present findings from social network data mining activities. **K3**
- Make use of security tools and techniques to assess and protect social networks. **K3**
- Analyze the prediction of human behavior in social communities **K3**

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING 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- Historical overview of privacy and security- Major paradigms for understanding privacy and security.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS 6

The evolution of privacy and security concerns with networked technologies- Contextual influences on privacy attitudes and behaviors- Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 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- Big data and Privacy.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 6

Understanding and predicting human behavior 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- What is Neo4j- Nodes- Relationships- Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 6

Understand the access control requirements for Social Network- Enforcing Access Control Strategies- Authentication and Authorization- Roles-based Access Control- Host- storage and network access control options- Firewalls- Authentication and Authorization in Social Network- Identity & Access Management- Single Sign-on- Identity Federation- Identity providers and service consumers- The role of Identity provisioning.

TOTAL:30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Design own social media application
2. Create a Network model using Neo4j
3. Read and write Data from Graph Database
4. Find "Friend of Friends" using Neo4j
5. Implement secure search in social media
6. Create a simple Security & Privacy detector

TOTAL:30

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x "Second Edition By Jérôme Baton, Rik Van Bruggen, Packt Publishing.
4. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES:

1. Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.
2. Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	1.25	1	-	-	-	2	2	-	2	-	2

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

25BECY6E45G WEB APPLICATION SECURITY (THEORY & LABORATORY) 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 TECHOLOGY

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Understand the fundamentals of web application security
- Focus on wide aspects of secure development and deployment of web applications
- Get an insight about Hacking techniques and Tools

COURSE OUTCOMES:

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

- Interpret the basic concepts of web application security and its necessity **K2**
- Illustrate the process for secure development and deployment of web applications **K2**
- Make use of vulnerability assessment and penetration testing tools **K3**
- Apply hacking techniques and tools for social engineering applications **K3**
- Develop Secure Web Applications that use Secure APIs **K3**

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 6

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

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT 6

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

UNIT III SECURE API DEVELOPMENT 6

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

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 6

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

UNIT VHACKING TECHNIQUES AND TOOLS 6

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

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Install wireshark and explore the various protocols
   a) Analyze the difference between HTTP vs HTTPS
   b) Analyze the various security mechanisms embedded with different protocols.
2. Identify the vulnerabilities using OWASP ZAP tool
3. Create simple REST API using python for following operation
   a) GET
   b) PUSH
   c) POST
   d) DELETE
4. Install Burp Suite to do following vulnerabilities:
   a) SQL injection
   b) cross-site scripting (XSS)
5. Attack the website using Social Engineering method

TOTAL: 30

TEXT BOOKS:

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

REFERENCES:

1. Ravi Das and Greg Johnson, Testing and Securing Web Applications, Taylor & Francis Group, LLC, 2021.
2. Prabath Siriwardena, Advanced API Security, Apress Media LLC, USA, 2020.
3. Malcom McDonald, Web Security for Developers, No Starch Press, Inc, 2020.

WEB REFERENCES:

1. https://www.geeksforgeeks.org/securing-web-applications/
2. https://www.invicti.com/blog/web-security/getting-started-web-application-security/
3. https://www.synopsys.com/glossary/what-is-web-application-security.html

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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**	**2**	**1**	**-**	-	-	-	**2**	**2**	-	**2**	-	**2**

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

SEMESTER-VI

25BTAD6E46G ROBOTIC PROCESS AUTOMATION (THEORY & LABORATORY) 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: Operating Systems

(i) THEORY

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.

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

REFERENCES:

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.

WEB REFERENCES:

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'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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-VI

25BTAD6E47G NoSQL DATABASES 4H-3C

(THEORY & LABORATORY)

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 NoSQL data.
- 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

REFERENCES:

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

WEB REFERENCES:

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'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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 - Low, 2 - Medium, 3 - High, '-' - No Correlation

SEMESTER-VI

25BECY6E48G QUANTUM COMPUTING (THEORY & LABORATORY) 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 student 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", FirstEdition (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)

REFERENCES:

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.

WEB REFERENCES:

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	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

25BECY6E49 SOFTWARE DEFINED NETWORKS (THEORY & LABORATORY) 4H-3C

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

PREREQUISITE: Computer Networks

(i) THEORY

COURSE OBJECTIVES:

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

- Learn the SDN Architecture, Data plane, Control plan and Application plan.
- Infer knowledge on Network Function Virtualization (NFV) Support and benefits.
- Study industrial deployment use-cases of SDN and NFV.

