ACADEMIC REGULATIONS (BH23)
COURSE STRUCTURE AND
DETAILED SYLLABUS

Computer Science and Engineering
(Artificial Intelligence and Machine Learning)

B.Tech. Four Year Degree Course

(Applicable for the batches admitted from AY 2023-24 onwards)

VISHNU
UNIVERSAL LEARNING

BVRITH

BVRIT HYDERABAD College of Engineering for Women
(UGC Autonomous Institution | Approved by AICTE | Affiliated to JNTUH)
(NAAC Accredited – A Grade | NBA Accredited B.Tech. (EEE, ECE, CSE and IT))
Bachupally, Hyderabad -500 090
www.bvrithyderabad.edu.in

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BVRIT HYDERABAD College of Engineering for Women

VISION

To emerge as the best among the institutes of technology and research in the country dedicated to the cause of promoting quality technical education.

MISSION

At BVRITH, we strive to

- Achieve academic excellence through innovative learning practices.
- Enhance intellectual ability and technical competency for a successful career.
- Encourage research and innovation.
- Nurture students towards holistic development with emphasis on leadership skills, life skills and human values.

CORE VALUES

1. Holistic Development
2. Excellence in Education
3. Women Empowerment
4. Integrity
5. Social Responsibility
6. Accountability and Transparency
7. Freedom of Expression

Department of Computer Science and Engineering (Artificial Intelligence and Machine Learning)

VISION

Produce competent technocrats, researchers, and entrepreneurs in Artificial Intelligence & Machine Learning to build an ecosystem that significantly contributes to the nation.

MISSION

M1: To provide quality education to the students with emphasis on training related to latest technologies as per industrial needs

M2: To impart research culture, professional ethics and moral values to the students by committed and competent faculty striving for excellence.

M3: To inculcate a perceptive alacrity in students to identify real life problems, formulate strategies and evolve into contextually effective solutions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After 3 to 6 years of graduation, the graduates will be able to

PEO-1:Adapt emerging technologies to contribute to the technical innovations for the progressive development in their respective fields.

PEO-2:Productively engage in multidisciplinary research areas by applying the basic principles of engineering sciences.

PEO-3:Demonstrate strong technical skills to bring out novel designs/products to address social & environmental issues.

PEO-4:Exhibit professional attitude, teamwork and practice code of ethics

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PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO-1: Ability to apply learned skills to build optimized solutions pertaining to Computer & Communication Systems, Data Processing, and Artificial Intelligence.

PSO-2: Employ standard strategies and practices in project development using FOSS (Free & Open-Source Software).

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to

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

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

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

Academic Regulations (BH23) for B.Tech. Regular Students with effect from Academic Year 2023-24

The B.Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates, admitted to the programme and fulfill all the requirements for the award of the Degree.

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E&T)

BVRIT HYDERABAD College of Engineering for Women (Autonomous) – BVRITHCEW(A) offers 4 Year (8 Semesters) **Bachelor of Technology** (B.Tech.) Degree Programme, under **Choice Based Credit System** (CBCS) with effect from the Academic Year 2023-24 onwards, in the following branches of Engineering.

S. No.	Branch Code	Branch Name
1	02	Electrical and Electronics Engineering (EEE)
2	04	Electronics and Communication Engineering (ECE)
3	05	Computer Science and Engineering (CSE)
4	12	Information Technology (IT)
5	66	Computer Science and Engineering (AI & ML)

2.0 Eligibility for admission

2.1 Admission to the undergraduate (UG) Programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (TSEAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.2 The medium of instructions for the entire undergraduate programme in Engineering & Technology will be English only.

3.0 B.Tech. Programme structure

3.1 A student after securing admission shall complete the B.Tech. Programme in a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech. course. Each student shall secure 160 credits (with CGPA $\geq$ 5) required for the completion of the undergraduate programme and award of the B.Tech. degree.

3.2 UGC / AICTE specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations / norms, which are listed below.

3.2.1 Semester scheme

Each undergraduate programme is of 4 academic years (8 semesters) with the academic year divided into two semesters of 22 weeks (≥ 90 instructional days) each, each semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)' under **Choice Based Credit System** (CBCS) and **Credit Based Semester System** (CBSS) indicated by UGC, and curriculum / course structure as suggested by AICTE are followed.

3.2.2 Credit courses

All subjects / courses are to be registered by the students in a semester to earn credits which shall be assigned to each subject / course in an L : T : P : C (Lecture periods : Tutorial periods : Practical periods : Credits) structure based on the following general pattern.

- One credit for one hour / week / semester for theory / lecture (L) courses or tutorials.
- One credit for two hours / week / semester for laboratory/ practical (P) courses.

Courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab are mandatory courses. These courses will not carry any credits.

3.2.3 Subject / Course Classification

All subjects / courses offered for the undergraduate programme in E & T (B.Tech. degree programmes) are broadly classified as follows. The BVRITHCEW(A) has followed almost all the guidelines issued by AICTE / UGC.

S. No.	Broad Course Classification	Course Group /Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry Courses
2		ES – Engineering Sciences	Includes Fundamental Engineering Courses
3		HS – Humanities and Social sciences	Includes Courses related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core courses related to the parent discipline / department / branch of Engineering.
5	Elective	PE – Professional Electives	Includes elective courses related to the parent discipline / department / branch of Engineering.

6	Courses (EℓC)	OE – Open Electives	Elective offered by all the disciplines / departments / branches of Engineering.
7	Core Courses	Project Work	B.Tech. project or UG project or UG major Project or Project Stage I & II
8		Industry Training / Internship / Industry Oriented Mini-project / Mini- Project / Skill Development Courses	Industry Training / Internship / Industry Oriented Mini-Project / Mini-Project / Skill Development Courses
9		Real-time Research Project/ Field Based Project	Real-time Research Project / Field Based Project
10		Seminar	Seminar / Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
11	Minor courses	-	1 or 2 Credit Courses (subset of HS)
12	Mandatory Courses(MC)	-	Mandatory Courses (non-credit)

4.0 Course registration

4.1 The academic section of the college invites **'registration forms'** from students before the beginning of the semester through **'online registration'**, ensuring **'date and time stamping'.** The online registration requests for any **'current semester'** shall be completed before the commencement of SEEs (Semester End Examinations) of the **'preceding semester'**.

4.2 A student can apply for on-line registration by consulting Faculty Advisor / Counsellor / Head of the Department (HOD).

4.3 A student may be permitted to register for all the subjects / courses in a semester as specified in the course structure with maximum additional subject (s) / course (s) limited to 6 Credits (any 2 elective subjects), based on progress and SGPA / CGPA, and completion of the '**prerequisites'** as indicated for various subjects / courses, in the department course structure and syllabus contents.

4.4 Choice for '**additional subjects / courses'**, not more than any 2 elective subjects in any semester, must be clearly indicated.

4.5 If the student submits ambiguous choices or multiple options or erroneous entries during online registration for the subject (s) / course (s) under a given / specified course group / category as listed in the course structure, only the first mentioned subject /

course in that category will be taken into consideration.

4.6 Subject / course options exercised through online registration are final and cannot be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject / course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any inevitable or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within a week after the commencement of class-work for that semester.

4.7 Dropping of subjects / courses may be permitted, only after obtaining prior approval from the faculty counsellor and HOD **'within a period of 15 days'** from the beginning of the current semester.

4.8 **Open Electives:** The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by her own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses, etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat / should not match with any category (Professional Core, Professional Electives, Mandatory Courses, etc.) of subjects even in the forthcoming semesters.

4.9 **Professional Electives:** The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

5.0 Subjects / courses to be offered

5.1 An Elective Course may be offered to the students, only if a minimum of 30 students opt for it. The maximum strength of a section is limited to 75.

5.2 In case of options coming from students of other departments / branches / disciplines (not considering **open electives**), first priority shall be given to the student of the '**parent department'**.

6.0 Attendance requirements

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in mandatory courses like Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab) for that semester. Two periods of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject. **This attendance should also be included in the fortnightly upload of attendance to the Academic Section.**

6.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the Academic Council on genuine and valid

grounds, based on the student's representation with supporting evidence.

6.3 A stipulated fee shall be payable for condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in no case be condoned.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled, including all academic credentials (internal marks, etc.) of that semester. They will not be promoted to the next semester. They may seek re-registration for all those subjects registered in that semester, in which the student is detained, by seeking re-admission into that semester as and when offered; if there are any professional electives and / or open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the same set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7.0 Academic requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no.**6.**

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course, if the student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing **'C'** grade or above in that subject / course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-Time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if she (i) does not submit a report on Industry Oriented Mini Project / Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-Time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such **'one re-appearance'** evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	**First year first semester to first year second semester**	**Regular course of study of first year first semester.**
2	**First year second semester to second year first semester**	**(i) Regular course of study of first year second semester.** **(ii) Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
3	**Second year first semester to second year second semester**	**Regular course of study of second year first semester.**
4	**Second year second semester to third year first semester**	**(i) Regular course of study of second year second semester.** **(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
5	**Third year first semester to third year second semester**	**Regular course of study of third year first semester.**
6	**Third year second semester to fourth year first semester**	**(i) Regular course of study of third year second semester.** **(ii) Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.**
7	**Fourth year first semester to fourth year second semester**	**Regular course of study of fourth year first semester.**

7.4 A student (i) shall register for all courses / subjects covering 160 credits as specified and listed in the course structure, (ii) fulfills all the attendance and academic requirements for 160 credits, (iii) earn all 160 credits by securing SGPA ≥ 5.0 (in each semester), and CGPA ≥ 5.0 (at the end of 8 semesters), (iv) **passes all the mandatory**

courses, to successfully complete the undergraduate programme. The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA **(at the end of undergraduate programme)**, and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5 If a student registers for '**extra subjects'** (in the parent department or other departments / branches of Engineering.) other than those listed subjects totalling to 160 credits as specified in the course structure of her department, the performance in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects'** registered, percentage of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1-7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject / course, but absent from it or failed (thereby failing to secure 'C' grade or above) may reappear for that subject / course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject / course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted in the same semester in the next academic year for fulfilment of academic requirements.** The academic regulations under which a student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which the student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which the student has been readmitted shall be applicable to her.

8.0 Evaluation-Distribution and Weightage of marks

8.1 The performance of a student in every subject / course (including practicals and Project Stage - I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination).

8.2 In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) **Part – A** for 10 marks, ii) **Part – B** for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:
   a. Part-A: Objective / quiz paper for 10 marks.
   b. Part-B: Descriptive paper for 20 marks.

The objective / quiz paper is set with multiple choices, fill - in the blanks and match the following type of questions for a total of 10 marks. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each

carrying 5 marks. The **average of the two Mid Term Examinations** shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as

2. Assignment for 5 marks. (**Average of 2 Assignments** each for 5 marks)
3. Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the concerned subject for 5 marks.

While the first mid-term examination shall be conducted on 50% of the syllabus, the second mid-term examination shall be conducted on the remaining 50% of the syllabus.

Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce / PPT / Poster Presentation / Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), her performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

There is NO Computer Based Test (CBT) for BH23 regulations.

The details of the end semester question paper pattern are as follows:

8.2.1 The Semester End Examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. i) **Part-A** for 10 marks, ii) **Part-B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

The duration of Semester End Examination is 3 hours.

8.2.2 For the subject, **Computer Aided Engineering Graphics**, the Continuous Internal

Evaluation (CIE) and Semester End Examinations (SEE) evaluation pattern is same as for other theory subjects.

8.3 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components / procedure, expected outcome) which shall be evaluated for 10 marks
2. 10 marks for viva-voce **(**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Report / Project and Presentation, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed by the Controller of Examinations / Chief Superintendent on the recommendation of BoS chairman of the concerned department.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment / program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment / program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

- The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), her performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

8.4 The evaluation of courses having ONLY internal marks in I Year I Semester and II Year II Semester is as follows:

1. I Year I Semester course (*ex.*, ***Elements of EEE / ECE / CSE*** *etc*): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e. 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if she (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

   For CSE / IT and allied branches the Continuous Internal Evaluation (CIE) will be for 50 marks. Each Mid-Term examination consists of two parts **i) Part – A** for 20 marks, ii) **Part–B** for 20 marks with a total duration of 2 hours.

   Part A: Objective / quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 20 marks. **Part B:** Descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.

   The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce / PPT / Poster Presentation / Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.

   For all other branches, the Continuous Internal Evaluation (CIE) will be for 50 marks. Out of the 50 marks for internal evaluation:
   a) A write-up on day-to-day experiment in the laboratory (in terms of aim, components/ procedure, expected outcome) which shall be evaluated for 10 marks
   b) **10 marks for viva-voce (**or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.
   c) Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for15 marks.
   d) The remaining 15 marks are for Laboratory Report/Project and Presentation, which consists of the Design (or) Software/Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

2. II Year II Semester *Real-Time (or) Field-based Research Project* course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (iii) secures less than 40% marks in this course.

8.5 There shall be Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students

shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation / semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

8.6 The UG project shall be initiated in the IV Year I Semester and the duration of the project work is one year. The student must present Project Stage - I during IV Year I Semester before II Mid examinations, in consultation with her Supervisor, the title, objective and plan of action of her Project work to the departmental committee for approval before commencement of IV Year II Semester. Only after obtaining the approval of the departmental committee, the student can start her project work.

8.7 UG project work shall be carried out in two stages: Project Stage - I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage - II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

8.8 For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear for the above evaluation, when it is scheduled again; if she fails in such **'one reappearance'** evaluation also, she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.9 For Project Stage –II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project / Internship / SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if she (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, Controller of Examinations / Chief Superintendent select an external examiner from the list of experts in the relevant branch submitted by the BoS Chairman of the concerned department.

A student, who has failed, may reappear once for the above evaluation, when it is scheduled again; if the student fails in such **'one reappearance'** evaluation also, she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.10 A student shall be given only one time chance to re-register for a maximum of two subjects in a semester:

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva-voce / PPT / Poster presentation / Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.

A student must re-register for the failed subject (s) for 40 marks within four weeks of commencement of the class work in next academic year.

In the event of the student taking this chance, her Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

8.11 For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the 100 marks allotted) in the Continuous Internal Evaluation for passing the subject / course. These marks should also be uploaded along with the internal marks of other subjects.

8.12 No marks or letter grades shall be allotted for mandatory / non-credit courses. Only Pass / Fail shall be indicated in Grade Card.

9.0 Grading procedure

9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory / Practical's, Seminar, Industry Oriented Mini Project, and Project Stage-I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade shall be given.

9.2 As a measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A^+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B^+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

9.3 A student who has obtained an '**F'** grade in any subject shall be deemed to have '**failed'** and is required to reappear as a **'supplementary student'** in the semester end examination, as and when offered. In such cases, internal marks in those subjects will remain the same as those obtained earlier.

9.4 To a student who has not appeared for an examination in any subject, '**Ab'** grade will be allocated in that subject, and she is deemed to have '**failed'**. A student will be required to reappear as a **'supplementary student'** in the semester end examination, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade secured in that subject/ course. The corresponding **'credit points'** (CP) are computed by multiplying the grade point with credits for that particular subject/ course.

Credit Points (CP) = Grade Point (GP) x Credits….for a course

9.7 A student passes the subject / course only when **GP ≥ 5 ('C' grade or above)**

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (∑CP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ .... for each semester}$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the no. of subjects '**registered'** for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in all registered courses in all semesters, and the total number of credits registered in all the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\textbf{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \quad \text{... for all S semesters registered}$$

(i.e., up to and inclusive of S semesters, S≥2),

where '**M'** is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered'** i.e., from the1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course / Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	4 x 8=32
Course 2	4	O	10	4 x 10 =40
Course 3	4	C	5	4 x 5=20
Course 4	3	B	6	3 x 6=18
Course 5	3	A+	9	3 x 9=27
Course 6	3	C	5	3 x 5=15
	21			152

SGPA = 152 / 21 = 7.24

Illustration of calculation of CGPA up to 3rd Semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Corresponding Grade Point (GP)	Credit Points (CP)
I	Course1	3	A	8	24
I	Course2	3	O	10	30
I	Course3	3	B	6	18
I	Course4	4	A	8	32
I	Course5	3	A+	9	27
I	Course6	4	C	5	20
II	Course7	4	B	6	24
II	Course8	4	A	8	32
II	Course9	3	C	5	15
II	Course10	3	O	10	30
II	Course11	3	B+	7	21
II	Course12	4	B	6	24
II	Course13	4	A	8	32
II	Course14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	**69**		**Total Credit Points**	**518**

CGPA = 518 / 69 = 7.51

The above illustrated calculation process of CGPA will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. Programme.

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

9.11 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which sitting she passed her last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 Passing standards

10.1 A student shall be declared successful or 'passed' in a semester, if she secures a GP ≥

5.0 (**'C'** grade or above) in every subject / course in that semester (i.e. when the student gets an SGPA ≥ 5.0 at the end of that particular semester); and she shall be declared successful or 'passed' in the entire undergraduate programme, only when gets a CGPA ≥ 5.0 (**'C'** grade or above) for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.), credits earned. **There is No exemption of credits in any case**.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used.

% of Marks = (final CGPA – 0.5) x 10

12.0 Award of degree

12.1 A student who registers for all the specified subjects / courses as listed in the course structure and secures the required number of 160 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have '**qualified'** for the award of B.Tech. degree in the chosen branch of Engineering selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 A student with final CGPA (at the end of the undergraduate programme) ≥ 8.00, and fulfilling the following conditions-shall be placed in '**first class with distinction'**.

However, she

(i) Should have passed all the subjects / courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.

(ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.

A student not fulfilling any of the above conditions with final CGPA ≥ 8.00 shall be placed in **'First Class'.**

12.4 Students with final CGPA (at the end of the undergraduate programme) ≥ 7.00 but < 8.00 shall be placed in **'First Class'.**

12.5 Students with final CGPA (at the end of the undergraduate programme) ≥ 6.00 but < 7.00, shall be placed in '**Second Class'**.

12.6 All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 6.00, shall be placed

in '**Pass Class**'.

12.7 A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

12.8 Students fulfilling the conditions listed under item 12.3 alone will be eligible for award of '**Gold Medal**'.

12.9 Award of 2-Year B.Tech. Diploma Certificate

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) up to B.Tech. II Year II Semester, if the student wants to exit the 4-Year B.Tech. Programme and *requests for the 2 –Year* B.Tech. (*UG) Diploma Certificate.*
2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B.Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B.Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, she should register for the subjects / courses in III Year I Semester before commencement of class work for that semester.*
3. *The students, who exit the 4-Year B.Tech. Programme after II Year of study and wish to re-join the B.Tech. Programme, must submit the 2 - Year* B.Tech. (*UG) Diploma Certificate awarded to her, subject to the eligibility for completion of Course / Degree.*
4. A student may be permitted to take one year break after completion of II Year II Semester or B.Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year Programme).

13.0 Withholding of results

13.1 If the student has not paid the fees to the college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory Regulations

A. For students detained due to shortage of attendance:

1. A student, who has been detained in I Year of R18/R22 Regulations due to lack of attendance, shall be permitted to join I Year I Semester of BH23 Regulations and she is required to complete the study of B.Tech. Programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student, who has been detained in any semester of II, III and IV years of R18/R22 regulations for want of attendance, shall be permitted to join the corresponding

semester of BH23 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The BH23 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

3. A student of R18/R22 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of BH23 Regulations only after acquiring the required number of credits as per the corresponding regulations of her first admission. The total credits required are 160 including both R18/R22 & BH23 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The BH23 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in BH23 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of her study including BH23 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to BH23 Regulations and has any subject with 80% of syllabus common with her previous regulations, that particular subject in BH23 Regulations will be substituted by another subject to be recommended by the Academic Council (AC), and approved by Governing Body (GB).

Note: If a student readmitted to BH23 Regulations and has not studied any subjects / topics in her earlier regulations of study which is prerequisite for further subjects in BH23 Regulations, the concerned department HoD shall conduct remedial classes to cover those subjects / topics for the benefit of the students.

15.0 Student Transfers

15.1 There shall be no branch transfers after the completion of admission process.

15.2 The students seeking transfer to BVRITHCEW(A) from various other Universities / Institutions have to pass the failed subjects which are equivalent to the subjects of BVRITHCEW(A), and also pass the subjects of BVRITHCEW(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of BVRITHCEW(A), the students have to study those subjects in BVRITHCEW(A) in spite of the fact that those subjects are repeated.

15.3 The BVRITHCEW(A) will provide one chance to write the internal examinations in the equivalent subject (s) to the students transferred from other universities /

institutions, as per the clearance (equivalence) letter issued by the University.

16.0 Scope

16.1 The academic regulations should be read as a whole, for the purpose of any interpretation.

16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the AC is final.

16.3 The AC may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the AC.

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Academic Regulations (BH23) for B.Tech. (Lateral Entry Scheme) from the AY 2024-25

1. Eligibility for award of B.Tech. Degree (LES)

The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5.0 from II year to IV year B.Tech. Programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfil the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech.

4. The attendance requirements of B.Tech. (Regular) shall be applicable to B.Tech. (LES).

5. Promotion rules

S. No.	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 24 credits out of 40 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

6. All the other regulations as applicable to B.Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

7. LES students are not eligible for 2-Year B.Tech. Diploma Certificate.

Malpractices Rules

Disciplinary Action for Malpractices / Improper Conduct in Examinations

	Nature of Malpractices / Improper conduct	Punishment
	If the student:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, she will be handed over to the police and a case is registered against her.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and allot her subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester / year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, she will be handed over to the police and a case is registered against her.
4.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and

	after the examination.	project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting her to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the chief superintendent/assistant -superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walkout, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to her person or to any of her relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of her relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears off the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
8.	Possesses any lethal weapon or fire arm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.

9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared for including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared for including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Chief Superintendent for further action to award a suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the students as per the above guidelines.

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Academic Regulations for B.Tech. with Minor program

1. Introduction

The philosophy behind Engineering as an academic discipline has been to orient the knowledge seekers in a manner that shatters the theoretical boundaries and pushes them into the realms of a practical world view.

The emphasis of BVRITHCEW has always been to orient the students towards the technologies that shall drive the world in the years to come; with this philosophy the Institution has decided to launch the **Bachelor of Technology in a particular branch with minor in a specified program** (Ex. B.Tech. in ECE / EEE with Minor in AI&ML) from the AY 2025-26 onwards.

The **Bachelor of Technology (B.Tech.) with Minor** program focuses on the fundamental principles of multiple Engineering disciplines, critical & analytical thinking and the ability to develop a distinctive approach to the interdisciplinary problems.

2. Objectives

The key objectives of offering B.Tech. with Minor program are:

- To expand the domain knowledge of the students in one of the other branches of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in inter-disciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own branch of study.
- To offer the knowledge in the areas which are identified as emerging technologies / thrust areas of Engineering.

3. Minor courses and the offering departments

S. No.	Minor Program	Eligible branch of students	@Offering Department	Award of Degree
1.	Data Science	All branches, except B.Tech. in CSE (Data Science) / B.Tech. (Data Science)	CSE	"B.Tech.in branch name with Minor in Data Science"
2.	IOT	All branches, except B.Tech. in CSE (IOT) / B.Tech. (IOT)	ECE	"B.Tech. in branch name with Minor in IOT"
3.	Innovation and Entrepreneurship	All branches	Management Science / MBA	"B.Tech. in branch name with Minor in Innovation and Entrepreneurship"

Note: @As per AICTE guidelines.

4. Academic Regulations for B.Tech. Degree with Minor programs

1. The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B.Tech. program.
2. For B.Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech degree). All these 18 credits need to be completed in III year and IV year only.
3. After registering for the Minor program, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., she will be awarded only B. Tech degree in the concerned branch.
4. There is no transfer of credits from Minor program courses to regular B.Tech. degree course & vice versa.
5. These 18 credits are to be earned from the additional courses offered by the host department in the college as well as from the MOOCs platform.
6. **For the course selected under MOOCs platform following guidelines may be followed:**
    a) Prior to registration of MOOCs courses, formal approval of the courses, by the Academic Council is essential. Academic Council considers the parameters viz., the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation, etc. before the issue of approval.
    b) Minimum credits for MOOCs course must be equal to or more than the credits specified in the Minor course structure provided by the University.
    c) Only Pass-grade / marks or above shall be considered for inclusion of grades in minor grade memo.
    d) Any expenses incurred for the MOOCs courses are to be met by the students only.
7. The choice to opt/ take a Minor program is purely on the choice of the students.
8. The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor program at anytime; and in that case the student will be awarded only B.Tech. degree in the concerned branch on earning the required credits of 160.
9. The student can choose only one Minor program along with her basic engineering degree. **A student, who chooses an Honors program, is not eligible to choose a Minor program and vice-versa.**
10. The B.Tech. with a Minor program shall be offered from the AY 2025-26 onwards. The students, pursuing their III year I semester from the AY 2025-26 onwards can

register for the Minor program if they fulfil the eligibility criteria.

11. A student can graduate with a Minor if she fulfils the requirements for her regular B.Tech. program as well as fulfils the requirements for Minor program.
12. The institute shall maintain a record of students registered and pursuing their Minor programs, minor program-wise and parent branch-wise.
13. The concerned department shall prepare the time-tables for each Minor course offered at without any overlap / clash with other courses of study in the respective semesters.

5. Eligibility conditions for the student to register for Minor course

a) A student can opt for B.Tech. degree with Minor program if she has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b) Prior approval of mentor and Head of the Department for the enrolment into Minor program, before commencement of III year I Semester (V Semester), is mandatory

c) If more than 50% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

6. Registration for the courses in Minor Program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied / registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum no. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

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Academic Regulations (BH23) for B.Tech. with Honors program

1. Objectives

The key objectives of offering B.Tech. with Honors program are:

- To expand the domain knowledge of the students laterally and vertically.
- To increase the employability of undergraduate students with expanded knowledge in one of the core Engineering disciplines.
- To provide an opportunity for the students to pursue their higher studies in wider range of specializations.

2. Academic Regulations for B.Tech. Honors degree

1) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B.Tech. program.
2) For B.Tech with Honors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B.Tech. degree). All these 20 credits need to be completed in III year and IV year only.
3) After registering for the Honors program, if a student is unable to pass all courses in first attempt and earn the required 20 credits, she shall not be awarded Honors degree. However, if the student earns all the required 160 credits of B.Tech., she will be awarded only B.Tech. degree in the concerned branch.
4) There is no transfer of credits from courses of Honors program to regular B.Tech. degree course & vice versa.
5) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCs platform.
6) **For the courses selected under MOOCs platform following guidelines may be followed:**
    a) Prior to registration of MOOCS courses, formal approval of the courses, by the Academic Council is essential. The Academic Council considers the parameters viz., the institute / agency, offering the course, syllabus, credits, duration of the programme and mode of evaluation, etc., before the issue of approval
    b) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honors course structure provided by the Institution.
    c) Only Pass-grade / marks or above shall be considered for inclusion of grades in the Honors grade memo.
    d) Any expenses incurred for the MOOCS courses are to be met by the students only.
7) The choice to opt / take the Honors program is purely on the choice of the students.

8) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Honors program at anytime; and in that case the student will be awarded only B.Tech. degree in the concerned branch on earning the required credits of 160.

9) The students of every branch can choose Honors program in their respective branches if they are eligible for the Honors program. A student who chooses an Honors program is not eligible to choose a Minor program and vice-versa.

10) The B.Tech. with Honors program shall be offered from the AY 2025-26 onwards. The students, pursuing their III year I semester from the AY 2025-26 onwards can register for the Honors program if they fulfil the eligibility criteria.

11) A student can graduate with Honors if she fulfils the requirements for her regular B.Tech. program as well as fulfils the requirements for Honors program.

12) The Institution shall maintain a record of students registered and pursuing their Honors programs branch-wise.

13) The department shall prepare the time-tables for each Honors program offered at their respective departments without any overlap / clash with other courses of study in the respective semesters.

3. Eligibility conditions of the students for the Honors degree

a) A student can opt for B.Tech. degree with Honors, if she passed all subjects in first attempt in all the semesters till the results announced and maintaining 7.5 or more CGPA.

b) If a student fails in any registered course of either B.Tech. or Honors in any semester of four years program, she will not be eligible for obtaining Honors degree. She will be eligible for only B.Tech. degree

c) Prior approval of mentor and Head of the Department for the enrolment into Honors program, before commencement of III year I Semester (V Semester), is mandatory.

d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the CGPA secured by the students till II year I semester.

e) The department concerned should be preferably NBA accredited and shall offer at least one M.Tech. Program.

f) Successful completion of 20 credits earmarked for Honors program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B.Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honors) degree.

g) For CGPA calculation of B.Tech. course, the 20 credits of Honors program will not be considered.

4. Registration for the course in Honors program

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Honors course structure) other than the courses they have studied / registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum no. of courses for the Honors is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. The broad guidelines for the courses of Honors program, their respective credits weightage and semester-wise break-up of the course are:

S. No.	Year /Semester	Course to be chosen from/studied	Mode of Learning	No. of Credits
1	III-I	PE-I or PE-II	Blended/Conventional	3
2	III-II	Research Methodologies	Conventional	3
3	III-II	PE-III	Conventional	3
4	IV-I	PE-IV	Conventional	3
5	IV-I	PE-V	Conventional	3
6	IV-II	Technical Paper writing	Under the mentorship of a supervisor	2
7	IV-II	PE-VI or an Inter-disciplinary subject as suggested by the Academic Council	MOOCs	3
	Total Credits			20

Note:

i. Professional Elective (PE) course should be selected (which is not studied) from each Professional Electives' list provided in regular B.Tech. course.

ii. Courses can be chosen as in above table.

1. **Technical paper writing:**

   a) The student shall take up a problem / topic of engineering branches (inter-disciplinary nature) and apply the knowledge which they acquired while pursuing their engineering branch. It is expected to analyze, design and develop an application for the identified problem and write a technical paper / document.

   Alternatively, the student i) shall identify a research topic, analyze the problem, carryout the experiments, write a technical paper and publish in / communicate for a Scopus indexed journal / any journal with decent reputation or ii) Demonstrate a talent / an idea / development of an innovative product.

   b) The evaluation shall be done by the same committee which is constituted for project evaluation, along with the final semester project work.

   c) The students should start exploration for the Technical Paper Writing immediately after the semester exams of III-II semester. Only the evaluation part shall be carried in IV-II semester.

2. The institute shall offer a course on Research Methodologies by combining the students of all branches (if the number of students is more, multiple parallel sessions may be conducted). The time slots in the time-tables of respective branches should be aligned. Both the CIE and SEE for the Research Methodologies course shall be done as regular B.Tech. courses.

3. If the blended course option is chosen, for the subject in III-I semester, the learning should be partially in online mode and partially in offline mode. The external evaluation shall be done as regular B.Tech. courses; however, for the CIE component, online assessment should also be taken into account while finalizing the internal marks by the course teacher.

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Academic Regulations for B.Tech. - MOOCs

1. Introduction

As per NEP, to inculcate the habit of self-learning and in compliance with the UGC guidelines, MOOC (Massive Open Online Courses) have been introduced.

The proposed MOOCs would be additional choices, proposed by concern department BoS (having credits >= the required credits) and approved by the Academic Council, in all the elective group courses subjected to the availability in the MOOC platforms during the respective semesters.

After the approval, at the beginning of the semester, the concerned departments shall declare the list of permitted courses to the student.

The progress of the MOOCs shall be monitored by the course coordinator of the department, nominated by the concerned HoD.

2. Eligibility

A student is eligible to register for OE / PE in Third Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year I Semester. Similarly, the eligibility to register for OE / PE, in the Third Year Second semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year II Semester and to register for OE / PE, in the Fourth Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to III Year I Semester.

3. Course Registration

Students interested in pursuing MOOCs shall register the course title at their department office before the start of the semester.

A student can register at most two MOOCs throughout the course of study after approval from Faculty Advisor / Counselor / HoD.

Detailed guidelines regarding credit transfer of the courses pursued through MOOC (NPTEL-SWAYAM) shall be issued time to time by the Institution.

Academic Regulations for B.Tech. - Acceleration of Course Work

1. Introduction

In order to allow the bright and motivated students, a provision is made to complete the final semester three elective subjects in advance. These subjects are offered through MOOCs / additional subjects and credit transfer is permitted.

These credits are shown in the Final Semester Grade card in order to calculate SGPA and CGPA. This provision is made to allow the students for industry internship or to undertake projects in industry in the final semester.

2. Eligibility

A student is eligible to register for OE / PE in Third Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year I Semester. Similarly, the eligibility to register for OE / PE, in the Third Year Second semester by having a CGPA of ≥ 6.5 without any active backlogs up to II Year II Semester and to register for OE / PE, in the Fourth Year First semester by having a CGPA of ≥ 6.5 without any active backlogs up to III Year I Semester.

3. Course Registration

A student can register at most two additional PE / OE in a semester after approval from Faculty Advisor / Counselor / HoD.

These additional courses have to be completed either through regular class work / MOOCs as per the directions of College Academic Committee.

The list of electives offered will be notified by the departments at the time of course work registration.

COURSE STRUCTURE (BH23 Regulations)
Applicable from AY 2023-24 Batch

I Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	**MA101BS**	Matrices and Calculus	3	1	0	4
2	**CH102BS**	Engineering Chemistry	3	1	0	4
3	**CS103ES**	Programming for Problem Solving	3	0	0	3
4	**EC104ES**	Electronic Devices & Circuits	2	0	0	2
5	**ME105ES**	Computer Aided Engineering Graphics	1	0	4	3
6	**CS106ES**	Elements of Computer Science & Engineering	0	0	2	1
7	**CH107BS**	Engineering Chemistry Laboratory	0	0	2	1
8	**CS108ES**	Programming for Problem Solving Laboratory	0	0	2	1
9	**CS109ES**	IT Workshop	0	0	2	1
		Induction Programme				
		Total	**12**	**2**	**12**	**20**

I Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	**MA201BS**	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	**PH202BS**	Applied Physics	3	1	0	4
3	**EE203ES**	Basic Electrical Engineering	2	0	0	2
4	**ME204ES**	Engineering Workshop	0	1	3	2.5
5	**EN205HS**	English for Skill Enhancement	2	0	0	2
6	**CS206ES**	Python Programming Laboratory	0	1	2	2
7	**PH207BS**	Applied Physics Laboratory	0	0	3	1.5
8	**EN208HS**	English Language and Communication Skills Laboratory	0	0	2	1
9	**EE209ES**	Basic Electrical Engineering Laboratory	0	0	2	1
		Total	**10**	**4**	**12**	**20**

II Year I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	**CS301PC**	Computer Organization and Architecture	3	0	0	3
2	**CS302PC**	Data Structures	3	0	0	3
3	**MA303BS**	Mathematical and Statistical Foundations	3	1	0	4
4	**AI304PC**	Software Engineering	3	0	0	3
5	**CS305PC**	Object Oriented Programming through Java	3	0	0	3
6	**AI306PC**	Introduction to Data Structures Lab	0	0	2	1
7	**AI307PC**	Java Programming Lab	0	0	2	1
8	**AI308PC**	Software Engineering Lab	0	0	2	1
9	**AI309PC**	Node JS/ React JS/ Django	0	0	2	1
10	***MC310**	Gender Sensitization Laboratory*	0	0	2	0
		Total	**15**	**1**	**10**	**20**

II Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	**CS401PC**	Discrete Mathematics	3	0	0	3
2	**AI402PC**	Automata Theory and Compiler Design	3	0	0	3
3	**AI403PC**	Database Management Systems	3	0	0	3
4	**AI404PC**	Introduction to Artificial Intelligence	3	0	0	3
5	**AI405PC**	Operating Systems	3	0	0	3
6	**AI406PC**	Data Base Management Systems Lab	0	0	2	1
7	**AI407PC**	Operating Systems Lab	0	0	2	1
8	**AI408PC**	Real time Research Project / Field Based Research Project	0	0	4	2
9	**CS410PC**	Prolog /Lisp / Pyswip	0	0	2	1
10	***MC409**	Environmental Science*	3	0	0	0
		Total	**18**	**0**	**10**	**20**

III Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	**CS501PC**	Design and Analysis of Algorithms	3	1	0	4
2	**CS502PC**	Computer Networks	3	0	0	3
3	**AI503PC**	Machine Learning	3	0	0	3
4	**AI504PC**	Knowledge Representation and Reasoning	3	0	0	3
5		Professional Elective-I	3	0	0	3
6	**EN505HS**	Advanced English Communication Skills Lab	0	0	2	1
7	**CS506PC**	UI design- Flutter	0	0	2	1
8	**CS507PC**	Computer Networks Lab	0	0	2	1
9	**AI508PC**	Machine Learning Lab	0	0	2	1
10	**MC509**	Constitution of India*	3	0	0	0
		Total	**18**	**1**	**8**	**20**

III Year II Semester

S. No.	Code	Title	L	T	P	Credits
1	**SM601MS**	Business Economics and Financial Analysis	3	0	0	3
2	**AI602PC**	Data Analytics	3	0	0	3
3	**AI603PC**	Natural Language Processing	3	0	0	3
4		Professional Elective – II	3	0	0	3
5		Open Elective -I	3	0	0	3
6	**AI604PC**	Natural Language Processing Lab	0	0	3	1.5
7	**AI605PC**	Data Analytics Lab	0	0	3	1.5
8	**AI606PC**	Industrial Oriented Mini Project / Internship / Skill Development Course (Dev Ops)	0	0	4	2
9	**MC607**	Intellectual Property Rights*	3	0	0	0
		Total	**18**	**0**	**10**	**20**

IV Year I Semester

S. No.	Code	Title	L	T	P	Credits
1	**AI701PC**	Deep Learning	3	0	0	3
2	**SM702MS**	Professional Practice, Law & Ethics	2	0	0	2
3	**AI703PC**	Nature Inspired Computing	2	0	0	2
4		Professional Elective – III	3	0	0	3
5		Professional Elective – IV	3	0	0	3
6		Open Elective – II	3	0	0	3
7		Professional Elective III Lab	0	0	2	1
8	**AI704PC**	Project Stage -I	0	0	6	3
		Total	**16**	**0**	**8**	**20**

IV Year II Semester

S. No.	Code	Title	L	T	P	Credits
1		Professional Elective – V	3	0	0	3
2		Professional Elective -VI	3	0	0	3
3		Open Elective – III	3	0	0	3
4	**AI801PC**	Project stage – II Including Seminar	0	0	22	11
		Total	**9**	**0**	**22**	**20**

Professional Electives

PE-I	AI511PE	1. Graph Theory
	AI512PE	2. R Programming
	AI513PE	3. Full Stack Development
	AI514PE	4. Computer Graphic
PE-II	AI621PE	1. Software Testing Methodologies
	AI622PE	2. Information Retrieval Systems
	AI623PE	3. Pattern Recognition
	AI624PE	4. Data Warehousing and Data Mining
PE-III	AI711PE	1. Internet of Things
	AI712PE	2. Generative AI
	AI713PE	3. Mobile Application Development
	AI714PE	4. Cloud Computing
PE-III Lab	AI731PE	1. Internet of Things Lab
	AI732PE	2. Deep Learning & Generative AI Lab
	AI733PE	3. Mobile Application Development Lab
	AI734PE	4. Cloud Computing Lab
PE-IV	AI721PE	1. Quantum Computing
	AI722PE	2. Reinforcement Learning
	AI723PE	3. Semantic Web
	AI724PE	4. Game Theory
PE-V	AI811PE	1. Social Network Analysis
	AI812PE	2. Federated Machine Learning
	AI813PE	3. Augmented Reality & Virtual Reality
	AI814PE	4. Web Security
PE-VI	AI821PE	1. Speech and Video Processing
	AI822PE	2. Robotic Process Automation
	AI823PE	3. Cryptography and Network Security
	AI824PE	4. Conversational AI

Open Electives

Open Electives	Department Offering	Course Code	Course Name
OE-I	EEE	EE600OE	Renewable Energy Sources
		EE601OE	Green Energy Technologies
		EE602OE	Fundamentals of Electric Vehicles
	ECE	EC600OE	Microcontrollers
		EC601OE	Fundamentals of IoT
		EC602OE	VLSI Design
	CSE/ CSE (AI&ML) /IT	CS600OE	Problem Solving using Data Structure
		CS601OE	Java Programming
		CS602OE	Fundamentals of AI
OE-II	EEE	EE700OE	Utilization of Electrical Energy
		EE701OE	Electric Drives and Control
		EE702OE	Principles of Power Systems
	ECE	EC700OE	Electronic Sensors
		EC701OE	Digital Image Processing
		EC702OE	Principles of Communications
	CSE/ CSE (AI&ML) /IT	CS700OE	Scripting Languages
		CS701OE	Database Management Systems
		CS702OE	Machine Learning
OE-III	EEE	EE800OE	Basics of Power Plant Engineering
		EE801OE	Energy Sources and Applications
		EE802OE	Battery Management Systems
	ECE	EC800OE	Electronic Measurements and Instrumentation
		EC801OE	Embedded System Design
		EC802OE	FPGA based System Design
	CSE/ CSE (AI&ML) /IT	CS800OE	Operating Systems
		CS801OE	Software Engineering
		CS802OE	Computer Networks

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
MA101BS	**Matrices And Calculus**	3	1	0	4

Pre-requisite: Mathematical Knowledge at pre-university level

Course Description: The course contains various topics related to Rank of the Matrix and their related properties, Echelon form, Normal form, Solving linear system of equations, Eigen values and vectors, Reduction of Quadratic form to canonical forms, Mean value theorems, Improper Integration and their applications of beta, gamma functions, Maxima a nd minima of functions of two variables and three variables, PartialDifferentiation, Evaluation of Double Integrals (Cartesian and polar coordinates), Change of order of integration, Evaluation of triple Integrals.