COURSE OUTCOMES:

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

- Outline the key benefits of SDN by separation of data and control planes. **K2**
- Identify the functions of data plane and control plane. **K3**
- Build network applications using SDN. **K3**
- Analyze Network Functions Virtualization roles in SDN. **K4**
- Examine the functionalities of SDN and NFV use cases. **K3**

UNIT I SDN: INTRODUCTION 6

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLANE 6

Data Plane functions and protocols – Open Flow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, Open Day light, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS **6**

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION **6**

Network Virtualization - Virtual LANs – Open Flow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V NFV FUNCTIONALITY **6**

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration- NFV Use cases – SDN and NFV

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Setup your own virtual SDN lab
    - Virtualbox/Mininet Environment for SDN - http://mininet.org
    - https://www.kathara.org
2. Setup your own Virtual SDN Lab using GNS3
3. Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT.
4. Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering and Firewall.
5. Create a simple end-to-end network service with two VNFs using vim-emu (https://github.com/containernet/vim-emu)
6. Install OSM, onboard and orchestrate network service.

TOTAL: 30

TEXT BOOKS:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.
2. Bruce Davie, Carmelo Cascone, Larry Peterson,"Software-Defined Networks", Systems Approach, LLC,2021.

REFERENCES:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Elsevier Science, 2016.

2. Thomas Nadeau, Ken Gray,"Sdn: Software Defined Networks: An Authoritative Review of Network Programmability Technologies",O'Reilly Media,2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.

WEB REFERENCES:

1. https://opennetworking.org/sdn-resources/sdn-learning-resources/
2. https://www.electronics-notes.com/articles/connectivity/data-networks/sdn-what-is-it-basics-technology.php
3. https://www.coursera.org/learn/sdn

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	3	2	1	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	-	-	-	2	2	-	2	2	-
AVG	**2.8**	**2.2**	**1**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**

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

25BECS6E410G IT INFRASTRUCTURE SERVICES II (THEORY & LABORATORY) 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

- Understand the fundamentals of networking and various network automation skills.
- Gain the knowledge of database management systems and IT Service management.
- Impart knowledge of cloud infrastructure management and cloud service provider.

COURSE OUTCOMES:

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

- Interpret the fundamentals of computer networking, including types, protocols, and network topologies. **K2**
- Apply knowledge on network protocols and automation tools. **K3**
- Build relational and NoSQL databases using appropriate database models and query languages. **K3**
- Develop skills in IT service management. **K3**
- Make use of cloud computing models, services, and infrastructure management for real time applications. **K3**

UNIT I NETWORK PROTOCOLS AND SERVICES **6**

Networking Basics: Overview of computer networks and types: LAN, WAN, MAN-OSI Model: Layers and Functions-TCP/IP Protocol Suite-Basic Networking Concepts: IP Addressing, Subnetting, DNS, DHCP-Network Topologies: Star, Mesh, Ring, Bus-Introduction to Routing and Switching-Remote Access Server and Client, Remote Desktop Protocols.

UNIT II NETWORK AUTOMATION **6**

Introduction to SDN – Control and data planes- centralized and distributed. Network topologies and implementation in SDN, Open Flow Protocols – NEWS Bound Interfaces. Fundamentals of SD-WAN-SD-WAN: Edge Devices, Gateway Controllers, Configurations and Benefits.

UNIT III DATABASE SYSTEMS **6**

Fundamentals: Definition- importance-applications-Database Terminology-Relational Database Management Systems (RDBMS): Relational model-SQL (Structured Query Language)-Database design and normalization-NoSQL Database Management Systems: models, query languages-Database design and denormalization. Relational Database Management Systems-Emerging Trends in Database Systems: Cloud database, Graph databases.

UNIT IV IT SERVICE MANAGEMENT **6**

Support Categories: Service desk-Command Centres-Touch support-Remote Support-Tools-Alert and Event Management-Service Management-Job Scheduling-Process Management (ITSM)-ITSM Incident Management- Service request-Change Management-Problem Management-Reports.

UNIT V CLOUD AND INFRASTRUCTURE MANAGEMENT **6**

Cloud Computing Basics: Overview of Cloud Computing: Types (Public, Private, Hybrid)-Cloud Service Models: IaaS, PaaS, SaaS-Introduction to Cloud Providers: AWS, Azure, Google Cloud-Basic cloud infrastructure management.

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Configure IP addressing and subnetting on a simulated network.
2. Configuration and Troubleshooting TCP/IP with Administrative Commands.
3. Design and Implementation of Relational Database Using SQL
4. Handling IT Incidents using Service Management Tools.
5. Demonstrate cloud storage usage (S3 bucket creation in AWS or blob storage in Azure).
6. Deploy a simple web application using PaaS and SaaS platforms.
7. Create secure passwords, enable multi-factor authentication on cloud accounts.