Course Outcomes: After completion of this course, the students will be able to

C101.1: Apply matrix techniques to solve system of linear equations.

C101.2: Find the Eigen values and Eigen vectors and reduce the Quadratic form to canonical Form.

C101.3: Apply Mean value theorems for given functions

C101.4: Evaluate the improper integrals using Beta and Gamma functions

C101.5: Find the extreme values of functions of two variables with/ without constraints.

C101.6: Evaluate the multiple integrals and apply the concept to find areas, volumes

Unit – I Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss- Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneousequations by Gauss elimination method, Gauss Seidel Iteration Method.

Unit - II Eigen Values and Eigen Vectors

Linear Transformation and Orthogonal Transformation: Eigen values, Eigenvectors and their properties,Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

Unit– III Single Variable Calculus

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their GeometricalInterpretation and applications, Cauchy's Mean value Theorem, Taylor's Series, Maclaurin Series. Definition of Improper Integrals: Beta, Gamma functions and their properties, Relation between Beta& Gamma functions and their applications.

Unit – IV Multivariable Calculus (Partial Differentiation and Applications)

Definitions of Limit and continuity. Partial Differentiation: Introduction to Partial Differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

Unit – V Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Change of variables (Cartesian to polar) for double integrals. Evaluation of triple integrals (Cartesian Coordinates) Applications: Areas (by double integrals) and volumes (by triple integrals).

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, 36th Edition, 2010, Khanna Publishers.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, , 5th Edition, 2016, Narosa Publications.

Reference Books

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons,.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, 2002,Pearson,Reprint,.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 2008, Laxmi Publications, Reprint,
4. H. K. Dass and Er. RajnishVerma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CH102BS	Engineering Chemistry	3	1	0	4

Course Description: Engineering Chemistry is a fundamental course designed to provide students with a solid foundation in the principles and applications of chemistry relevant to engineering disciplines. The course aims to equip students with the knowledge and skills necessary to understand the chemical properties of materials, analyse chemical reactions, and apply chemical concepts in engineering practice.

Course Outcomes: After completion of this course, the students will be able to

C102.1 Analyse the basic properties of water and its usage in domestic and industrial purposes.

C102.2 Inspect the working principles and reaction mechanisms of various energy storage devices

C102.3 Acquire the basic knowledge of electrochemical procedures related to corrosion and its control.

C102.4 Impart the fundamental knowledge and sustainability implemented through smart engineering materials.

C102.5 Distinguish various energy sources to prioritise eco-friendly fuels for environmentally sustainable development.

C202.6 Discriminate the limitations of conventional basic engineering materials for developing multiphase materials.

Unit – I Water and its Treatment

Hardness of water – Types of hardness, Units, Estimation of hardness of water by complexometric method; numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by ozonisation and chlorination - breakpoint chlorination. Defluoridation - Determination of F^- ion by ion-selective electrode method. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of Brackish water – Reverse osmosis.

Unit – II Battery Chemistry and Corrosion

Introduction to Electrochemistry- Galvanic Cells, Electrode Potentials, Nernst Equation, EMF of the cell, Cell representation. Classification of batteries- primary, secondary, flow and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of Zn-air, $Pb/HClO_4$ and Lithium-ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell.

Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion,. Types of corrosion: Galvanic, Water line and Pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

Unit– III Polymeric Materials

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP).

Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

Unit – IV Energy Sources

Calorific value of fuel – HCV, LCV- Dulongs formula. Classification- solid fuels: coal – analysis of coal – Proximate and Ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages. Hydrogen as fuel-Production, Storage & applications.

Unit – V Engineering Materials

Composites: Introduction- Constituents of composites – advantages, classification and constituents of composites. Applications of composites.

Smart Materials and Engineering Applications: Smart Materials- Classification- (Piezo-electric materials, Shape Memory Alloys, Thermoresponse Materials, Magnetorhetroic Materials, Smart Polymers) SMAs-Nitinol. Thermoresponse materials- Poly vinyl amides.

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

Text Books

1. P.C. Jain and M. Jain , Engineering Chemistry, 2010, Dhanpatrai Publishing Company.
2. Shashi Chawla, Engineering Chemistry by, 2011, Dhanpatrai and Company (P) Ltd. Delhi.
3. Shikha Agarwal, Engineering Chemistry, 2015, Cambridge University Press, Delhi.
4. Rama Devi, Venkata Ramana Reddy and Rath, Engineering Chemistry, 2016, Cengage learning.

Reference Books

1. Jaya Shree Anireddy ,Textbook of Engineering Chemistry , Wiley Publications.
2. M. Thirumala Chary, E. Laxminarayana and K. Shashikala , A text book of Engineering Chemistry, 2021, Pearson Publications.

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CS103ES	Programming For Problem Solving (Common to CSE,IT & CSE(AIML) branches)	3	0	0	3

Course Description: The course contains topics related to fundamentals of problem solving using structured programming approach. It introduces standard programming techniques like alternation, iteration and recursion using C. It aims on using arrays, pointers and structures to formulate algorithms and programs. The course also covers files, searching and sorting problems.

Course Outcomes: At the end of the course, the student will be able to

CS103.1 Understand the basics of algorithms and flowcharts for solving problems
CS103.2 Implement control structures using C programming language
CS103.3 Apply the knowledge of derived data types & use of preprocessor commands to solve problems
CS103.4 Explore dynamic memory allocation and file handling functions using C
CS103.5 Develop reusable code using the concept of modular programming.
CS103.6 Demonstrate various searching and sorting techniques along with their time complexities

Unit – I Introduction to Programming

Introduction to Programming: Compilers, compiling and executing a program. Representation of Algorithm - Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number Flowchart/Pseudocode with examples, Program design and structured programming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch- case, ternary operator, goto, Iteration with for, while, do- while loops I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

Unit – II Arrays, Strings, Structures and Pointers

Arrays: one- and two-dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self-referential structures in linked list (no implementation) Enumeration data type.

Unit – III Preprocessor and File handling in C

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef

Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

Unit – IV Functions and Dynamic Memory Allocation

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types.

Unit – V Searching and Sorting

Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C, 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, 3rd Edition, Cengage Learning.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, 16th Impression, Pearson
5. Programming in C, Stephen G. Kochan,, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum’s Outline of Programming with C, Mc Graw-Hill

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
EC104ES	Electronic Devices And Circuits	2	0	0	2

Course Description: This course provides an in-depth understanding of the principles, operation, and design of electronic devices and circuits, equipping students with the knowledge and skills necessary to analyze, design, and troubleshoot electronic systems.

Course Outcomes: After completion of this course, the students will be able to

C104.1: Analyze the characteristics of PN junction diode.
C104.2: Construct diode circuits for various applications.
C104.3: Illustrate the transistor working in different configurations.
C104.4: Differentiate between FET and BJT devices.
C104.5: Illustrate the operation and characteristics of special purpose diodes.
C104.6: Use diode and transistor as switches in electronic circuits.

Unit – I Diodes

Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch- switching times

Unit – II Diode Applications

Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

Unit – III Bipolar Junction Transistor (BJT)

Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times.

Unit – IV Junction Field Effect Transistor (FET)

Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSTET as a capacitor.

Unit – V Special Purpose Devices

Zener Diode - Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Schottky diode.

Text Books

1. Jacob Millman - Electronic Devices and Circuits, McGraw Hill Education.
2. Robert L. Boylestad, Louis Nashelsky- Electronic Devices and Circuits theory, 11th Edition, 2009, Pearson.

Reference Books

1. David A. Bell - Electronic Devices and Circuits, 5th Edition, Oxford.
2. Chinmoy Saha, Arindam Halder, Debaati Ganguly - Basic Electronics-Principles and Applications, Cambridge, 2018.
3. Thomas L. Floyd - Electronic Devices, 9th Edition, 2012, Pearson.
4. A. Anand Kumar - Pulse and Digital Circuits - PHI Learning.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
ME105ES	**Computer Aided Engineering Graphics**	**1**	**0**	**4**	**3**

Course Description: To acquire computer-aided drafting skill set and to build the ability to visualize various objects through traditional drawing practice in order to communicate concepts and ideas in the design of engineering products.

Course Outcomes: After completion of this course, the students will be able to

C105.1: Construct different types of non circular curves and scales used in various engineering applications.
C105.2: Analyze the projections of points and lines.
C105.3: Analyze the projections of planes and solids.
C105.4: Apply different types of sectional planes to get the interior features of the objects bymeans of sectional views.
C105.5: Develop the surfaces to fabricate the objects
C105.6: Identify orthographic, Isometric projections and various CAD commands.

Unit – I

Introduction to Engineering Graphics: Principles of Engineering Graphics and their Significance, Geometrical Constructions.
Scales: Plain & diagonal.
Conic Sections: Conic Sections including the rectangular hyperbola- General methods only.
Cycloidal curves: Cycloid, Epicycloid and Hypocycloid -General methods only.

Unit – II

Orthographic Projections: Principles of orthographic projections- conventions- Projections of points in all positions.
Projection of straight lines: Line inclined to one reference plane and with two reference planes.

Unit – III

Projections of Planes: Projections of Plane geometric figures
Projections of Regular Solids: Projections of solids (prisms, pyramids, cylinders and cones) in simpleposition and axis inclined to one reference plane and with two reference plane
Introduction to computer aided drafting: (For internal evaluation weightage only)
Introduction to AutoCAD Software: The Menu System, Toolbars (Standard, Object Properties, Draw)

Unit – IV

Section of Regular solids: Section or Sectional views of Right Regular Solids- Prism, Cylinder,Pyramid and Cone.

Development of Surfaces of Right Regular Solids

Unit – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale Isometric Views – Isometric views of Lines, Planes and Simple Solids only. Orthographic Views: Conversion of Isometric Views to Orthographic Views and Vice-Versa.

Auto CAD Software: (For internal evaluation weightage only)

Toolbars (Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System),Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

Text Books

1. Bhatt, N. D., V. M. Panchal, and Pramod R. Ingle, Engineering Drawing, Fifty Third edition, 2016, Charotar Publishing House Pvt. Limited.
2. Agrawal, Basant, and C. M. Agrawal, Engineering Drawing, Third Edition, 2020, Tata McGraw Hill Education (India).
3. Venugopal, K., Sreekanjana, G.,Engineering Drawing, Second Edition, 2011, New Age International.
4. Jeyapoovan, T., Engineering drawing & Graphics Using AutoCAD, Third Edition, 2010, Vikas Publishing House.

Reference Books

1. Parthasarathy, N. S., and Vela Murali, Engineering drawing, First Edition, 2015, Oxford University Press.

2. Balaveera Reddy, K., Computer Aided Engineering Drawing, Second Edition, 2015, CBS Pvt. Limited.

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CS106ES	**Elements of Computer Science and Engineering** (**Common to CSE,IT,CSE(AIML) branches**)	0	0	2	1

Course Description: To provide an overview of the subjects of computer science and engineering. Discuss about software installation and hardware assembling. Advanced topics related to computer science are discussed.

Course Outcomes: At the end of the course student will be able to

C106.1: Understand the purpose of various components of a basic computer, significance of essentials in software development.
C106.2: Understand the functionalities of various operating systems.
C106.3: Understand the basics of organization and management of databases.
C106.4: Understand the types of connectivity, applications and security issues, fundamentals of self - driven systems.

Unit – I Basics of a Computer

Basics of a Computer – Hardware, Software, Generations of computers. Hardware - functional units, Components of CPU, Memory – hierarchy, types of memory, Input and output devices. Software – systems software, application software, packages, frameworks, IDEs.

Task 1: Demonstrate assembling of computer by detaching and reassembling.

Unit – II Software development

Software development – waterfall model, Agile, Types of computer languages – Programming, markup, scripting Program Development –steps in program development, flowcharts, algorithms, data structures – definition, types of data structures.

Task 2: Draw flowchart to find the biggest of three numbers.

Task 3: Write algorithm to find the roots of a quadratic equation.

Unit – III Operating Systems

Operating systems: Functions of operating systems, types of operating systems, Device & Resource management.

Database Management Systems: Data models, RDBMS, SQL, Database Transactions, data centers, cloud services.

Task 4: Demonstrate the installation of any one operating system.

Task 5: Demonstrate creating a table and insert records with any one dbms application.

Unit – IV Networks

Computer Networks: Advantages of computer networks, LAN, WAN, MAN, internet, WiFi, sensor networks, vehicular networks, 5Gcommunication.

World Wide Web – Basics, role of HTML, CSS, XML, Tools for web designing, Social media, Online social networks.

Security – information security, cyber security, cyber laws.

Task 6: Demonstrate LAN connections and Proxy settings.

Task 7: Create a web page with self data and photo.

Unit – V Autonomous Systems

Autonomous Systems: IoT, Robotics, Drones, Artificial Intelligence – Learning, natural language processing, image and video processing, Game Development, Cloud Basics.

Task 8: Demonstrate any one AI tool to perform tasks.

Text Book:

1. G. Michael Schneider, Invitation to Computer Science, Macalester College, Judith L. Gersting University of Hawaii, Hilo, Contributing author: Keith Miller University of Illinois, Springfield.

Reference Books:

1. Reema Thareja , Fundamentals of Computers, , Oxford Higher Education, Oxford University Press.
2. Peter Norton, Introduction to computers, , 8th Edition, Tata McGraw Hill.
3. Anita Goel, Computer Fundamentals, 2010, Pearson Education India.

B.Tech. I Year I Semester

Course Code	Course Title	L	T	P	Credits
CH107BS	Engineering Chemistry Laboratory	0	0	2	1

Course Description: The Engineering Chemistry Laboratory is a practical course designed to provide students with hands-on experience in conducting chemical experiments relevant to engineering applications. This laboratory-based course aims to reinforce the theoretical concepts learned in the engineering chemistry lecture course and develop students' practical skills in chemical analysis, synthesis, and material testing.

Course Outcomes: After completion of this course, the students will be able to

C107.1: Analysis of materials using small quantities of materials involved for quick and accurate results

C107.2: Interpret a new application by the analysis of physical principle involved in various instruments.

C107.3: Develop experimental skills in building technological advances by qualitative and quantitative analysis of materials.

C107.4: Learn and apply basic techniques used in chemistry laboratory for preparation, purification and identification.

List of Experiments

1. Determination of total hardness of water by complexometric method using EDTA.
2. Estimation of concentration of an acid by Conductometric titrations.
3. Estimation of concentration of an acid by pH metry..
4. Estimation of Concentration of Ferrous Iron (II) by Potentiometry using $KMnO_4$.
5. Estimation of Concentration of Fluoride ion by UV-Visible spectrometer.
6. Determination of viscosity of lubricant oil by using Ostwald’s viscometer.
7. Preparation of Bakelite.
8. Determination of rate of corrosion of mild steel in presence and absence of inhibitor.
9. Determination of Acid value of given coconut oil.
10. Proximate analysis of solid fuel- Coal.

Virtual Lab Experiments

1. Batteries for Electric Vehicles.
2. Conducting Polymers-Study and Working.
3. Smart Materials-Engineering Applications.
4. Construction of Fuel Cell & It’s Working.

Text Books

1. B. Ramadevi and P. Aparna, Lab manual for Engineering chemistry, 2022, S Chand Publications, New Delhi.
2. Vogel's text book of practical organic chemistry, 5th edition.
3. A.I. Vogel , Inorganic Quantitative analysis by, ELBS Publications.
4. V.K. Ahluwalia, College Practical Chemistry, 2007, Narosa Publications Ltd. New Delhi.
5. B. Ramadevi and P. Aparna, Lab manual for Engineering chemistry, 2022, S Chand Publications, New Delhi.

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CS108ES	**Programming for Problem Solving Laboratory (Common to CSE,IT & CSE(AIML) branches)**	0	0	2	1

Course Description: This lab introduces the importance of programming, C language constructs, and program development. It introduces standard programming techniques like alternation, iteration and modular programming.

Course Outcomes: At the end of the course, the student will be able to

C108.1 Build programs using control structures to solve simple mathematical problems
C108.2 Apply the concepts of user defined, pre-defined and file handling functions
C108.3 Develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
C108.4 Develop searching and sorting algorithms using C programs

List of Programs

CYCLE 1:

Practice session

1) Write a simple program that prints the results of all the operators available in C (including pre/ post increment , bitwise and/or/not , etc.). Read required operand values from standard input.
2) Write a simple program that converts one given data type to another using auto conversion and casting. Take the values from standard input.

Simple numeric problems:

1) Write a program for finding the max and min from the three numbers.
2) Write the program for the simple, compound interest.
3) Write a program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction.
4) Read percentage from standard input.Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
   5 x 1 = 5
   5 x 2 = 10
   5 x 3 = 15.
5) Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

1) A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s

= ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).

2) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
3) Write a program that finds if a given number is a prime number
4) Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
5) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
6) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
7) Write a C program to find the roots of a Quadratic equation.
8) Write a C program to calculate the following, where x is a fractional value. 1-x/2 +x^2/4-x^3/6
9) Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3+.....+x^n. For example: if n is 3 and x is 5, then the program computes 1+5+25+125

CYCLE 2:

Arrays, Pointers and Functions:

1) Write a C program to find the minimum, maximum and average in an array of integers.
2) Write a function to compute mean, variance, Standard Deviation, sorting of n elements in a single dimension array.
3) Write a C program that uses functions to perform the following:
4) Addition of Two Matrices
5) Multiplication of Two Matrices
6) Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be the same.
7) Write C programs that use both recursive and non-recursive functions
   a) To find the factorial of a given integer.
   b) To find the GCD (greatest common divisor) of two given integers.
   c) To find x^n
8) Write a program for reading elements using a pointer into an array and display the values using the array.
9) Write a program for display values reverse order from an array using a pointer.
10) Write a program through a pointer variable to sum of n elements from an array**.**

Files:

1) Write a C program to display the contents of a file to standard output device.
2) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
3) Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.

4) Write a C program that does the following: It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function) Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function) The program should then read all 10 values and print them back.
5) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)

Strings:

1) Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
2) Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
3) Write a C program that uses functions to perform the following operations:
4) To insert a sub-string into a given main string from a given position.
5) To delete n Characters from a given position in a given string
6) Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
7) Write a C program that displays the position of a character ch in the string S or – 1 if S doesn‘t contain ch.
8) Write a C program to count the lines, words and characters in a given text.

Miscellaneous

1) Write a menu driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.
2) Write a C program to construct a pyramid of numbers as follows:

3) 1 * 1
4) 1 2 * * 2 3
5) 1 2 3 * * * 4 5 6

Sorting and Searching

1) Write a C program that uses non recursive function to search for a Key value in a given list of integers using linear search method.
2) Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using binary search method.
3) Write a C program that implements the Bubble sort method to sort a given list of . integers in ascending order.
4) Write a C program that sorts the given array of integers using selection sort in descending order
5) Write a C program that sorts the given array of integers using insertion sort in ascending order
6) Write a C program that sorts a given array of names.

B. Tech. I Year I Sem

Course Code	Course Title	L	T	P	Credits
CS109ES	IT Workshop	0	0	2	1

(Common to CSE, IT & CSE(AIML) branches)

Course Description

This Lab course describes various OS installation procedures. It enables the student to get hands on with various Productivity tools including Word, Excel, PowerPoint and Latex. It introduces the concepts of Internet & World Wide Web.

Course Outcomes: At the end of the course, the student will be able to

C109.1	Demonstrate the step-by-step installation process of the Operating System.
C109.2	Evaluate the credibility and reliability of online sources found through search engines.
C109.3	Use productivity tools like Word processors and Excel for performing calculations & plotting to represent the input data.
C109.4	Apply the knowledge of Power point and Latex to perform various tasks.

List of Experiments / Programs.

PC Hardware

Task 1: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 2: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Task 1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1: Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using

LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a Project Certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Using LaTeX and Word Creating Project Abstract. Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel Orientation

The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text.

Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

PowerPoint & Presentation using Latex

Task 1: Students will be working on basic power point utilities and tools which help them create basic powerpoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

Task 4: Create a Presentation: Features to be covered:-Templates, Slide Transitions, and Customization Options, Image formats and provides options for Resizing, Positioning, and Captioning images, hyperlink and Animations and Multimedia elements such as Videos and Audio clips, enabling you to create dynamic and interactive presentations on Real Time Scenario.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
MA201BS	**Ordinary Differential Equations and Vector Calculus**	**3**	**1**	**0**	**4**

Prerequisite: Mathematical Knowledge at pre-university level

Course Description: The course contains various topics related to Exact differential equations, Orthogonal trajectories, Newton's law of cooling, Natural growth and decay, Second order linear differential equations with constant coefficients and their models, Equations reducible to linear ODE with constant coefficients, Applications to Electric Circuits, Laplace Transforms and their application, Vector point functions and scalar point functions, Vector Differentiation, Vector Integral theorems and their applications.

Course Outcomes: After completion of this course, the students will be able to

C201.1: Solve first order Ordinary differential equations by analytical methods.
C201.2: Solve higher Ordinary differential equations by analytical methods.
C201.3: Find Laplace and inverse Laplace transform of given functions and solve ODEs byapplying Laplace Transform
C201.4: Calculate divergence, curl of a vector point function and gradient of scalar point function.
C201.5: Apply and verify Gauss, Green's & Stoke's theorems and find volume, surface of the solid and work done by force.
C201.6: Evaluate the line, surface & volume integrals and converting them from one toanother

Unit – I First Order Ordinary Differential Equations

Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli'sequations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

Unit – II Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin *ax*, cosax, polynomials in x, $e^{ax}(x)$, and $xV(x)$, Method of variation of parameters. Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits.

Unit– III Laplace Transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function, Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

Unit – IV Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

Unit – V Vector Integration

Line, Surface and Volume Integrals, Vector Integral theorems: Green, Gauss and Stokes (without proofs) and their applications.

Text Books

1. B.S. Grewal, Higher Engineering Mathematics, 36th Edition, 2010, Khanna Publishers.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 5th Editon, 2016, Narosa Publications.

Reference Books

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006, John Wiley & Sons.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, 2002, Pearson,Reprint.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 2008, Laxmi Publications, Reprint.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
PH202BS	Applied Physics	3	1	0	4

Course Description: This course consists of principles of Quantum mechanics with advanced topics in their respective engineering branches. It introduces the principles of semiconductors and some widely used semiconductor devices for various applications. It introduces fundamental concepts related to the dielectric and magnetic materials. It introduces the importance of Lasers, optical fibers with propagation characteristics. It also introduces the fundamentals of nanotechnology and various material growth and characterization techniques.

Course Outcomes: After completion of this course, the students will be able to

C202.1: Understand the physical world from a fundamental point of view by the concepts of quantum mechanics.
C202.2: Identify the role of semiconductor devices in science and technology applications.
C202.3: Explore the fundamental properties of dielectric and magnetic materials for device applications.
C202.4: Understand various aspects of Lasers and their applications in diverse fields.
C202.5: Explain the principle of optical fibers and their significance in communication
C202.6: Appreciate the features and applications of nanomaterials.

Unit – I Principles of Quantum Mechanics

Quantum Mechanics: Introduction, blackbody radiation – Stefan-Boltzmann's law, Wein's and Rayleigh-Jean's law (qualitative) - Planck's radiation law - photoelectric effect – De-Broglie hypothesis - matter waves - Davisson and Germer experiment –Heisenberg uncertainty principle – time independent Schrodinger wave equation - Born interpretation of the wave function - particle in a 1-D potential well.

Unit – II Semiconductors and Devices

Intrinsic and extrinsic semiconductors – Hall effect – construction, working principle and characteristics of P-N Junction diode, Zener diode and Bipolar Junction Transistor (BJT) – direct and indirect band gap semiconductors – LED – photodiodes: PIN photodiode, avalanche photodiode (APD) and solar cells: structure, materials, working principle and characteristics.

Unit – III Dielectric and Magnetic Materials

Dielectric Materials: Basic definitions - types of polarizations (qualitative) - ferroelectric, piezoelectric and pyroelectric materials – applications - liquid crystal displays (LCD) and crystal oscillators.

Magnetic Materials: Origin of the magnetic moment - classification of magnetic materials - domain theory of ferromagnetism - hysteresis - soft and hard magnetic materials - magnetostriction, magnetoresistance – applications – magnetic field sensors and multiferroics.

Unit – IV Lasers and Fiber Optics

Lasers: Laser beam characteristics - three quantum processes - Einstein coefficients and their relations - laser components - lasing action - pumping methods - Types of Lasers: Ruby laser, Nd: YAG laser, He-Ne laser, CO_2 laser - semiconductor laser – applications.

Fiber Optics: Introduction - total internal reflection - construction of optical fiber - acceptance angle - numerical aperture - classification of optical fibers - losses in optical fiber - optical fiber for communication system – advantages and applications.

Unit – V Nanotechnology

Introduction - Nanoscale, surface-to-volume ratio, quantum confinement - bottom-up approach: sol-gel and precipitation methods – top-down approach: ball milling, physical vapor deposition (PVD) and chemical vapor deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.

Text Books

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy, 11th Edition, 2019, A Text book of Engineering Physics -S. Chand Publications.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, 2nd Edition, 2022, Cengage Learning,
3. Donald A, Neamen, Semiconductor Physics and Devices- Basic Principle, 4th Edition, 2021, Mc Graw Hill.
4. Narasimha Reddy Katta, Essentials of Nanoscience & Nanotechnology, 1st Edition, 2021, Typical Creatives NANO DIGEST.

Reference Books

1. H.C. Verma, Quantum Physics, 2nd Edition 2012, TBS Publication,.
2. Halliday, Resnick and Walker, Fundamentals of Physics, 11th Edition, 2018, John Wiley & Sons.
3. A.K. Bhandhopadhya, Nano Materials, 1st Edition, 2007, New Age International.
4. Aliaksandr S. Bandarenka, Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage, 1st Edition, 2022, CRC Press Taylor & Francis Group Energy Materials Taylor & Francis Group.

B.Tech. I Year II Semester

Course code	Course Title	L	T	P	Credits
EE203ES	Basic Electrical Engineering	2	0	0	2

Course Description: Basic Electrical Engineering is a professional engineering subject that deals with the study and application of electrical engineering. A good grasp of the fundamentals of Electrical Engineering is an absolute necessity to become a good engineer in any discipline. Our day-to-day life is completely dependent on electricity. A reasonable understanding on the basics of electricity is therefore important for every engineer. This course deals with the basics of DC and AC circuit analysis under steady state and transient conditions. The basic knowledge on the constructional details and working principles of the commonly used DC and AC machines are included in the course. This course also gives an overview of the components in electrical installations.

Course Outcomes: After completion of this course, the students will be able to

C203.1: Analyze DC electric circuits with basic electrical components.

C203.2: Analyze single phase and three phase AC circuits.

C203.3: Illustrate the performance of transformers.

C203.4: Explain the construction of DC and AC machines

C203.5: Explain the working Principle of DC and AC machine

C203.6: Differentiate various components in electrical installations

Unit – I D.C. Circuits

Electrical circuit elements (R, L and C), voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation - Network reduction techniques, Mesh Analysis, Super-Mesh Analysis, Nodal Analysis and Super-Node Analysis. Superposition, Thevenin and Norton Theorems. (Problems with independent sources).

Time-domain analysis of first-order RL and RC circuits.

Unit – II A.C. Circuits

Representation of sinusoidal waveforms, peak, rms, and average values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit.

Three-phase balanced circuits, voltage and current relations in star and delta connections.

Unit – III Transformers

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Working principle of Auto-transformer and three-phase transformer connections.

Unit – IV Electrical Machines

Construction and working principle of dc motor, performance characteristics of dc shunt motor. Generation of rotating magnetic field, Construction and working principle of a three-phase induction motor, Significance of torque-slip characteristics, Single-phase induction

motor - Capacitor-start Capacitor run motor (elementary treatment only). Construction and working principle of synchronous generator.

Unit – V Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Types of Cables, Earthing. Elementary calculations for energy consumption, power factor improvement, Applications of Batteries as Energy storage devices.

Text Books

1. D.P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 4th Edition, 2019, Tata McGraw Hill.
2. P. Ramana, M. Suryakalavathi, G.T. Chandrasheker, Basic Electrical Engineering, 2nd Edition, 2019, S. Chand.

Reference Books

1. MS Naidu and S Kamakshaiah, Basic Electrical Engineering, 2nd Edition, 2008, Tata McGraw Hill,.
2. D. C. Kulshreshtha, Basic Electrical Engineering, 2009, McGraw Hill.
3. M. S. Sukhija, T. K. Nagsarkar, Basic Electrical and Electronics Engineering, 1st Edition, 2012, Oxford.
4. Abhijit Chakrabarthi, Sudipta Debnath, Chandan Kumar Chanda, Basic Electrical Engineering, 2nd Edition, 2021, McGraw Hill.
5. L. S. Bobrow, Fundamentals of Electrical Engineering, 2nd Edition, 1996, Oxford University Press.
6. E. Hughes, Electrical and Electronics Technology, 2010, Pearson.
7. V. D. Toro, Electrical Engineering Fundamentals, 1989, Prentice Hall India.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
ME204ES	Engineering Workshop	0	1	3	2.5

Course Description:

Engineering workshop demonstrates about how different working tools, machinery, and equipment are operated, applied, and used. Acquire the essential knowledge necessary to manufacture a variety of engineering products. To provide students with hands-on practice using a variety of engineering materials, tools, equipment, and processes that is widely utilized in the engineering field. To encourage optimism, cooperation, accuracy, and safety at work. To gain knowledge of various hand-powered tools, their uses, and how they function.

Course Outcomes: After completion of this course, the students will be able to

C204.1: Distinguish carpentry, fitting, black smithy and welding manufacturing processes.
C204.2: Develop house hold and engineering goods from metallic sheets in tin smithy.
C204.3: Apply basic electrical engineering knowledge for house wiring practice.
C204.4: Construct a sand mould for a given pattern using foundry tools.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

Cycle 1:

1. Tin Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
2. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
3. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
4. Black Smithy – (Round to Square, Fan Hook and S-Hook

Cycle 2:

5. Fitting – (Square fit, V-Fit, & Dovetail Fit)
6. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
7. Welding Practice – (Arc Welding & Gas Welding)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting, Power tools in construction and Wood Working.

TEXT BOOKS:

1. Kannaiah, P., Narayana, K.L., Work shop Manual, Second Edition, 2013, Scitech.

2. Venkat Reddy, Workshop Manual, Sixth Edition, 2008, BSP.

REFERENCE BOOKS:

1. Juneja, B. L., Workshop Practice, Second Edition, 2016, Cengage Learning India Pvt. Limited.

2. Venugopal, K., Prabhu Raja, V., Sreekanjana, G., Workshop Manual, First Edition, 2012, Anuradha.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EN205HS	**English For Skill Enhancement**	2	0	0	2

Course Description: With the growing importance of English as a tool for global technical communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop the linguistic, communicative, creative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development.

Course Outcomes: After completion of this course, the students will be able to

C205.1	Apply English language effectively in spoken and written forms
C205.2	Analyze the given texts and essence of poem ,respond appropriately
C205.3	Apply various grammatical structures in personal and academic fronts.
C205.4	Develop appropriate vocabulary for professional communication
C205.5	Make use of competency in various forms of academic and professional writing.
C205.6	Improve language skills for the enhancement of employability opportunities.

Unit – I Toasted English by R. K. Narayan

Vocabulary: The concept of Word Formation, Prefixes and Suffixes

Grammar: Identifying Common Errors in Writing with Reference to Articles and prepositions

Reading Skills: Reading and Its Importance- Techniques for Effective Reading.

Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents**.**

Unit – II Appro JRD by Sudha Murty

Vocabulary: Words Often Confused, Homophones, Homonyms and Homographs & collocations

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun and Subject-verb Agreement.

Reading Skills: Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

Writing Skills: Nature and Style of Writing

Unit – III The Character of a Happy Life by Sir Henry Wotton (Poem)

Vocabulary: Words Often Misspelt, - Words from Foreign Languages and their Use in English

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses

Reading Skills: Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

Writing Skills: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

Unit – IV Art and Literature by Abdul Kalam

Vocabulary: Standard Abbreviations in English.

Grammar: Redundancies and Clichés in Oral and Written Communication

Reading Skills: Reading Techniques- Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

Writing Skills: Writing Practices- Essay Writing-Writing Introduction, Body and Conclusion

Unit – V Go, Kiss the World by Subroto Bagchi

Vocabulary: Technical Vocabulary and their Usage

Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)

Reading Skills: Reading Comprehension-Exercises for Practice

Writing Skills: Technical Reports- Introduction – Characteristics of a Report – Categories of Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Text Books

1. *English: Language, Context and Culture by* Orient Black Swan Pvt. Ltd, Hyderabad, 2022 Print.

Reference Books

1. Liss and Davis, Effective Academic Writing, 2nd Edition, 2017, Oxford University Press.
2. Wood, F.T, Remedial English Grammar ,2017, 2nd Edition, Macmillan.
3. Wiley, Technical Communication, 2019, India Pvt. Ltd.
4. Swan, Michael. Practical English Usage, 4th Edition, 2016, Oxford University Press.

B. Tech. I Year II Sem

Course Code	Course Title	L	T	P	Credits
CS206ES	Python Programming Laboratory (Common to CSE,IT & CSE(AIML) branches)	0	1	2	2

Course Description: This Course Covers Installation procedure of python and packages. Course focuses on implementation of different control structures, data structures and Files in Python. It also helps to implement GUI applications using TKinter.

Course Outcomes: At the end of the course, the student will be able to

C206.1: Build basic programs using fundamental programming constructs.
C206.2: Explore Strings, Lists, Tuples and Dictionaries in Python
C206.3: Develop reusable code and GUI application using standard Library.
C206.4: Implement File I/O and Digital Logic Gates using Python

List of Experiments

CYCLE 1:

Week -1:

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
   ii) Start the Python interpreter and type help() to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3. i) Write a program to calculate compound interest when principal, rate and number of periods are given.
   ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Find the Euclidean distance with the given values and check the validity of values to find the distance.
2. Generate a random number between 1-10 and ask the user to guess the number. Give chance for 3 times. If guessed correctly then congratulate other wise print message as sorry.
3. Accept a string and generate the combinations of string until the source string doesn't repeated.
4. Generate prime numbers of fibonacci series between 1-50.

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
   ii) Write a program to find common values between two arrays.
2. Write a program to add comma separators in a given big number as per the standard

American convention. Ex: i/p: 100000000 o/p: 100,000,000

3. Write a program to convert given formula 3X+4Y as 3*X+4*Y and 3(X+Y) as 3*X+3*Y

Week - 4:

1. Write a function called is sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
2. Write a function called has duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
   i) Write a function called remove duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
   ii). ii) The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
   iii) Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
   ii) Remove the given word in all the places in a string?
   iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints
   ii) Write a python program to perform addition of two square matrices
   iii) Write a python program to perform multiplication of two square matrices
2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
3. Use the structure of exception handling all general purpose exceptions.

CYCLE 2:

Week-6:

1. i) Write a function called draw rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
   ii) Add an attribute named color to your Rectangle objects and modify draw rectangle so that it uses the color attribute as the fill color.
   iii) Write a function called draw point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
   iv) Define a new class called Circle with appropriate attributes and instantiate a few Circle objects.
   v) Write a function called draw circle that draws circles on the canvas.
2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
3. Write a python code to read a phone number and email-id from the user and validate.

Week- 7

1. Write a Python code to merge two given file contents into a third file.
2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
3. Write a Python code to Read text from a text file, find the word with most number of occurrences
4. Write a function that reads a file file1 and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.
2. Install NumPy package with pip and explore it.
3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

Text Books:

1. Brian R. Overland and John Bennett, Supercharged Python: Take your code to the next level, O'reilly.
2. Mark Lutz, Learning Python, O'reilly.

Reference Books:

1. Dr. Mohd. Abdul Hameed, Python for Data Science, , Wiley Publications - 1st Ed. 2021.
2. Vamsi Kurama , Python Programming: A Modern Approach, Pearson.
3. Sheetal Taneja, Naveen Kumar, Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Pearson.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
PH207BS	**Applied Physics Laboratory**	**0**	**0**	**3**	**1.5**

Course Description: This course is designed for the students to provide an opportunity for learning through observation, interpretation and application. It includes instruments related to the Hall Effect, Photoelectric Effect, dielectric constant and B-H curve experiments and their measurements. It introduces the characteristics of various devices such as P-N junction diode, Zener diode, BJT, LED, solar cell, LASERs and optical fibers, measurement of energy gap and resistivity of semiconductor materials.

Course Outcomes: After completion of this course, the students will be able to

C207.1: Estimate the work function of metal using Photoelectric effect and identify the type of semiconductor material whether it is n-type or p-type by Hall effect.
C207.2: Determine energy gap and resistivity of semiconductors and draw the characteristics of semiconductor and optoelectronic devices.
C207.3: Understand the electrical and magnetic properties of materials
C207.4: Demonstrate the working principle of lasers and optical fibers

List of Experiments

1. Determination of work function of a metal and Planck's constant using photoelectric effect.
2. Determination of Hall co-efficient, carrier concentration and carrier mobility of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode.
5. Input and output characteristics of BJT (CE / CB configurations).
6. V-I and L-I characteristics of light emitting diode (LED).
7. V-I Characteristics of solar cell.
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Determination of the resistivity of semiconductors by two probe method.
10. Study B-H curve characteristics of magnetic material.
11. Determination of dielectric constant of a given material.
12. a) Determination of the beam divergence of a given LASER beam.
    b) Determination of acceptance angle and numerical aperture of an optical fiber.

Note: Any 8 experiments are to be performed.

Reference Book

1. S. Balasubramanian, M.N. Srinivasan A Textbook of Practical Physics- S Chand Publishers, 2017.

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EN208HS	**English Language and Communication Skills Laboratory**	**0**	**0**	**2**	**1**

Course Description: The course aims an in-depth look into English articulation and its sound system, thus developing your sensitivity to all aspects of English pronunciation. Students develop their listening skills to appreciate their role in the LSRW skills approach to language and improve their pronunciation. Students are able to express themselves fluently and appropriately in social and professional contexts.

Course Outcomes: After completion of this course, the students will be able to

C208.1	Understand the nuances of English language through audio - visual experience
C208.2	Apply soft skills effectively while working in group activities
C208.3	Create Neutralize accent for intelligibility
C208.4	Understand and discuss with clarity and confidence which in turn enhances their employability skills

Listening Skills

Objectives

1. To enable students develop their listening skills to appreciate its role in the LSRW skills approach to language and improve their pronunciation.
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions.

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts

- Oral practice: Just A Minute (JAM) Sessions
- Describing objects/situations/people

- Role play – Individual/Group activities
- Group Discussions
- Debate

Exercise-1

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

Practice: Introduction to Phonetics–Speech Sounds–Vowels and Consonants–Minimal Pairs-Consonant Clusters-Past Tense Marker and Plural Marker-*Testing Exercises*

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session - Situational Dialogues–Greetings–Taking Leave – Introducing Oneself and Others.

Exercise II

CALL Lab:

Understand: Structure of Syllables –Word Stress–Weak Forms and Strong Forms–Stress pattern in sentences– Intonation.

Practice: Basic Rules of Word Accent– Contractions –Stress Shift-Weak Forms and Strong Forms – Intonation in context -*Testing Exercises*

ICS Lab:

Understand: Features of Good Conversation–Strategies for Effective Communication.

*Practice:*SituationalDialogues–RolePlay-ExpressionsinVariousSituations–Making Requests and Seeking Permission-Telephone Etiquette

Exercise-III

CALL Lab:

Understand: Errors in Pronunciation-Neutralizing Mother Tongue Interference (MTI).