TOTAL: 30

TEXT BOOKS:

1. "Security Risk Management: Building an Information Security Risk Management Program from the Ground Up" by Evan Wheeler (2020).
2. "The Basics of IT Audit: Purposes, Processes, and Practical Information" by Stephen D. Gantz (2022).

REFERENCES:

1. "Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis" by Mark Talabis, Jason Martin, Shayan Bashar, and Manu Jose (2021)
2. "Security Risk Assessment and Management: A Professional Practice Guide for Protecting Buildings and Infrastructures" by Betty E. Biringer, Rudolph V. Matalucci, Sharon L. O'Connor (2022)
3. "IT Security Risk Control Management: An Audit Preparation Plan" by Raymond Pompon (2023)

WEBSITES:

1. https://www.healthit.gov/topic/privacy-security-and-hipaa/security-risk-assessment-tool

2.https://docs.servicenow.com/bundle/washingtondc-governance-risk-compliance/page/product/grc-risk/concept/advanced-risk-assessment.html

CO, PO, PSO Mapping:

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	3	2	1	-	-	-	1	1	-	2	-	2
CO5	3	3	2	1	-	-	-	1	1	-	2	-	2
AVG	**2.8**	**2.2**	**1.5**	**1**	-	-	-	**1**	**1**	-	**2**	-	**2**

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

25BECY6E411G ENGINEERING SECURE SOFTWARE SYSTEMS (THEORY & LABORATORY) 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:
- Know the principles of secure software design and need for software security.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

COURSE OUTCOMES:

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

- Infer vulnerabilities related to memory attacks. **K2**
- Interpret the extent of risks in the risk management cycle. **K2**
- Apply the security principles in software development. **K3**
- Identify testing techniques related to software security during the testing phase of software development. **K3**
- Make use of tools for securing a software system. **K3**

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS **6**

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory Based Attacks: Low-Level Attacks against Heap and Stack - Defense Against Memory-Based Attacks

UNIT II SECURE SOFTWARE DESIGN **7**

Requirements Engineering for secure software - SQUARE process Model – Requirement elicitation and prioritization- Isolating the Effects of Untrusted Executable Content – Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

UNIT III SECURITY RISK MANAGEMENT **5**

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

UNIT IV SECURITY TESTING **8**

Traditional Software Testing – Comparison - Secure Software Development Life Cycle – Risk Based Security Testing – Prioritizing Security Testing with Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client-Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing

UNIT V SECURE PROJECT MANAGEMENT **4**

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like Kali Linux.
5. Develop and test the secure test cases
6. Penetration test using kali Linux

TOTAL: 30

TEXT BOOKS:

1. Erik Fretheim, Marie Deschene, “Secure Software Systems’, Jones & Bartlett Learning, 2023.
2. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
3. Evan Wheeler, “Security Risk Management: Building an Information Security Risk, Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
4. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006.

REFERENCES:

1. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
2. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
3. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012.
4. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.

WEB REFERENCES:

1. https://study.com/academy/lesson/secure-software-definition-characteristics.html
2. https://www.geeksforgeeks.org/what-is-software-security-definition-and-best-practice/

CO, PO, PSO Mapping:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	2	3	-
CO2	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	-
CO	**2.6**	**2**	**1**	**-**	-	-	-	**2**	**2**	-	**2**	**3**	-

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

25BECS6E412G GAME THEORY 4H-3C
(THEORY & LABORATORY)

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.

REFERENCES:

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.

WEB REFERENCES:

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	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

25BTAD7E41G AI IN EDGE COMPUTING (THEORY & LABORATORY) 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

(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

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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.

REFERENCES:

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.

WEB REFERENCES:

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'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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 - Low, 2 - Medium, 3 - High, '-' - No Correlation

25BECS7E42G **3D PRINTING AND DESIGN (THEORY & LABORATORY)** **4H-3C**

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

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students 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 of modeling 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 APPLICATIONS **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

REFERENCES:

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

WEB REFERENCES:

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	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

25BECY7E43 FIREWALL AND INTRUSION DETECTION SYSTEMS (THEORY & LABORATORY) 4H-3C

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

End Semester Exam:3 Hours

PREREQUISITE: COMPUTER NETWORK

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Provide an in-depth understanding of intrusion detection systems (IDS) and their role in network security
- Equip students with the skills to configure, deploy, and manage IDS tools
- Explore contemporary techniques and technologies used in intrusion detection and prevention

COURSE OUTCOMES:

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

- Infer basic concepts related to Intrusion Detection System **K2**
- Interpret the components of all intrusion detection systems **K2**
- Illustrate the different tiered architectures and its functionalities **K2**
- Summarize the characteristics and types of firewalls **K2**
- Identify the tools and approaches for anomaly detection and alert management **K3**

UNIT I – INTRODUCTION 6

Basic Concepts of Security- Introduction to Intrusions- Need of Intrusion Detection- Classification of Intrusion Detection Systems- Sources of Vulnerabilities- Attacks against various security objectives- countermeasures of attacks- Insider threats. Network Threats: Active/ Passive – Interference –Interception –Impersonation – Internal threats - Environmental threats - Threats to Server security.