Practice: Common Indian Variants in Pronunciation–Differences between British and American Pronunciation-*Testing Exercises*

ICS Lab:

*Understand:*Descriptions-Narrations-GivingDirectionsandGuidelines–BlogWriting-Netiquette

Practice: Giving Instructions–Seeking Clarifications–Asking for and Giving Directions–Thanking and Responding in a forum–Agreeing and Disagreeing–Seeking and Giving Advice –Making Suggestions.

Exercise-IV

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests-*Testing Exercises*

ICS Lab:

Understand: Public Speaking–Structured Talks - signposting in speech-Non-verbal Communication-Presentation Skills.

Practice: Making a Short Speech – Extempore-Making a Presentation

Exercise-V

CALL Lab:

Understand: Listening for Inference *(focus on implicit meaning)*

Practice: Listening Comprehension Tests-*Testing Exercises*

ICS Lab:

Understand: Introduction to Group Discussion & Interview Skills

Practice: Group Discussion & Mock Interviews

Minimum Requirement of Infrastructural Facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

i) Computers with Suitable Configuration
ii) High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder, etc.

Source of Material (Master Copy):

- *Exercises in Spoken English. Part1, 2, 3*. CIEFL and Oxford University Press

Note: Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

Suggested Software

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.

- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO &BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All, Orell Digital Language Lab(Licensed Version)

Reference Books

1. *English Language Communication Skills–Lab Manual cum Workbook.* 2022, Cengage Learning India Pvt. Ltd.
2. Shobha, K N & Rayen, J. Lourdes. 2019. *Communicative English–A workbook.* Cambridge University Press.
3. Kumar, Sanjay & Lata, Pushp. 2019. *Communication Skills: A Workbook.* Oxford University Press.
4. Board of Editors. 2016. *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activitie* Orient Black Swan Pvt. Ltd.
5. Mishra, Veerendra, et al. 2020. *English Language Skills: A Practical Approach.* Cambridge University Press

B.Tech. I Year II Semester

Course Code	Course Title	L	T	P	Credits
EE209ES	**Basic Electrical Engineering Laboratory**	**0**	**0**	**2**	**1**

Course Description: BEE lab is part of the curriculum for the first year students. The lab is intended for introducing the basic methods and instruments used for measuring the electrical quantities to the newly joined students. The experiments are modeled in such a way that it can be used as a learning aid for the students, as it goes in hand with the theory.

Course Outcomes: After completion of this course, the students will be able to

C209.1: To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach

C209.2: To Analyze the transient responses of first order circuits.

C209.3: To Evaluate the performance of Transformers through various testing methods.

C209.4: To Evaluate the performance of DC and AC Motors by direct testing methods.

The following experiments are required to be conducted as compulsory.

PART-A

1. Verification of KVL and KCL.
2. Verification of Thevenin's and Norton's theorems.
3. Transient Response of Series RL and RC circuits for DC excitation.
4. Resonance in series RLC circuit.
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer.
7. Performance Characteristics of a DC Shunt Motor.
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

PART-B

1. Verification of Superposition theorem.
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
5. No-Load Characteristics of a Three-phase Alternator.

B. TECH II Year I Sem

Course Code	Course Title	L	T	P	Credits
CS301PC	Computer Organization and Architecture	3	0	0	3

Course Description: This course introduces principles of computer organization and the basic architectural concepts.It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

Course Outcomes: After successful completion of the course, students will be able to

C301.1	Understand Micro-operations in Design, Organization and Architecture of a basic computer.
C301.2	Design a suitable Control unit for a decided set of Instructions.
C301.3	Design Hardware and Algorithms for manipulation of data, represented in different formats.
C301.4	Understand data transfer with appropriate IO Interface and Interrupt mechanism.
C301.5	Choose suitable type of Memory for given purpose
C301.6	Perform Parallel Processing using suitable mechanism

UNIT-I Digital Computers

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

UNIT-II Microprogrammed Control & Central Processing Unit

Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT-III Data Representation & Computer Arithmetic

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

UNIT-IV Input-Output Organization & Memory Organization

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

UNIT-V RISC & Pipeline and Vector Processing

Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.

Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache Coherence.

Text Books:

1. Computer System Architecture – M. Morris Mano, Third Edition, Pearson/PHI.

Reference Books:

1. Zvonks Vranesic, SafeaZaky , Computer Organization – Carl Hamacher, Vth Edition, McGraw Hill.
2. William Stallings , Computer Organization and Architecture , Sixth Edition, Pearson/PHI.
3. Andrew S. Tanenbaum , Structured Computer Organization , 4 th Edition, PHI/Pearson.

B. Tech. II Year I Sem

Course Code	Course Title	L	T	P	Credits
CS302PC	Data Structures (Common to CSE, IT, CSE(AIML) branches)	3	0	0	3

Pre-Requisite Programming for Problem Solving

Course Description: This course covers linear data structures such as stack , queue and linked lists. Discusses various operations on non-linear data structures like trees and graphs. Introduces various sorting techniques and pattern matching algorithms.

Course Outcomes: At the end of the course, the student will be able to

C302.1: Implement various operations on linear data structures to solve real world problems.
C302.2: Design solutions using Dictionaries ,Hash Tables and time complexity.
C302.3: Implement various kinds of trees and its operations.
C302.4: Describe graph representations and implement traversals.
C302.5: Implement various sorting algorithms.
C302.6: Demonstrate the Pattern matching algorithms and Tries.

Unit – I Introduction to Data Structures

Introduction to Data Structures: abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array and linked representations.

Unit – II Dictionaries, Hash Tables and complexity

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching.

Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

Introduction to complexity: The Growth of Functions, asymptotic notations.

Unit – III Search Trees

Search Trees: Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, B- Trees, B+ Trees, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red –Black, Splay Trees.

Unit – IV Graphs & Sorting

Graphs: Graph Implementation Methods. Graph Traversal Methods.

Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

Unit – V Pattern Matching and Tries

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

Text Books:

1. E. Horowitz, S. Sahni and Susan Anderson Freed, Fundamentals of Data Structures in C, 2nd Edition, Universities Press.

2. A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein , Data Structures using C , PHI/Pearson Education.

Reference Books:

1. R. F. Gilberg andB.A.Forouzan , Data Structures: A Pseudocode Approach with C, 2 nd Edition, Cengage Learning.

B.Tech II year, I semester

Course code	Course Title	L	T	P	Credits
MA303BS	**Mathematical And Statistical Foundations**	3	1	0	4

Pre - Requisite Mathematics courses of first year of study.

Course Description The course contains various topics related to Number theory and its applications, Correlation and Regression of a bivariate data, Random variable, its expected value, mean and variance, Discrete and Continuous distributions like Binomial, Poisson and Normal distributions, Sampling distribution of a random variable, small sample and Large sample tests, Stochastic process and Markov chain with their applications.

Course Outcomes: At the end of the course, the student will be able to

C303.1 Distinguish between discrete and continuous random variables.
C303.2 Analyze and interpret statistical data using appropriate probability distributions
C303.3 Apply sampling distributions in real world problems.
C303.4 Estimate the value for a given parameter by choosing appropriate method
C303.5 Apply suitable test to accept or reject a given hypothesis
C303.6 Apply Stochastic process and Markov process to solve various problems

Unit – I Greatest Common Divisors and Prime Factorization

Greatest Common Divisors and Prime Factorization: Greatest common divisors, The Euclidean Algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers. Congruences: Introduction to congruences, Linear congruences, The Chinese remainder Theorem, Systems of linear congruences.

Unit – II Correlation & Regression, Random Variables and Probability Distributions

Correlation and Regression: Introduction, Meaning of correlation, Karl Pearson's coefficient of correlation, Calculation of correlation coefficient, Rank correlation, Linear Regression, Regression curves. Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. Discrete Probability Distributions**:** Binomial Distribution, Poisson distribution.

Unit – III Fundamentals of Sampling Distributions

Continuous Probability Distributions**:** Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial.
Fundamentals of Sampling Distributions: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central Limit Theorem, t–Distribution and F- Distribution.

Unit – IV Estimation and Tests of Hypotheses

Introduction, Statistical Inference, Classical Methods of Estimation. Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Estimating the Variance, Estimatinga Proportion for single mean, Difference between Two Means, between Two Proportions for Two Samples and Maximum Likelihood Estimation.

Statistical Hypotheses: General Concepts, testing a Statistical Hypothesis, Single sample: Tests concerning a single mean, Two samples: tests on two means, One sample: test on a single proportion.Two samples: tests on two proportions, Goodness-of-Fit test.

Unit – V Stochastic Processes and Markov Chains

Introduction to Stochastic processes- Markov process. Transition Probability, Transition ProbabilityMatrix, First order and Higher order Markov process, n-step transition probabilities, Markov chain,

Steady state condition, Markov analysis.

Text Books:

1. Kenneth H. Rosen, Elementary number theory & its applications, sixth edition,Addison-Wesley, ISBN 978 0-321-50031-1.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics For Engineers & Scientists, 9th Ed. Pearson Publishers.
4. S.D.Sharma, Operations Research, Kedarnath and Ramnath Publishers, Meerut,Delhi.

Reference Books:

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, 2004, John Wiley &Sons, Ltd.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academicpress.
3. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations

B.Tech II Year I Semester

Course Code	Course Title	L	T	P	Credits
AI304PC	**Software Engineering**	**3**	**0**	**0**	**3**

Course Description: This course discusses principles of software engineering, process models and software requirements. Also, it explores design principles, testing strategies and risks in software development.

Course Outcomes: After successful completion of the course, students will be able to

C304.1	Illustrate software process framework and models for the development of software application.
C304.2	Analyze and validate the requirement engineering strategy for developing software requirement specification documents.
C304.3	Choose an appropriate model to create an architectural design.
C304.4	Apply various testing strategies to verify the software quality.
C304.5	Illustrate the importance of framework for product metrics.
C304.6	Identify the risk strategy and QA techniques for developing quality software.

UNIT – I Introduction to Software Engineering:

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. **A Generic view of process**: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI).
Process models: The waterfall model, Spiral model and Agile methodology.

UNIT – II Requirement Engineering

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.
Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

UNIT - III Design Engineering

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

UNIT – IV Testing

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Metrics for Process and Products: Software measurement, metrics for software quality.

UNIT – V Risk Management

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM. **Quality Management**: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Text Books:

1. Roger S. Pressman , Software Engineering, A practitioner's Approach, 6th edition, McGraw Hill International Edition.
2. Sommerville , Software Engineering, 7th edition, Pearson Education.

Reference Books:

1. James Rambaugh, Ivar Jacobson , The unified modeling language user guide Grady Booch, , Pearson Education.
2. James F. Peters, Witold Pedrycz, John Wiley , Software Engineering, an Engineering approach.
3. Waman S Jawadekar , Software Engineering principles and practice, The McGraw-Hill Companies.
4. Jones , Fundamentals of object-oriented design using UML Meiler page, Pearson Education.

B. Tech. II Year I Sem

Course Code	Course Title	L	T	P	Credits
CS305PC	Object Oriented Programming Through Java	3	0	0	3

(Common to CSE & CSE(AI & ML))

Pre - Requisite C programming Knowledge

Course Description This course contains Object oriented principles, java basics. Discuss file handling operations and inter process communication through threads. Implement applications using GUI components.

Course Outcomes: At the end of the course student will be able to

C305.1 Illustrate Object Oriented concepts and basics of java programming.

C305.2 Explore the concepts of Inheritance, packages and Interfaces.

C305.3 Implement the concepts of exception handling and util package.

C305.4 Apply the knowledge of multithreading to solve problems related to IPC.

C305.5 Design GUI applications using event handling concepts & AWT.

C305.6 Develop look and feel GUI applications using applets and swing.

Unit – I Object oriented thinking and Java Basics

Object oriented thinking and Java Basics-Need for oop paradigm, summary of oop concepts, coping with complexity, abstraction mechanisms. A way of viewing world – Agents, responsibility, messages, methods, History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program.

Classes & Objects - concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, method binding, inheritance, overriding and exceptions, parameter passing, recursion, nested and inner classes, exploring string class.

Unit – II Inheritance, Packages and Interfaces

Inheritance – Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism- method overriding, abstract classes, the Object class.

Packages - Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces -differences between classes and interfaces, defining an interface, implementing interface,
applying interfaces, variables in interface and extending interfaces. Exploring java.io.

Unit – III Exception handling, Multithreading and java.util

Exception handling -- Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. String handling, Exploring java.util **LinkedList, Hash Table. Multithreading–**Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups,
daemon threads. Enumerations, auto boxing, annotations, generics.

Unit – IV GUI & Event Handling

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. The AWT class hierarchy.

User interface components- labels, button, canvas, scrollbars, text components, check box, checkbox groups, choices, lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

Unit – V Applets Programming & Swing

Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class,
Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Text Books:

1. Herbert schildt , Java the complete reference, 7th edition , TMH.
2. T. Budd , Understanding OOP with Java, updated edition , Pearson education
3. R. Nageswara Rao ,Core Java (an Integrated approach), DreamTech Press,2009

Reference Books:

1. J.Nino and F.A. Hosch , An Introduction to programming and OO design using Java, John wiley & sons.
2. T. Budd, An Introduction to OOP, third edition, Pearson education.
3. Y. Daniel Liang, Introduction to Java programming, Pearson education
4. R.A. Johnson , An introduction to Java programming and object-oriented application development, Thomson
5. R.Buyya, S.T.Selvi, X.Chu, Object Oriented Programming with Java, TMH.

B.TECH II Year I Sem

Course Code	Course Title	L	T	P	Credits
AI306PC	Introduction To Data Structures Lab	0	0	2	1

(COMMON TO CSE, IT & CSE(AIML) BRANCHES)

Course Description: This course focuses on implementation of linear data structures and sorting algorithms. Course also deals with operations related to different height balanced trees, graph traversing and pattern matching algorithms.

Course Outcomes: At the end of the course student will be able to

C306.1 Implement with various kinds of linked list and their operations

C306.2 Design programs to implement stack and queue ADT

C306.3 Implement programs for sorting algorithms

C306.4 Implement trees and graph traversal and pattern matching algorithms

List of Programs

CYCLE 1:

1. Write a program that uses functions to perform the following operations on singly linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal

2. Write a program that uses functions to perform the following operations on doubly linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal

3. Write a program that uses functions to perform the following operations on circular linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal

4. Write a program that implement stack and its operations using i) Arrays ii) Pointers

5. Write a program that implement Queue and its operations using i) Arrays ii) Pointers

6. Write a program to implement hashing techniques.

CYCLE 2:

7. Write a program that implements the following sorting methods to sort a given list of integers in ascending order i) Quick sort ii) Heap sort iii) Merge sort

8. Write a program to implement the tree traversal methods (Recursive and Non-Recursive).

9. Write a program to implement

i) Binary Search tree ii) BTrees iii) B+ Trees iv) AVL trees v) Red - Black trees

10. Write a program to implement the graph traversal methods.

11. Implement a Pattern matching algorithms using Boyer- Moore, Knuth-Morris-Pratt.

B. Tech. II Year I Sem

Course Code	Course Title	L	T	P	Credits
AI307PC	**Java Programming Lab**	**0**	**0**	**2**	**1**

Course Description: This Lab introduces Implementing oops principles, implementing various collections and multi- threading concepts. Design GUI using awt, swing and applets and also applying various events on GUI.

Course Outcomes: At the end of the course students will be able to

C307.1 Make use of JDK, Eclipse platform for developing java programs using Oops.
C307.2 Build programs using abstract classes and multithreading concepts.
C307.3 Develop programs using GUI components and event handling.
C307.4 Design look and feel GUI using swings and applets.

List of Programs

CYCLE 1:

WEEK-1

1. Use Eclipse or Net bean platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.

WEEK-2

3. Given two strings s1 and s2, your task is to merge those strings to form a new merged string. A merge operation on two strings is described as follows: Append alternating characters from s1 and s2, respectively, to merged String. Once all of the characters in one of the strings have been merged, append the remaining characters in the other string to merged String.
4. Write a java program to find whether given sentence is Pangram or not. If it is pangram, then print 1 else print -1.A pangram is a sentence containing every letter in the English Alphabet.
   Ex: The quick brown fox jumps over the lazy Dog

WEEK-3

5. A) Develop an applet in Java that displays a simple message.
   B) Develop an applet in Java that receives an integer in one text field, and computes its factorial Value and returns it in another text field, when the button named “Compute” is clicked.
6. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog bo

WEEK-4

7. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a Java program for the following:
   a) Create a doubly linked list of elements.
   b) Delete a given element from the above list.
   c) Display the contents of the list after deletion.

Cycle 2:

WEEK-5

9. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “Stop” or “Ready” or “Go” should appear above the buttons in the selected color. Initially, there is no message shown.
10. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

WEEK-6

11. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a java program to display the table using Labels in Grid Layout.
12. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).

WEEK-7

13. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).
14. Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.

WEEK-8

15. Write a Java program to list all the files in a directory including the files present in all its subdirectories.
16. Create an abstract class 'Bank' with an abstract method 'getBalance'. $100, $150 and $200 are deposited in banks A, B and C respectively. 'BankA', 'BankB' and 'BankC' are subclasses of class 'Bank', each having a method named 'getBalance'. Create a 3 files to store different banks objects using ObjectOutputStream and ObjectInputStream classes.

B.Tech II Year I Semester

Course Code	Course Title	L	T	P	Credits
AI308PC	**Software Engineering Lab**	0	0	2	1
Pre-Requisite	Programming for Problem Solving				

Course Description: This course focuses on end to end development of software which includes requirement analysis, design analysis, and test case analysis. Also explores case studies and software models.

Course Outcomes: After successful completion of the course, students will be able to

C308.1 Translate end-user requirements into system and software requirements

C308.2 Generate a high-level design of the system from the software requirements

C308.3 Explore the awareness of testing problems.

C308.4 Develop a simple testing report

List of Experiments

Do the following seven exercises for given case studies:

1. Development of problem statements.
2. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.
3. Preparation of Software Configuration Management and Risk Management related documents.
4. Study and usage of any Design phase CASE tool
5. Performing the Design by using any Design phase CASE tools.
6. Develop test cases for unit testing and integration testing
7. Develop test cases for various white box and black box testing techniques.

CASE STUDIES:

CYCLE-1

WEEK-1

1. Passport automation System

Description:

a) Passport Automation System is used in the effective dispatch of passport to all of the applicants. This system adopts a comprehensive approach to minimize the manual work and schedule resources, time in a cogent manner.

b) The core of the system is to get the online registration form filled by the applicant whose testament is verified for its genuineness by the Passport Automation System with respect to the already existing information in the database.

c) This forms the first and foremost step in the processing of passport application. After the first round of verification done by the system, the information is in turn forwarded to the regional administrator's office.

d) The application is then processed manually based on the report given by the system, and any forfeiting identified can make the applicant liable to penalty as per the law.
e) The system forwards the necessary details to the police for its separate verification whose report is then presented to the administrator. After all the necessary criteria have been met, the original information is added to the database and the passport is sent to the applicant.

WEEK-2

2. Book Bank

Description:

The process of members registering and purchasing books from the book bank are described sequentially through following steps:

a) Eirst the member registers himself if he was new to the book bank.
b) Old members will directly select old member button.
c) They select their corresponding year.
d) After selecting the year they fill the necessary details and select the book and he will be directed towards administrator.
e) The administrator will verify the status and issue the book.

WEEK-4

3. Online Exam Registration

Description:

a) Exam Registration system is used in the effective dispatch of registration form to all of the students.The core of the system is to get the online registration form filled by the student whose details id verified for its genuineness with respect to the already existing information in the database.
b) The system also provides the student list of exam dates. The system helps students of either schools or colleges or institutions to other a quick way and easy way to appear for a exam.

WEEK-5

4. Stock Maintenance System

Description:

a) A new stock maintenance system for a book store is to replace the existing maintenance system which is in efficient. The new stock maintenance system will allow the employee to record information of the books available in the book store and generate report based on the total amount of sales.
b) The new system will has a windows based desktop interface to allow employee to enter the information of sale, purchase orders, change employee preferences and create reports. Employee can only access the information and purchase orders for security purpose.
c) The system retains information on all the books in the shop. The system retains the records of the cost, edition, author, publication of the books.
d) The employee maintains the information of the sale of books. He can add the books at right time and update the database. The customer can view the availability of the required books and the price of the books. The customer can just view them but cannot make any changes.

WEEK-6

5. Online course reservation system

Description:

a) The system is built to be used by students and managed by an administrator.
b) The student and employee have to login to the system before any processing can be done.
c) The student can see the courses available to him/her and register to the course he/she wants.
d) The administrator can maintain the course details and view all the students who have registered to any course.

CYCLE-2

WEEK-7

6. E-ticketing

Description:

E-ticketing website of a movie theatre. This software is for designing tickets, managing reservation and creating a unique bar code for every ticket. It allows the user to book a ticket for a movie at a liked theatre and wished time. The software takes as input the e-mail id or phone number for a primary verification to create an account. Payment should be through online transactions like net banking, or through debit/ credit cards or other UPI's. So, it also takes input of their choice like either details od net banking, or debit/credit cards, or UPI id. The software produces an e-ticket as an output. The user can download it in PDF format.

WEEK-8

7. Software Personnel Management System

Description:

a) Software personnel management system allows employees to record time card electronically and automatically generates pay slips based on number of hours worked and total amount of sales.
b) The system will run on individual employee desktops where the employee can access and edit only their personal details.
c) The system will maintain information on the employee in the company in order to calculate the payroll.
d) The employees will also be able to know from the system, the number of hours worked per day and total of all hours spent on a project and total pay received year-to-date etc.
e) Payroll administrators keep track of all the information including adding new employees, deleting employees, and edit information and run reports. The system will generate records and performance report of the employees.

WEEK-9

8. Credit Card Processing

Description: A credit card processor is a vendor service that enables merchants and business owners to accept payments from customers who are using payment methods other than cash or check. A credit card processor navigates the interface between the merchant's bank and the customers.

WEEK-10

9. E-book management System.

Description:

a) EBook process is well organized online buying and selling of books.
b) The process of e-books is fully based on online, and the process for this mainly interaction between buyer and seller, buyer who enter the site for purchase of book will use search engine for book to purchase, the search engine will mainly focused on the database process, it used to search book for the buyer who mentioned the book name, author name, edition, publication details in the site, so that the search engine will show many books.
c) There will be a payment option and option for pdf file or hardcopy delivery to home, the user should decide whether he want which one.
d) Whether he choice hardcopy means, full detail address, driving license no, and then he should login with his username and password, and then payment through atm debit or credit card applicable.

WEEK-11

10. Recruitment system

Description:

This project is "Online Recruitment System" is an online website in which jobseekers can register themselves and then attend the exam. Based on the outcome of the exam the jobseekers will be short listed. For fresher, the exam will be conducted at some venue after short listing of the preliminary Aptitude Test. The details of the examination, venue & Date of the examination will be made available to them through the website. Module in this project:

a) Administrator
b) Jobseekers
c) Company

B. Tech II Year I Sem

Course Code	Course Title	L	T	P	Credits
AI309PC	**Node JS/ React JS/ Django**	**0**	**0**	**2**	**1**

Prerequisite Object Oriented Programming through Java

Course Description: This course used to develop dynamic web applications using different frameworks and deploy them.

Course Outcomes: After successful completion of the course, students will be able to

C309.1 Build a custom website with HTML, CSS, and Bootstrap and little JavaScript.
C309.2 Demonstrate Advanced features of JavaScript and learn about JDBC.
C309.3 Develop Server – side implementation using Java technologies.
C309.4 Develop the server – side implementation using Node JS.

EXERCISES:

CYCLE-1

WEEK-1

1. Build a responsive web application for E-Book management system with registration, login, catalog and cart pages using CSS3 features, flex and grid. Description of application given in Ebook system of Software Engineering.
2. Make the above web application responsive web application using Bootstrap framework for E- ticketing system. Description of application given in E-ticketing of Software Engineering.

WEEK-2

3. Use JavaScript for doing client – side validation of the pages implemented in experiment 1 and experiment 2.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.

WEEK-3

5. Develop a java standalone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.

WEEK-4

6. Create an xml for the bookstore. Validate the same using both DTD and XSD. Description of application given in Book Bank of Software Engineering.
7. Design a controller with servlet that provides the interaction with application developed in experiment 1 and the database created in experiment 5.

CYCLE-2

WEEK-5

8. Maintaining the transactional history of any user is very important. Explore the various session tracking mechanism (Cookies, HTTP Session)

WEEK-6

9. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.

10. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)

WEEK-7

11. For the above application create authorized end points using JWT (JSON Web Token).
12. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.

WEEK-8

13. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js
14. Create a TODO application in react with necessary components and deploy it into github.

B.Tech. II Year I Semester

Course Code	Course Title	L	T	P	Credits
* MC310	**Gender Sensitization Lab**	0	0	2	0

Course Description: This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Course Outcomes: After completion of this course, the students will be able to

C310.1 Students will have developed a better understanding of important issues related to gender in contemporary India.

C310.2 Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.

C310.3 Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.

C310.4 Students will acquire insight into the gendered division of labour and its relation to politics and economics.

UNIT-I Understanding Gender

Introduction: Introduction to Gender, What is Gender, Why should we study it.. Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste: Different Masculinities.

UNIT-II Gender Roles And Relations

Two or Many? -Struggles with Discrimination- Missing Women-Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences - Gender Spectrum: Beyond the Binary.

UNIT – III Gender And Labour

Division & Valuation of Labour - Housework: The Invisible Labor - "My Mother doesn't Work." "Share the Load." - Work: Its Politics and Economics - Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT – IV Gender - Based Violence

Sexual Harassment: Say No! -Sexual Harassment, not Eve – teasing - Coping with Everyday Harassment- Further Reading: "Chupulu". Domestic Violence: Speaking Out Is Home a Safe Place? - When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim - "I Fought for my Life…." Additional Reading: The Caste Face of Violence.

UNIT – V Gender And Coexistence

Gender Issues - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks The Brave Heart.

Text Books

1. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu, Towards a World of Equals: A Bilingual Textbook on Gender, 2015, Telugu Akademi, Hyderabad, Telangana.

Reference Books

1. Menon, Nivedita, Seeing like a Feminist, 2012, New Delhi: Zubaan-Penguin Books.
2. Abdulali Sohaila, I Fought For My Life…and Won, Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI401PC	**Discrete Mathematics**	3	0	0	3

Course Description: Discrete mathematics is the study of mathematical structures that are discrete, separated or distinct. The course covers formal logic notation, inference mechanisms, sets, functions, relations, algebraic structures, permutations and combinations, counting principles, elementary graph theory.

Course Outcomes: At the end of the course, the student able to:

C401.1 Comprehend, and construct mathematical arguments for proofs.

C401.2 Model real-world problems using graphs and trees.

C401.3 Explore Discrete Structures.

C401.4 Describe combinations and permutations to various problems.

C401.5 Analyze problems using Binomial and Multinomial Theorems.

C401.6 Analyze counting problems on finite and discrete structures

Unit – I Mathematical logic

Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus

Unit – II Graph Theory

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

Unit – III Set theory

Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions, Partial ordering.

Unit – IV Elementary Combinatorics

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

Unit –I V Advanced Counting Techniques

Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

Text Books:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.

2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2nd ed.

Reference Books:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, Pearson education, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill publishing co.
3. Discrete Mathematics and its Applications with Combinatorics and Graph Theory- Kenneth H Rosen, 7th Edition, TMH.
4. Discrete Mathematics- Richard Johnsonbaugh, 7^{th} Edn., Pearson Education.
5. Discrete Mathematics with Graph Theory- Edgar G. Goodaire, Michael M. Parmenter.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI402PC	**Automata Theory & Compiler Design**	3	0	0	3

Pre-Requisite --

Course Description: This course explains the fundamental concepts of formal languages, deterministic and non-deterministic machines, also covers phases of compilers with the associated components.

Course Outcomes: After successful completion of the course, the student will be able to:

C402.1 Design Finite Automata (FA) machines with the capability to minimize and convert among them.

C402.2 Construct Regular expressions, perform derivations, test for regular languages and derive normal forms for context free grammar.

C402.3 Design Pushdown Automata for Languages, grammars and conversions.

C402.4 Apply the knowledge of patterns, tokens & regular expressions for lexical analysis.

C402.5 Implement a language using of skills for using lex tool and design LR parsers.

C402.6 Generate intermediate code using the outcome of syntax directed translation

UNIT 1 Introduction to Finite Automata, Non Deterministic Finite Automata, Deterministic Finite Automata

Introduction to Finite Automata: Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.

Nondeterministic Finite Automata: Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.

Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with Є-transitions to NFA without Є -transitions. Conversion of NFA to DFA

UNIT 2 Regular Expressions, Context-Free Grammars

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.

UNIT 3 Pumping Lemma for Regular Languages, Push Down Automata, Turing Machines

Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA and CFG's, Acceptance by final state

Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine

UNIT 4 Introduction to Compilers, Lexical Analysis, Syntax Analysis

Introduction: The structure of a compiler,
Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical- Analyzer Generator Lex.
Syntax Analysis: Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers

UNIT 5 Syntax-Directed Translation, Intermediate-Code Generation.

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.
Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code

Text Books:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrasekaran, 2nd Edition, PHI
3. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman , Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India

Reference Books:

1. Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson
2. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson
3. Introduction to Languages and The Theory of Computation, John C Martin, TMH.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI403PC	**Database Management Systems**	3	0	0	3

Course Description: The course focuses on database management systems, its architecture and various applications. This course contains the topics related to conceptual data modeling, relational data model, relational query languages, relational database design and transaction management and files. The course also focuses on the fundamentals of knowledgebase and relational database management systems, and the current developments in database theory and the practice.

Course Outcomes: At the end of the course, the student will be able to:

C403.1 Explore the basic concepts of DBMS.

C403.2 Design conceptual models using ER Diagram and normalize the model.

C403.3 Impose constraints on relations.

C403.4 Implement the procedural and non-procedural languages on database.

C403.5 Explore the recovery and concurrency control techniques.

C403.6 Describe file organization techniques and tree-based indexing structures.

UNIT-I Database Management Systems, Database Design and ER Model

Introduction to Database Management Systems: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS.

Database Design and ER Model: Entities, Attributes, Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Database Design and ER Diagrams, Conceptual Design with the ER Model.

UNIT-II Schema Refinement and Relational Model

Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, First, Second, Third normal forms, BCNF, lossless join decomposition, multivalued dependencies, Fourth normal form, Fifth normal form.

Relational Model: Introduction to Relational Model, Constraints on the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical database design.

UNIT-III Formal Query Languages and SQL

Formal Relational Query Languages: Relational Algebra, Relational Calculus - Tuple relational Calculus, Domain relational calculus.

Structured Query Language: Form of basic SQL query, DDL Commands, DML Commands, UNION, INTERSECT and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, Introduction to views, destroying/altering tables and views, triggers and active databases.

UNIT-IV Transaction Management , Recovery Management

Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity

and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation-Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

UNIT-V File Organization & Trees

File Organization: Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes-Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+Trees: A Dynamic Index Structure.

Textbooks

1. Silberschatz, Korth, Database System Concepts, 3rd Edition, McGraw hill.
2. Database Management Systems, Raghuram Krishnan, and Johannes Gehrke, Tata McGraw Hill.

Reference Books

1. Peter Rob & Carlos Coronel, Database Systems design, Implementation and Management, 7th Edition.
2. Elmasri Navrate, Fundamentals of Database Systems, Pearson Education.
3. C. J. Date, Introduction to Database Systems, Pearson Education.
4. The XTeam, S. Shah and V. Shah, Oracle for Professionals, SPD.
5. Shah, Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, PHI.
6. M.L. Gillenso, Fundamentals of Database Management Systems.

B.Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI404PC	Introduction to Artificial Intelligence	3	0	0	3
Pre-requisite	Data Structures				

Course Description: This course covers concepts viz., intelligent agents, problem-solving strategies, game playing, logic, first-order logic, knowledge representation, planning, and probabilistic reasoning under uncertainty, emphasizing practical applications and algorithms.

Course Outcomes: At the end of the course, the student will be able to:

C404.1 Explore search strategies and intelligent agents
C404.2 Describe different adversarial search techniques
C404.3 Interpret search algorithms for any AI problem
C404.4 Use propositional logic, predicate logic for knowledge representation
C404.5 Discuss AI techniques to solve problems of game playing and machine learning
C404.6 Design Bayesian networks to model complex relationships.

Unit–I Introduction and Searching for Solutions

Introduction to AI- Intelligent Agents, Problem-Solving Agents
Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

Unit–II Games and Logic

Games-Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge- Based Agents, **Logic-** Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses

Unit–III First-Order Logic and Knowledge Representation

First-Order Logic-Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.
Knowledge Representation: Ontological Engineering, Categories and Objects, Events

Unit–IV Planning

Planning-Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

Unit–V Probabilistic Reasoning

Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

Text Books:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

Reference Books:

1. Artificial Intelligence,3rd Edn., E.Rich and K.Knight(TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems–Patterson, Pearson Education.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI405PC	**Operating Systems**	3	0	0	3

Pre-requisite Programming for Problem Solving, Elements of Computer Science and Engg.

Course Description: This course covers concepts viz., CPU Scheduling, Process Management, Synchronization, Virtual Memory, Memory Allocation Methods, File Management etc.,

Course Outcomes: After the end of the course, the student will be able to

C405.1	Explore basic concepts of System Structures, Process and Threads.
C405.2	Evaluate CPU scheduling algorithms and deadlock handling mechanisms
C405.3	Apply various mechanism to achieve synchronization.
C405.4	Identify suitable mechanism for Inter Process Communication.
C405.5	Choose appropriate Memory Management techniques.
C405.6	Implement efficient File Management techniques through System Calls.

Unit – I Introduction

Introduction: System Structures, Operating System Services, User OS Interface, System Calls and Types, System Programs.

Process: Process Concept, Process Scheduling, Operations on Processes.

Multithreaded Programming: Overview, Multithreading Models.

Unit – II CPU Scheduling

CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.System Call Interface for Process Management-fork, exit, wait, waitpid, exec

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, DeadlockPrevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

Unit – III Process management and Synchronization

Process Management and Synchronization: The Critical Section Problem, Synchronization
Hardware, Semaphores, Classical Problems of Synchronization, Monitors.

Inter Process Communication Mechanisms: IPC using Pipes, FIFOs, Message Queues, Shared Memory.

Unit – IV Memory Management and Virtual Memory

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation.

Virtual Memory: Demand Paging, Page Replacement, Page Replacement Algorithms.

Unit – V File System Interface and operations

File System Interface: Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management.

File Operations: Usage of open, create, read, write, close, lseek, stat, ioctl system calls

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Principles - 7th Edition, John Wiley.
2. W.R. Stevens, Advanced programming in the UNIX environment, Pearson education.

Reference Books:

1. William Stallings, Operating Systems - Internals and Design Principles, Fifth Edition-2005, Pearson Education/PHI.
2. Crowley, Operating System A Design Approach, TMH.
3. Andrew S. Tanenbaum, Modern Operating Systems, 2nd edition, Pearson/PHI
4. Kernighan and Pike, UNIX programming environment, PHI/ Pearson Education
5. U. Vahalia, UNIX Internals - The New Frontiers, Pearson Education

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI406PC	**Database Management System Lab**	0	0	2	1

Course Description: This course aims to provide a deep understanding of concept design, modelling, and practical implementation of databases. Course explores the proficiency in writing and executing Data Definition Language (DDL), Data Manipulation Language (DML) commands, querying, subqueries, aggregate functions, normalization, triggers, procedures, and cursors.

Course Outcomes: At the end of the course, the student will be able to:

C406.1 Create conceptual design for the real-world problems using ER Diagrams.

C406.2 Convert the conceptual model into relational and normalize.

C406.3 Apply DDL and DML commands on given database

C406.4 Implement Triggers, Procedures and Cursors.

CYCLE - 1

1. Concept design with E-R Model.
2. Relational Model.
3. Normalization.
4. Practicing DDL commands.
5. Practicing DML commands.

   Consider the following schema for a Library Database and perform DML commnads
   BOOK(Book_id, Title, Publisher_Name, Pub_Year)
   BOOK_AUTHORS(Book_id, Author_Name)
   PUBLISHER(Name, Address, Phone)
   BOOK_COPIES(Book_id, Programme_id, No-of_Copies)
   BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)
   LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)
   Write SQL queries to
   1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
   2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
   3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
   4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
   5. Create a view of all books and its number of copies that are currently available in the Library.

CYCLE - 2

6. a. Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints etc.)

   b. Nested, Correlated sub queries.

   Consider the schema for Movie Database and perform above operations.

ACTOR(Act_id, Act_Name, Act_Gender)

DIRECTOR(Dir_id, Dir_Name, Dir_Phone)

MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)

MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id, Rev_Stars)

Write SQL queries to

1. List the titles of all movies directed by 'Hitchcock'.

2. Find the movie names where one or more actors acted in two or more movies.

3. List all actors who acted in a movie before 2000 and in a movie after 2015 (use JOIN operation).

4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.

5. Update rating of all movies directed by 'Steven Spielberg' to 5.

7. Queries using Aggregate functions, GROUPBY, HAVING and Creation and dropping of Views.

Consider the schema for College Database:
STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec)
CLASS(USN, SSID)
COURSE(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)
Write SQL queries to
1. List all the student details studying in fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.

8. Create Triggers for insert operation , delete operation and update operation .

9. Create stored procedures for specific databases application like college database, movie database, library database.

10. Create Cursors to retrieve data for specific database applications like College database, movie database, library database.

Textbooks:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, Tata Mc Graw Hill.

2. Silberschatz, Korth, Database System Concepts, V edition, Mc Graw Hill.

Reference Books:

1. Elmasri Navrate, Fundamentals of Database Systems, Pearson Education.
2. C.J. Date, Introduction to Database Systems, Pearson Education.
3. The X Team, S. Shahand Vaishali. Shah, Oracle for Professionals, SPD.
4. Nilesh Shah, Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, PHI.
5. M.L. Gillenson, Fundamentals of Database Management Systems, Wiley Student Edition.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI407PC	Operating Systems Lab	0	0	2	1

Course Description: This lab complements the Operating Systems syllabus. Students will be able to simulate and implement Operating systems Concepts such as CPU Scheduling, Process Management through System Calls, Deadlock Management, Inter Process Communication, Semaphores, MemoryManagement, File Management, etc.,

Course Outcomes: At the end of the course, the student will be able to

C407.1 Evaluate CPU Scheduling Algorithms and Memory management techniques.

C407.2 Construct deadlock detection and avoidance algorithms.

C407.3 Solve classical problems of synchronization using semaphores.

C407.4 Evaluate Inter process communication mechanisms.

LIST OF PROGRAMS

Cycle 1:

1. Write a program to simulate the following CPU Scheduling algorithms.
   a) FCFS b) SJF c) Round Robin d) priority
2. a) Write a program to implement Process management system calls viz., fork, exit, wait, waitpid, exec.
   b) Write a program to implement I/O system calls viz., open, read, write, close, seek, stat, opendir, readdir.
3. Write a program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.
4. Write a program to implement the Producer – Consumer problem using semaphores using UNIX/LINUX system calls.

Cycle 2:

5. Write a program to illustrate the following IPC mechanisms
   a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write a program to simulate the following memory management techniques
   a) Paging b) Segmentation
7. Write a program to simulate Contiguous Memory Allocation techniques
   a) First-Fit b) Best-Fit c) Worst-fit
8. Write a program to stimulate Page Replacement Algorithms
   a) FCFS b) LRU c) Optimal

Text Books:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Operating System Principles,7th Edition, John Wiley
2. W.R.Stevens, Advanced programming in the Unix environment, Pearson education.

Reference Books:

1. William Stallings, Operating Systems – Internals and Design Principles, Fifth Edition– 2005, Pearson Education/PHI.

B.TECH II Year II Sem

Course Code	Course Title	L	T	P	Credits
AI410PC	Prolog/Lisp/ Pyswip	0	0	2	1

Course Description: This course deals into the practical implementation of logic programming, a powerful paradigm widely used in artificial intelligence and problem-solving domains. This course provides , a solid understanding of the syntax, semantics, and applications of logic programming, enabling them to effectively solve problems using logical programming languages.

Course Outcomes: At the end of the course , student will be able to:

C410.1 Apply basics of logic programming.

C410.2 Develop programs to solve problems involving mathematics.

C410.3 Experiment logical and rule-based problem solving.

C410.4 Implement list manipulations and design predicates.

LIST OF PROGRAMS

CYCLE 1:

1. Write simple fact for following:
   a. Ram likes mango.
   b. Seema is a girl.
   c. Bill likes Cindy.
   d. Rose is red.
   e. John owns gold
2. Implement mathematical operations using logic programming.
3. Write the rules to generate permutations and combinations
4. Write a matrix operations using logic Programming
5. Write predicates one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
6. Write a program to solve the Monkey Banana problem.
7. WAP for medical diagnosis and show the advantages and disadvantages of green and red cuts.
8. Write a program to solve the 4-Queenproblem
9. Write a program to solve travelling salesman problems
10. Write a program to solve water jug problems.