UNIT II - INTRUSION DETECTION AND PREVENTION TECHNOLOGIES 6

Host-based intrusion detection system (HIDS)- Network-based IDS- Information Sources for IDS- Host and Network Vulnerabilities and Countermeasures. Intrusion detection techniques- misuse detection: pattern matching- rule-based and state-based anomaly detection: statistical based- machine learning based- data mining based hybrid detection.

UNIT III - IDS AND IPS ARCHITECTURE **6**

Tiered architectures, Single-tiered, Multi-tiered, Peer-to-Peer. Sensor: sensor functions, sensor deployment and security. Agents: agent functions, agent deployment and security. Manager component: manager functions, manager deployment and security. Information flow in IDS and IPS, defending IDS/IPS, Case study on commercial and open-source IDS. IDS Evaluation Metrics.

UNIT IV - ALERT MANAGEMENT AND CORRELATION DATA FUSION **6**

Alert correlation, Pre-process, Correlation Techniques, Post-process, Alert Correlation architectures. Cooperative Intrusion Detection, Cooperative Discovery of Intrusion chain, Abstraction-based Intrusion Detection, Interest-based communication and cooperation, agent-based cooperation.

UNIT V – FIREWALLS **6**

Firewalls: Characteristics, Types – Packet Inspection, VPN, SOHO, NAT Firewalls, Basing, DMZ,Forensics, Services and Limitations.

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Demonstrate intrusion detection system (ids) using any snort tool on IDS dataset. Calculate the IDS metrics for the Data Set.
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.
3. Study of different types of vulnerabilities for hacking a websites / Web Applications.
4. Automated Attack and Penetration Tools Exploring N-Stalker- a Vulnerability Assessment Tool
5. Study of Tools:
   - Windows XP Pro
   - Windows Server
   - nmap - multi-functional scanning and enumeration utility used to quickly gather info about network hosts (incl. their availability, ports, IP addresses, names, their OSs, services they run).
6. Study of Ehereal communication network

- ping
- YN Flood – DOS attack utility
- SMBDie – buffer overflow attack utility
- Ethereal - to analyze network traffic (generated by SMBDie)

TOTAL: 30

TEXT BOOKS:

1. C. Endorf, E. Schultz and J. Mellander, Intrusion Detection & Prevention, McGraw-Hill/Osborne , 2004
2. William Stallings, "Network Security Essentials Applications and Standards", Pearson Education, Fifth Edition, 2017

REFERENCES:

1. J. M. Kizza, Computer Network Security, Springer, 2009.
2. Chris Sanders and Jason Smith, Applied Network Security Monitoring: Collection, Detection, and Analysis, Syngress, 2013
3. William Stallings, Lawrie Brown, "Computer Security: Principles and Practice", Third Edition, 2015
4. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
5. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010

WEB REFERENCES:

1. https://cybersecurity.att.com/blogs/security-essentials
2. https://www.fortinet.com/resources/cyberglossary/intrusion-detection-system
3. https://www.cs.unibo.it/babaoglu/courses/security/resources/documents/Computer_Security_Principles_and_Practice_(3rd_Edition).pdf
4. https://download.e-bookshelf.de/download/0000/0028/43/L-G-0000002843-0002340348.pdf
5. https://owasp.org/www-community/Vulnerability_Scanning_Tools

CO, PO, PSO Mapping

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

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

SEMESTER-VII

25BECY7E44G CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES 4H-3C
(THEORY & LABORATORY)

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

End Semester Exam:3 Hours

PREREQUISITE: Computer Networks

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Understand the basics of Blockchain
- Learn Different protocols and consensus algorithms in Blockchain
- Learn the Blockchain implementation frameworks

COURSE OUTCOMES:

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

- Interpret the key concepts related to cryptocurrency and blockchain technologies **K2**
- Illustrate the concept of a public ledger supporting cryptocurrency transactions. **K2**
- Develop a simple blockchain-based application or cryptocurrency. **K3**
- Build a decentralized application that interacts with an Ethereum smart contract. **K3**
- Compare the security features of Proof of Work (PoW) versus Proof of Stake (PoS) consensus algorithms. **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. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

REFERENCES:

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 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”, Packt Publishing.