CYCLE 2:

11. Experiment with pattern matching in logical programming, creating programs that match specific patterns in data
12. Write simple Logic Programming functions such as the following. Take into account lists which are too short.
    a) Remove the Nth item from the list.

b) Insert as the Nth item.

13. Assume the logic Programming predicate gt(A, B) is true when A is greater than B. Use this predicate to define the predicate addLeaf(Tree,X,NewTree) which is true if New Tree is the Tree produced by adding the item X in a leaf node. Tree and New Tree are binary search trees. The empty tree is represented by the atom nil.

14. Write a Logic Programming predicate, countLists(Alist, Ne, Nl), using accumulators, that is true when Nl is the number of items that are listed at the top level of Ali stand Ne is the number of empty lists. Suggestion: First try to count the lists, or empty lists, then modify by adding the other counter.

15. Define a predicate memCount(AList,Blist,Count) that is true if Alist occurs Count times with in Blist. Define without using an accumulator. Use "not" as defined in utilities. pro, to make similar cases are unique, or else you may get more than one count as an answer.

    Examples:
    memCount(a,[b,a],N).N=1;
    nomemCount(a,[b,[a,a,[a],c],a],N).
    N=4;
    nomemCount([a],[b,[a,a,[a],c],a],N).
    N=1;
    No

Reference Book:

1. PROLOG: Programming for Artificial Intelligence, 3e, by BRATKO, WILEY
2. The Programming Language LISP: Its Operation and Applications: Information International, Inc. Edmund C. Berkeley and Daniel G. Bobrow, editors.

B. Tech. II Year II Sem

Course Code	Course Title	L	T	P	Credits
*MC409	Environmental Science	3	0	0	0

Course Description: This course enables the students engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems. It provides the scope to examine alternative solutions for resolving or preventing them. It is essentially a multidisciplinary approach that brings out an appreciation of our natural world and human impact on its existence and integrity. Its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health, Anthropology, Economics, Statistics, Computers and Philosophy.

Course Outcomes: At the end of the course, the student will be able to

C229.1 Analyze the important components of environment.
C229.2 Illustrate the major environmental effects of exploiting natural resources.
C229.3 Utilize environmental laws for the protection of forest and wildlife.
C229.4 Categorize different types of pollutions and their control measures and discover effective methods of waste management.
C229.5 Identify global environmental problems and come out with best possible solutions.
C229.5 Illustrate green environmental issues.

Unit – I ECOSYSTEMS

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnifications, ecosystem value, services and carrying capacity, Field visits

Unit – II Natural Resources: Classification of Resources

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies

Unit – III Biodiversity and Biotic Resources

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situconservation.

Unit – IV Environmental Pollution and Control Technologies: Environmental Pollution

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. **Green Environmental Issues:** Clean development mechanism, carbon foot printing, carbon credits, carbon sequestration and Polluter pay principle

Unit – V Environmental Policy, Legislation & EIA

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act-1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA),Low carbon life style.

Text Books:

1. Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses. 1st edition, Universities press, 2005.
2.Anubha Kaushik, C.P. Kaushik. Perspectives in Environmental Studies. 4th edition, New age international publishers
3. S.Deswal and A.Deswal. A basic course in environmental studies. 2nd edition, Dhanapathi rai & Co.,2004.
4.Benny joseph. Environmental studies. 3rd edition, McGraw Hill Education (India) Private Limited.

Reference Books:

1.Daniel B.Botkin and Edwards A.Keller. Environmental science. 8th edition, Wiley India (P) Ltd.
2. Richard T. Wright. Environmental Science: towards a sustainable future. 4th edition, PHL Learning Private Ltd.
3. P.D.Sharma. Ecology And Environment. 5th edition, Rastogi Publications.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
CS501PC	**Design and Analysis of Algorithms**	3	1	0	4

Pre - Requisite Computer Programming and Data Structures

Course Description: This course covers performance of algorithms, algorithmic design paradigms, modelling of problems using disjoint sets, priority queues and graphs, classification of problems into P & NP classes.

Course Outcomes: At the end of the course, the student will be able to

C501.1	Analyze the performance of the algorithms and represent using relevant notations.
C501.2	Apply the concepts of disjoint sets and priority queues to solve real world problems.
C501.3	Choose appropriate algorithmic design paradigms to solve various real world problems.
C501.4	Identify the issues in graph connectivity and resolve them.
C501.5	Reduce the search space of a problem using bounding functions.
C501.6	Classify problems into NP hard & NP Complete.

Unit – I Introduction to Algorithms & Disjoint Sets

Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations.

Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue - Heaps, Heapsort.

Unit – II Divide & conquer, Greedy method

Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Single source shortest path problem.

Unit – III Dynamic Programming

Dynamic Programming: General method, Multistage Graph problem, Applications- Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

Unit – IV Graphs and Backtracking

Graphs: Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.

Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graph Coloring, hamitonian cycles.

Unit – V Branch & Bound, NP-Hard & NP-Complete

Branch and Bound: General method, applications - Traveling salesperson problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes, Cook's theorem.

Text Book:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University press, 1998.

Reference Books:

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and sons.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
CS502PC	**Computer Networks**	3	0	0	3

Pre - Requisite Elements of Computer Science and Engineering, Data Structures

Course Description: This course covers concepts viz., basic taxonomy and terminology of the computer networking and enumerates the layers of OSI model and TCP/IP model. Design issues and Protocols related to Data link layer, Network layer, Transport layer and Application layer.

Course Outcomes: At the end of the course, the student will be able to

C502.1	Analyze pros and cons of the components, reference models and various transmission media.
C502.2	Analyze various link control and access control mechanisms available in the data link layer.
C502.3	Grasp the foundational principles, challenges, and mechanisms of the network layer in computer networks.
C502.4	Choose the appropriate routing algorithm suitable for the given network topology.
C502.5	Manage the networks to ensure efficient, reliable, and high-quality communication.
C502.6	Explore the Transport layer protocols and the features of Application layer.

Unit – I Introduction to Networking Concepts

Network hardware, Network software, Reference Models, Example Networks: Internet, Wireless LANs: 802.11x.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable and fiber optics. Wireless Transmission: Electromagnetic Spectrum, Radio Transmission, Microwave Transmission and Infrared Transmission.

Data link layer: Design issues, Error detection and correction.

Unit – II Data Link Layer & Medium Access Control Sub layer

Elementary data link protocols: A Simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channels.

Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocol: SONET

Medium Access Control Sublayer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, Collision free protocols, Ethernet; Data link layer switching.

Unit – III Network Layer -I

Network Layer Design Issues, Network Layer in the Internet: The IPv4 Protocol, IP Addresses, IPv6.

Routing algorithms: Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast, Multicast.

Unit – IV Network Layer –II

Congestion Control Algorithms, Quality of Service, Internetworking, BGP.

Unit – V Transport Layer & Application Layer

Transport Layer: Transport Services, Elements of Transport protocols, The Internet Transport protocols: TCP and UDP protocols.
Application Layer: The Domain Name System, Electronic Mail, The WORLD WIDE WEB, Streaming Audio and Video.

Text Book:

1. Andrew S Tanenbaum, David. j. Wetherall, Computer Networks, 5th Edition. Pearson Education / PHI

Reference Books:

1. S. Keshav, An Engineering Approach to Computer Networks, 2nd Edition, Pearson
2. Behrouz A. Forouzan, Data Communications and Networking, Third Edition TMH.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI503PC	**Machine Learning**	3	0	0	3

Course Description: The course introduces the basic concepts and techniques of Machine Learning with a thorough understanding of the Supervised and Unsupervised learning techniques and its differences. The course elucidates the principles of evolutionary computing algorithms, ensembling techniques for increased prediction accuracy, and enlightens the principles of Reinforcement learning.

Course Outcomes: At the end of the course, the student will be able to

C503.1	Explore the basic concepts of Machine Learning Techniques.
C503.2	Apply the neural network concepts with Perceptron and Back Propagation .
C503.3	Evaluate various supervised, unsupervised learning algorithms with ensemble techniques.
C503.4	Discuss Dimensionality Reduction concepts for model building.
C503.5	Apply evolutionary computing algorithms approach for search and optimization.
C503.6	Analyze the concepts of Reinforcement Learning for building autonomous ystems**.**

Unit – I Introduction to Learning

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept earning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants: – Perceptron – Linear Separability – Linear Regression.

Unit – II Multi-layer Perceptron– Going Forwards – Going Backwards

Multi-layer Perceptron– Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines

Unit – III Learning with Trees

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Basic Statistics – Gaussian Mixture Models – Nearest Neighbour Methods – Unsupervised Learning – K means Algorithms.

Unit – IV Dimensionality Reduction and Evolutionary Learning

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization

Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms

Unit – V Reinforcement Learning

Reinforcement Learning – Overview – Getting Lost Example Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods

Text Books

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series.

REFERENCE BOOKS

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2017.
2. Marco Gori, Alessandro Betti, Stefano Melacci, Machine Learning A Constraint-Based Approach, 2023.
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.
4. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014.
5. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI504PC	**Knowledge Representation and Reasoning**	3	0	0	3

Course Description: This course introduce the study of ontologies as a KR paradigm and applications of ontologies. Also helps to understand various KR techniques and process, knowledge acquisition and sharing of ontology.

Course Outcomes: At the end of the course, the student will be able to

C504.1	Explain and design knowledge-based systems intended for computer implementation
C504.2	Acquire theoretical knowledge about principles for logic-based representation and reasoning
C504.3	Explore knowledge-engineering process
C504.4	Implement production systems, frames, inheritance systems
C504.5	Describe approaches tohandle uncertain or incomplete knowledge
C504.6	Analyze knowledge acquisition and sharing of ontology

Unit – I The Key Concepts

The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic

Logic: Historical background, Representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity

Unit – II Ontology

Ontology: Ontological categories, Philosophical background, Top-level categories, Describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time

Unit – III Knowledge Representations

Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules anddata, Object-oriented systems, Natural language Semantics, Levels of representation

Unit – IV Processes & Contexts

Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change Contexts: Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.

Unit – V Knowledge Soup

Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic Fuzzy logic, Nonmonotonic Logic, Theories, Models and the world, Semiotics Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, Accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition.

Text Books

1. Knowledge Representation logical, Philosophical, and Computational Foundations by John F. Sowa, Thomson Learning.
2. Knowledge Representation and Reasoning by Ronald J. Brachman, Hector J. Levesque, Elsevier

References

1. Knowledge in Action: Logical Foundations for Specifying and Implementing Dynamical Systems" by Raymond Reiter
2. Representation and Reality: Humans, Animals and Machines" by Hilary Putnam

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI511PE	**Graph Theory** **Professional Elective – I**	3	0	0	3

Pre - Requisite **Discrete Mathematics**

Course Description: This course deals with some basic concepts and properties in graph theory. This course also covers the concepts of graph connectivity and colouring of graphs.

Course Outcomes: At the end of the course student will be able to

C511.1 Perform various operations in different digraphs.

C511.2 Apply the algorithms to find the shortest paths in connected graphs

C511.3 Analyze the classification of Trees based on properties and derive spanning trees.

C511.4 Describe the different types of graphs.

C511.5 Formulate and prove theorems about trees and graphs.

C511.6 Solve problems on vertex colorings.

Unit – I **Introduction**

Introduction: Definitions, Degree of a vertex, Directed walks, paths and cycles, Connectivity in digraphs, Eulerian and Hamilton digraphs, Eulerian digraphs, Hamilton digraphs, Union, Sum, Cartesian Product, Composition.

Unit – II **Connected graphs and shortest paths**

Walks, trails, paths, cycles, connected graphs, Cut-vertices and cut-edges, Blocks, Connectivity, Weighted graphs and shortest paths, Menger's theorem, Dijkstra's algorithm, Floyd Algorithm.

Unit – III **Trees and Graphs**

Definition, Characterization, and Simple Properties, minimum spanning trees, Counting the Number of Spanning Trees, Kruskal's Algorithm, Prim's Algorithm, Cayley's Formula, The Connector Problem.
Special classes of graphs- Bipartite Graphs, Line Graphs, Chordal Graphs, Eulerian Graphs, Chinese Postman problem.

Unit – IV **Independent sets coverings and matchings**

Introduction: Vertex-Independent sets and Vertex coverings, Matching and factors, Matchings in bipartite graphs, Ramsey's Theorem, Perfect Matchings and the Tutte Matrix.

Unit – V **Vertex Colorings**

Basic definitions, Cliques and Chromatic number, Applications of Graph Coloring , Brooks' Theorem, B-Colorings, Edge Colorings of graphs, Gupta-Vizing's Theorem. A scheduling problem and equitable edge-coloring.

Textbooks:

1. J. A. Bondy and U. S. R. Murty. Graph Theory, volume 244 of Graduate Texts in Mathematics. Springer, 1st edition, 2008.
2. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.
3. R. Balakrishnan and K. Ranganathan A Textbook of Graph Theory,second edition.

Reference Books:

1. Lecture Videos: http://nptel.ac.in/courses/111106050/13.
2. Introduction to Graph Theory, Douglas B. West, Pearson.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI512PE	**R - Programming Professional Elective – I**	**2**	**1**	**0**	**3**

Pre - Requisite **Mathematical and Statistical Foundations**

Course Description: This course explains Data Manipulation, Statistical Analysis, Vectors, Matrices, Data Frames, Charts, Graphs and Regression Techniques using R Programming.

Course Outcomes: At the end of the course, the student will be able to

C512.1	Evaluate the implications of Big Data and Explore statistical inference techniques.
C512.2	Apply the basic concepts of R programming including environment setup and manipulation of basic data types.
C512.3	Classify different types of data attributes and understand the principles of measurement.
C512.4	Analyse structured data through vectors, matrices, arrays, factors, data frames, and lists in R programming.
C512.5	Implement operators, iterative programming and functions in R.
C512.6	Develop various charts, graphs and regression analysis techniques.

Unit – I Introduction and Basics of R

Introduction: Definition of Data Science, Big Data and Data Science hype, Getting past the hype, Datafication, Current landscape of perspectives, Statistical Inference, Populations and samples, Statistical modelling, probability distributions, fitting a model, Over fitting.

Basics of R: Introduction, R-Environment Setup, Programming with R, Basic Data Types.

Unit – II Data Types and Statistical Description.

Types of Data: Attributes and Measurement, Attribute, The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

Unit – III Vectors, Matrices, Factors and Data Frames

Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting.

Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays, Class.

Factors and Data Frames: Introduction to Factors: Factor Levels, summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, subsetting of Data Frames, Extending Data Frames, Sorting Data Frames.

Lists: Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors.

Unit – IV Control Flow and Functions

Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.
Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.
Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

Unit – V Charts, Graphs and Regression

Charts and Graphs: Introduction, Pie Chart: Chart Legend, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.
Regression: Linear Regression Analysis, Multiple Linear regression.

Textbooks:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
2. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

Reference Books:

1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
3. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
5. Paul Teetor, "R Cookbook", O'Reilly, 2011.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI513PE	**Full Stack Development Professional Elective -1**	**3**	**0**	**0**	**3**

Pre - Requisites Object Oriented Programming &Web Programming

Course Description: This course explains. The Collections Framework (java.util),Node.js & react frame works, Back-End Development with Spring Boot, Hibernate and Mongo DB.

Course Outcomes: At the end of the course, the student will be able to

C513.1	Apply Java Collections Framework concepts, including collections, iterators, and algorithms, for efficient data management.
C513.2	Develop dynamic web applications using Servlets, JSP, and JDBC.
C513.3	Develop RESTful APIs using Spring Boot, integrating database access with Hibernate for efficient backend operations.
C513.4	Evaluate security, error handling, and monitoring strategies in Spring Boot applications.
C513.5	Implement Hibernate ORM concepts, including CRUD operations, caching, and transaction management for database interactions.
C513.6	Design NoSQL database applications using MongoDB, managing collections and integrating with Node.js.

Unit – I The Collections Framework (java.util)

The Collections Framework (java.util)- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, Dictionary, Hashtable, Stack, Vector, Jdk.1.8 features: Lamda Expressions, Stream API and Functional Interfaces.

Unit – II Introduction to Servlets &Introduction to JSP

Introduction to Servlets: Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, implicit objects.

Unit – III Back-End Development with Spring Boot

Back-End Development with Spring Boot: Introduction to Spring Framework and Spring Boot, Building RESTful APIs, Spring Data JPA and Hibernate for database access, Error handling and validation, Security with Spring Security – authentication and authorization, Spring Boot Actuator for monitoring and managing application, Testing Spring Boot applications, Deployment strategies.

Unit – IV Hibernate

Hibernate: Introduction to Hibernate, Object-Relational Mapping (ORM) Concepts, Benefits of ORM, Overview of Hibernate, Database Configuration in Hibernate, Hibernate Annotations, Inheritance Mapping in Hibernate, Class-to-Table Mapping, Performing CRUD Operations, Transactions in Hibernate, Caching Mechanisms in Hibernate, Hibernate Query Language (HQL), Named Queries in Hibernate.

Unit – V MongoDB

MongoDB: Understanding NoSQL and MongoDB, Building MongoDB Environment, User accounts, Access control, administering databases, managing collections, Connecting to MongoDB from Node.js simple applications.

Textbooks:

1. Mark Tielens Thomas, React in Action, 1st Edition, Manning Publications.
2. Java The complete reference, 9th edition, Herbert Schildt,2014, McGraw Hill Education (India) Pvt. Ltd.
3. Internet and World Wide Web — How to program. Dietel and Nieto,2004, Pearson.

Reference Books:

1. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Edition, Apress, 2019.
2. Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2nd edition, Addison-Wesley Professional, 2018.
3. Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap by Mayur Ramgir, Wiley Publications, 2020

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI514PE	**Computer Graphics Professional Elective – I**	3	0	0	3

Pre - Requisite Engineering Graphics, Programming for Problem Solving

Course Description: This course contains the fundamentals of drawing and filling primitives, exploring the attributes associated with output primitives, understanding both two-dimensional and three-dimensional geometric transformations, and delving into the concepts of two-dimensional and three-dimensional viewing.

Course Outcomes: At the end of the course, the student will be able to

A514.1	Explore application of computer graphics and apply different algorithms for drawing line, circle, polygon and polygon filling.
A514.2	Determine effects of Two-Dimensional geometric transformations on points, lines and planes.
A514.3	Describe window to view-port transformation
A514.4	Apply various clipping algorithms.
A514.5	Elaborate interpolation of line and space curves using Splines and Bezier curves.
A514.6	Determine the effects of Three-Dimensional geometric transformations on Three-Dimensional objects and explain the method of Three-Dimensional viewing and clipping

Unit – I Introduction, Output primitives, Polygon Filling

Introduction: Application areas of Computer Graphics, overview of graphics systems
Output primitives: Points and lines, line drawing algorithms (DDA and Bresenham's Algorithm) circle- generating algorithms and ellipse - generating algorithms
Filled Area primitives: Scan-line polygon fill algorithm, boundary-fill, flood-fill algorithm, Attributes of Output primitives- line attributes and curve attributes.

Unit – II Two-Dimensional Geometric Transformations

Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transformations, transformations between coordinate systems.

Unit – III Two-Dimensional Viewing:

The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Clipping operations, point clipping, Line clipping-Cohen Sutherland algorithms, Polygon clipping-Sutherland Hodgeman polygon clipping algorithm.

Unit – IV Three-Dimensional Object Representation:

Polygon surfaces, quadric surfaces, spline representation, Bezier curve, B-Spline curves, Bezier and B-Spline surfaces.

Unit – V Three-Dimensional Geometric and Modelling Transformations:

Translation, rotation, scaling, reflection and shear, composite transformations.
Three-dimensional viewing: Viewing pipeline, viewing coordinates, projections, view volume, General perspective- Projection Transformation, clipping.

Textbook:

1. "Computer Graphics C version", Donald Hearn and M. Pauline Baker, Pearson Education

Reference Books:

1. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw hill, 2nd edition.
2. Principles of Interactive Computer Graphics", Neuman and Sproul, TMH.
3. Principles of Computer Graphics, Shalini Govil, Pai, 2005, Springer.
4. "Computer Graphics Principles & Practice", second edition in C, Foley, VanDam, Feiner and Hughes, Pearson Education.
5. Computer Graphics, Steven Harrington, TMH.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
CS506PC	UI design- Flutter	0	0	2	1

Course Description: The Flutter UI design lab provides hands-on experience in creating visually appealing and responsive user interfaces using the Flutter framework. Participants learn to build cross-platform applications with a single codebase, utilizing Flutter's widget-based architecture to craft beautiful designs for both iOS and Android platforms. The lab emphasizes practical skills in UI development, enhancing proficiency in Flutter's rich set of tools and components.