5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

WEB REFERENCES:

1. https://consensys.io/blockchain-use-cases/case-studies
2. https://www.ibm.com/blockchain/use-cases/
3. https://blockchain.gov.in/Home/CaseStudy?CaseStudy=PDS

CO, PO, PSO Mapping

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	2	3	-
CO2	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	**2.6**	**1.8**	**1.3**	**1**	-	-	-	**2**	**2**	-	**2**	**3**	-

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

SEMESTER-VII

25BECY7E45 SOFTWARE TESTING AND AUTOMATION (THEORY & LABORATORY) 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**:**

- Understand the basics of software testing and planning effectively.
- Focus on wide aspects of testing and understanding multiple facets of testing
- Get an insight about test automation and the tools used for test automation

COURSE OUTCOMES:

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

- Outline the basic concepts of software testing and the need for software testing. **K2**
- Utilize C constructs for finding solutions for computational problems **K3**
- Develop effective test cases that can uncover critical defects in the application. **K3**
- Apply advanced testing for Web and mobile application development. **K3**
- Experiment with Selenium and TestNG for software test Automation. **K3**

UNIT I FOUNDATIONS OF SOFTWARE TESTING **6**

Introduction to Manual Testing, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Agile Model, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II TEST PLANNING **6**

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION **6**

Test Objective Identification, Test Design Strategies, Boundary Value Analysis, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness,

Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS **6**

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V TEST AUTOMATION AND TOOLS **6**

Software test automation, Skills needed for automation – scope of automation, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the test cases for testing the e-commerce application
3. Develop the test plan and design the test cases for an inventory control system.
4. Test the performance of the e-commerce application.
5. Automate the testing of e-commerce applications using Selenium.
6. Mini Project:
   a) Build a data-driven framework using Selenium and TestNG
   b) Build Page object Model using Selenium and TestNG
   c) Build BDD framework with Selenium, TestNG and Cucumber

TOTAL: 30

TEXT BOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018.

REFERENCES:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
3. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106101163
2. https://www.simplilearn.com/tutorials/selenium-tutorial/selenium-automation-testing
3. https://testsigma.com/automated-testing

CO, PO, PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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-VII

25BECY7E46G MODERN CRYPTOGRAPHY (THEORY & LABORATORY) 4H-3C

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

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES:

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

- Learn how cryptographic algorithms and protocols work
- Build a Pseudorandom permutation and construct Basic cryptanalytic techniques
- Use the concepts of block ciphers and message authentication codes

COURSE OUTCOMES:

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

- Interpret the basic principles of cryptography and general cryptanalysis **K2**
- Illustrate the concepts of symmetric encryption and authentication **K2**
- Identify the uses of Message Authentication Codes **K3**
- Apply cryptographic algorithms to compose simple cryptographic solutions **K3**
- Make use of public key encryption, digital signatures, and key establishment **K3**

UNIT I INTRODUCTION **6**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II FORMAL NOTIONS OF ATTACKS **6**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPAand NM-CCA2, Inter-relations among the attack model

UNIT III RANDOM ORACLES **6**

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV BUILDING A PSEUDORANDOM PERMUTATION **6**

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V MESSAGE AUTHENTICATION CODES **6**

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme.

TOTAL: 30

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement Feige-Fiat-Shamir identification protocol.
2. Implement GQ identification protocol.
3. Implement Schnorr identification protocol.
4. Implement Rabin one-time signature scheme.
5. Implement Merkle one-time signature scheme.
6. Implement GMR one-time signature scheme.

TOTAL: 30

TEXT BOOKS:

1. Introduction to Modern Cryptography, 3rd Edition Katz, Jonathan and Lindell, Yehuda Hardcover, December 2020.
2. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, Second Edition, 2010.
3. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education, 2003.

REFERENCES:

1. Shaffi Goldwasser and Mihir Bellare, Lecture Notes on Cryptography, 2008.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd, Edition, 2006.

WEB REFERENCES:

1. https://www.tutorialspoint.com/cryptography/modern_cryptography.htm
2. https://www.geeksforgeeks.org/cryptography-tutorial/
3. https://www.w3schools.in/cyber-security/modern-encryption

CO, PO, PSO Mapping

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CO1	2	1	-	-	-	-	-	2	2	-	2	-	3
CO2	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	**2.6**	**1.8**	**1.3**	**1**	-	-	-	**2**	**2**	-	**2**	-	**3**

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