Course Outcomes: After completion of this course, the student will be able to:

C506.1	Apply the basics of the Dart programming language, Flutter Widgets.
C506.2	Create responsive UI Widgets using navigator in Flutter Applications
C506.3	Implement a form with various input fields and animations, along with validation and error handling.
C506.4	Demonstrate Flutter Application using REST API and Flutter debugging tools.

LIST OF PROGRAMS

CYCLE 1:

1. a) Install Flutter and Dart SDK.

b) Write a simple Dart program to understand the language basics.

2. a) Explore various Flutter widgets (Text, Image, Container, etc.).

b) Implement different layout structures using Row, Column, and Stack widgets.

3. a) Design a responsive UI that adapts to different screen sizes.

b) Implement media queries and breakpoints for responsiveness.

4. a) Set up navigation between different screens using Navigator.

b) Implement navigation with named routes.

5. a) Design stateful and stateless widgets.

b) Implement state management using set State and Provider.

6. a) Create custom widgets for UI elements.

b) Apply styling using themes and custom styles.

CYCLE 2:

7. a) Design a form with various input fields.

b) Implement form validation and error handling.

8. a) Add animations to UI elements using Flutter's animation framework.

b) Experiment with different types of animations (fade, slide, etc.).

9. a) Fetch data from a REST API.

b) Display the fetched data in a meaningful way in the UI.

10. a) Write unit tests for UI components.

b) Use Flutter's debugging tools to identify and fix issues.

REFERENCE BOOKS:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. “Flutter in Action” by Eric Windmill.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
CS507PC	**Computer Networks Lab**	0	0	2	1

Pre - Requisite Programming for problem solving

Course Description: This lab introduces implementation of various framing methods, error detection and correction mechanisms. Design and implementation of various routing protocols and congestion control. It helps in providing & monitoring security using tools like nmap, Wireshark and NS2.

Course Outcomes: After completion of this course, the student will be able to:

C507.1 Implement various Framing methods, Error Control methods and Sliding window protocols.

C507.2 Analyze various protocols, operating system detection using appropriate monitoring tools.

C507.3 Evaluate various routing protocols and congestion control mechanisms.

C507.4 Evaluate the performance of routing protocols and IEEE 802.x standards using NS2 simulator

CYCLE 1:

1. Implement the data link layer framing methods such as character count, character stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC-CCIP.
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Wireshark
    i. Packet Capture Using Wire shark
    ii. Starting Wire shark
    iii. Viewing Captured Traffic
    iv. Analysis and Statistics & Filters.
5. Nmap
    i. How to run Nmap scan
    ii. Operating System Detection using Nmap

CYCLE 2:

6. Implement Dijsktra's algorithm to compute the shortest path through a network
7. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
8. Implement distance vector routing algorithm for obtaining routing tables at each node.
9. Write a program for congestion control using Leaky bucket algorithm.
10. Do the following using NS2 Simulator
    i. NS2 Simulator-Introduction
    ii. Simulate to Find the Number of Packets Dropped
    iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
    iv. Simulate to Find the Number of Packets Dropped due to Congestion.
    v. Simulate to Compare Data Rate & Throughput.
    vi. Simulate to Plot Congestion for Different Source/Destination
    vii. Simulate to Determine the Performance with respect to Transmission of Packets

Text Books:

1. Computer Networks, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI.

Reference Books:

1. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
2. Data Communications and Networking – Behrouz A. Forouzan. 3rd Edition, TMH.

B. Tech. III Year II Sem

Course Code	Lab Title	L	T	P	Credits
AI508PC	**Machine Learning Lab**	**0**	**0**	**2**	**1**

Pre - Requisite **Python Programming Laboratory**

Course Description: This Course implements fundamental statistical concepts using Python libraries. Various classification and regression models are built, which helps to gain practical experience in machine learning model selection and evaluation.

Course Outcomes: After completion of this course, the student will be able to

C508.1 Implement statistical concepts required for data analysis

C508.2 Analyze data, model, model complexity and predict the trends.

C508.3 Correlate various machine learning algorithms along with their strengths and Weaknesses.

C508.4 Build predictive models from data and analyze the model performance.

List of Experiments:

Cycle 1:

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, and Standard Deviation.

2. Write a program to perform Arithmetic Array Operations (Addition, Subtraction, Multiplication, Division, Exponentiation, and Modulus) using Libraries such as Statistics, Math, Numpy and Scipy.

3. Implement and demonstrate the following by importing the dataset from load_ dataset.

   a. Pandas library function for data analysis & manipulation

   b. Matplotlib library functions for data visualization

4. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis for a given dataset.

   ['Sunny', 'Warm', 'Normal', 'Strong', 'Warm', 'Same', 'Yes']

   ['Sunny', 'Warm', 'High', 'Strong', 'Warm', 'Same', 'Yes']

   ['Rainy', 'Cold', 'High', 'Strong', 'Warm', 'Change', 'No']

   ['Sunny', 'Warm', 'High', 'Strong', 'Cool', 'Change', 'Yes']

5. Write a Python program to find out the correlation between Salary (dependent variable) and Experience (independent variable) using Simple Linear Regression.

Cycle 2:

6. Write a Python program to find out the correlation between Salary (dependent variable) and Experience (independent variable) using Simple Linear Regression.
7. Using scikit-learn, perform House Price Prediction with Multiple Linear Regression (minihomeprices.csv)
8. Write a program to Predict Humidity using Decision Tree Algorithm.(daily_weather.csv)
9. Write a program to implement k-Nearest Neighbour classification algorithm using iris dataset.
10. Write a program to predict rainfall using Logistic Regression. (weatherAUS.csv)
11. Write a program to implement K-Means algorithm for clustering Mall customers (Mallcustomers.csv)

TEXT BOOK:

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2017.

REFERENCE BOOK:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis,Second Edition.

B. Tech III Year I Semester

Course Code	Course Title	L	T	P	Credits
MC509	Constitution of India	3	0	0	0

Course Description : The students will be able to understand the history of Indian Constitution, and to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. It is to address the role of socialism in India after the commencement of the Bolshevik Revolution and develops the spirit of nationalism.

Course Outcomes: At the end of the course, the student will be able to

C509.1 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

C509.2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

C509.3 Discuss the circumstances surrounding the foundation of the Congress Socialist Party (CSP) under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

C509.4 Discuss the passage of the Hindu Code Bill of 1956.

C509.5 Understand the Parliamentary form of Government in India.

C509.6 Discuss the role and importance of Local Administration.

Unit – I History and Philosophy of the Indian Constitution

History of Drafting Committee, Preamble and Salient Features of the Indian Constitution.

Unit – II Contours of Constitutional Rights & Duties

Fundamental Rights:Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies ,Directive Principles of State Policy.Fundamental Duties.

Unit – III Organs of Governance

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit – IV Local Administration

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Unit – V Election Commission

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Mahendra Pal Singh, V.N.Shukla's Constitution of India, Eastern Book Company, 2017.
3. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
4. J.N. Pandey, Constitutional Law of India, Central Law Agency, 2018.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
SM601MS	Business Economics and Financial Analysis	3	0	0	3

Course Description: The course contains various topics related to forms of Business and the impact of economic variables on the Business. It includes the Demand, Supply, Production, Cost, Market Structure and Pricing aspects in business. The Students can study the firm's financial position by analyzing the Financial Statements of a Company which can be used in their engineering career development.

Course Outcomes After successful completion of the course, students will be able to:

C601.1 Understand the Economic Concepts in business decision making process.
C601.2 miliarize with the cost concepts, market structures.
C601.3 Make use of break-even analysis, CVP Analysis, pricing strategies.
C601.4 Examine financial accounting and analyze various financial statements.
C601.5 Interpret various financial statements by applying different types of ratios.
C601.6 Examine the usefulness of Investment decisions of a company.

Unit – I Introduction To Business And Economics

Business: Introduction to business, Structure of Business Firm, Types of Business Entities: Sole Proprietorship, Partnership, Limited Liability Company & Co-operatives, Sources of Capital for a Company: Conventional, Non-Conventional Sources of Finance. Theory of Firm.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

Unit – II Demand And Supply Analysis

Demand: Demand Determinants, Law of Demand

Elasticity of Demand: Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

Unit – III Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Perfect competition, Monopoly, Oligopoly, Monopolistic Competition: Features and Price Determination.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

Unit – IV Financial Accounting

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance,

Elements of Financial Statements, Preparation of Final Accounts.

Unit – V Financial Analysis Through Ratios

Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

Text Books:

1. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.
2. D.D.Chaturvedi, S.L.Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
3. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.

Reference Books:

1. S.N.Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.
2. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
3. Managerial Economics: Theory and Applications, D.M. Mithani, Himalaya Publishing House, 2017.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI602PC	**Data Analytics**	3	0	0	3

Pre-Requisite Database Management Systems, probability and statistics.

Course Description: This course explores the fundamental concepts of analytics, its principles and methods using statistical analysis. It contains supervised and unsupervised models with estimation to discover interesting patterns and analyze its impact in business decisions. This also covers the various search methods and visualization techniques to carry out standard data visualization and formal inference procedures.

Course Outcomes: After successful completion of the course, students will be able to

C602.1 Fetch data from various sources and make it ready for analysis.

C602.2 Make use of various tools and technologies for data analysis.

C602.3 Apply regression techniques to data and evaluate performance.

C602.4 Build supervised and unsupervised learning models for objective segmentation.

C602.5 Build models for time series and evaluate its performance.

C602.6 Visualize the data and interpret the insights that exist in the data.

UNIT-I Data Management

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality - Noise, Outliers, Missing Values, Duplicate data, and Data Processing.

UNIT-II Data Analytics

Data Analytics : Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and Variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT-III Regression

Regression: Introduction, Correlations and Relationships, Visual Look at relationships, Linear Regression, Blue property assumptions, Least Square Estimation, Non-linear regression, Logistic Regression, Advantages and Disadvantages of Regression Models, Analytics applications to various Business Domains

UNIT-IV Object Segmentation

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, ETL approach, Extract features from generated model as Height, Average Energy etc and analyze for prediction.

UNIT-V Data Visualization

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques,

Visualizing Complex Data and Relations.

Text Books:

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.
3. Data Analytics -Anil Maheswaran, McGrawHill.

Reference Books:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.
4. Beautiful Visualization, Looking at Data Through the Eyes of Experts, Julie Steele and Noah Iliinsky, Oreilly.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI603PC	**Natural Language Processing**	3	0	0	3

Pre - Requisite Data Structures and compiler design

Course Description: This course covers various core NLP problems and solutions. Explores concepts of syntax, semantics and language models.

Course Outcomes: At the end of the course, the student will be able to

C603.1	Explore the interconnection between document structure and different morphological models
C603.2	Comprehend the representation of syntactic structures by utilizing treebanks for parsing natural language.
C603.3	Apply appropriate parsing models to efficiently address ambiguity and multilingual contexts
C603.4	Analyze semantic parsing principles and system paradigms to achieve accurate disambiguation of word senses.
C603.5	Examine the structure of predicate arguments to establish meaningful representation systems.
C603.6	Develop diverse language modeling techniques.

Unit – I Structure of Words & Documents

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches, Features

Unit – II Syntax I

Syntax I: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms

Unit – III Syntax II

Syntax II: Models for Ambiguity Resolution in Parsing, Multilingual Issues

Semantic Parsing I: Introduction, Semantic Interpretation, System Paradigms, Word Sense

Unit – IV Semantic Parsing

Semantic Parsing : Predicate-Argument Structure, Meaning Representation Systems

Unit – V Language Modeling

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Bayesian parameter estimation, Language Model Adaptation, Language Models- class based, variable length, Bayesian topic based, Multilingual and Cross Lingual Language Modeling

Text Books:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.

Reference Books:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI621PE	**Software Testing Methodologies** **Professional Elective – II**	3	0	0	3

Pre - Requisite Software Engineering

Course Description This Course provides a comprehensive overview of various software testing methodologies, techniques and best practices to ensure the delivery of high-quality software products. This course also deals with the principles and processes involved in testing software applications from unit testing to system testing.

Course Outcomes: At the end of the course, the student will be able to

C614.1 Explore the software testing foundations and bugs

C614.2 Apply suitable testing techniques for representation of flow graphs

C614.3 Apply data flow and interface testing techniques for identifying nice and ugly domains

C614.4 Choose appropriate path expression, KV charts for logic based testing strategies

C614.5 Examine the state graphs for state testing and the testability tips

C614.6 Explore graph matrices, matrix properties and node reduction algorithms.

Unit – I Software Testing fundamentals

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of Bugs.

Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

Unit – II Testing types- Transaction flow testing and Domain testing

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: Domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domains and testability

Unit – III Path testing and Logic based Testing

Paths, Path products and Regular expressions: Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

Unit – IV State testing and Transition Testing

State, State Graphs and Transition testing: State graphs, good & bad state graphs, state testing, Testability tips.

Unit – V Applications of Graph matrices

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.

Textbook:

1. Software Testing techniques - BarisBeizer, Dreamtech, second edition.
2. Software Testing Techniques – SPD(Oreille)

Reference Books:

1. The craft of software testing - Brian Marick, Pearson Education.
2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech**.**
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

B. Tech. III Year I Sem

Course Code	Course Title	L	T	P	Credits
AI622PE	**Information Retrieval Systems** **Professional Elective – II**	3	0	0	3
Pre - Requisite	Data structures & Database Management Systems				

Course Description: The course aims to provide the concepts of information retrieval and their application to locate relevant information in a large corpus of documents.

Course Outcomes: At the end of the course, the student will be able to

C622.1	Describe Information Retrieval Systems' (IRS) principles, capabilities, and functionalities.
C622.2	Choose appropriate data structure, file structure and indexing mechanism for efficient retrieval.
C622.3	Differentiate among various classes of automatic indexing methods and clustering techniques.
C622.4	Select suitable search technique based on the context.
C622.5	Apply visualization techniques for efficient presentation of information.
C622.6	Make use of the algorithms for different media data.

Unit – I Information Retrieval Systems & Capabilities

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

Unit – II Cataloging & Indexing, Data Structures

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Information Extraction

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

Unit – III Automatic Indexing , Document and Term Clustering

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

Unit – IV User Search Techniques & Visualization

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

Unit – V Text Search Algorithms & MIR

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems

Multimedia Information Retrieval (MIR): Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

Text Book:

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury.

Reference Books:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.

2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.

3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

4. Modern Information Retrieval by Yates and Neto Pearson Education.

B.Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI623PE	**Pattern Recognition Professional Elective - II**	3	0	0	3

Pre-requisite Programming for problem solving

Course Description: This course covers concepts viz, pattern recognition, data representation, and various classification techniques.

Course Outcomes: At the end of the course, the student will be able to:

C623.1 Explore the importance of pattern recognition and its representation
C623.2 Classify the variants of Nearest Neighbor Algorithm
C623.3 Implement Markov Models for classification, mastering the intricacies of Hidden Markov Models
C623.4 Apply Decision Trees for effective pattern classification.
C623.5 Develop Support Vector Machines, Neural Networks, and Ensemble Classifiers for optimal pattern classification.
C623.6 Analyze different types of clustering algorithms for pattern clustering

Unit–I Introduction and Representation

Introduction: Pattern Recognition, Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition. **Representation:** Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature Extraction, Feature Selection, Evaluation of Classifier, Evaluation of Clustering.

Unit–II Nearest Neighbor Based Classifier and Bayes Classifier

Nearest Neighbor Based Classifier: Nearest Neighbor Algorithm, Variants of the NN Algorithm, use of the Nearest Neighbor Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection. **Bayes Classifier:** Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with the NNC, Naïve Bayes Classifier, Bayesian Belief Network.

Unit–III Hidden Markov Models and Decision Trees

Hidden Markov Models : Markov Models ,Hidden Morkov Models, Classification using HMMs. **Decision Trees:** Introduction, Decision Tree for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Overfitting and Pruning, Examples of Decision Tree Induction.

Unit–IV Support Vector Machines and Combination of Classifiers

Support Vector Machines: Introduction, Learning the Linear Discriminant Functions, Neural Networks, SVM for Classification. **Combination of Classifiers:** Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers.

Unit–V Clustering and Recognition

Clustering: Importance of clustering, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets .An Application-Hand Written Digit **Recognition:** Description of the Digit Data, Preprocessing of Data, Classification Algorithms, Selection of Representative Patterns, Results.

Textbook:

1. Pattern Recognition: An Algorithmic Approach: Murty, M.Narasimha, Devi, V.Susheela, Spinger Pub, 1stEd.

Reference Books:

1. Machine Learning-Mc Graw Hill, Tom M. Mitchell.
2. Fundamentals Of Speech Recognition: Lawrence Rabiner and Biing-Hwang Juang. Prentice Hall Pub.

B.Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI624PE	**Data Warehousing and Data Mining** **Professional Elective - II**	3	0	0	3

Pre-requisite Probability and Statistics

Course Description: This course covers concepts such as data warehouse, discovering patterns, correlations, anomalies, trends within large datasets to extract useful information and make informed decisions. This course also introduces the techniques and algorithms used in data mining.

Course Outcomes: At the end of the course, the student will be able to:

C624.1 Examine data mining tasks, KDD process, challenges and data types of data.

C624.2 Explore Data Preprocessing techniques to make data sets ready for mining.

C624.3 Identify the frequent patterns and association rules from transactional datasets.

C624.4 Demonstrate pattern mining to the multilevel and multi-dimensional dataset.

C624.5 Classify the real world data into appropriate classes using various supervised learning techniques and measure its performance.

C624.6 Discuss clustering and outlier detection techniques on given data sets and evaluate goodness measures.

Unit–I Data Warehouse and Data Mining

Data Warehouse: Data Warehouse, Data Warehouse Modelling, OLAP operations, Data Qube Computation methods.

Data Mining: Introduction – Data mining, Kinds of data to be mined, Kinds of patterns to be mined, Technologies used, Applications of data mining, Major Issues in Data Mining.

Know Your Data – Data Objects and Attribute types, Basic statistical descriptions of data, data visualization, Measuring data similarity and dissimilarity.

Unit–II Data Preprocessing

Data Preprocessing – Overview, Data cleaning- Missing values, Noisy data, Data cleaning as a process, Data integration - Entity identification problem, Redundancy and correlation analysis, Tuple duplication, Data value conflict detection and resolution.

Data Reduction & Transformation – Overview of data reduction strategies, Principal Component Analysis, Attribute subset selection, Parametric data reduction, Histograms, Clustering, Sampling, Data cube aggregation, Data transformation and Data discretization.

Unit–III Association Rule Mining

Mining Frequent Patterns – Basic concepts, Frequent item set mining methods, Pattern evaluation methods.

Advanced Pattern Mining – Pattern mining in multilevel, Multidimensional space, Constraint-Based frequent pattern mining, Mining High-dimensional data and Colossal patterns, Pattern exploration and Application.

Unit–IV Classification

Classification and Prediction – Basic concepts, Decision tree induction, Bayesian classification, Rule based classification, Model evaluation and selection, Lazy Learner.

Unit–V Clustering and Application

Cluster analysis, Partitioning methods, Hierarchical methods, Density based methods, Grid based methods, Evaluation of clustering.
Outlier Detection – Outlier Analysis, Outlier detection methods, Statistical approaches, Proximity based approaches.

Textbook

1. Data Mining– Concepts and Techniques - Jiawei Han & Micheline kamber,Elsevier,4thEdition.

Reference Books

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.
2. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.
3. DataWarehousing,DataMining&OLAP-AlexBersonandStephenJ.Smith-TataMcGraw-HillEdition,Tenthreprint2007
4. Data Mining Introductory and Advanced topics–Margaret HDunham, PEA.
5. Building the Data Warehouse-W.H. Inmon, Wiley Dream tech India Pvt. Ltd.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI604PC	**Natural Language Processing Lab**	**0**	**0**	**3**	**1.5**

Lab Description: This lab helps to develop natural language based application by processing statements as words, phrases and sentences by applying various NLTK library functions.

Course Outcomes: After completion of this course, the student will be able to:

C604.1 Apply word processing techniques to perform tokenization, stemming.
C604.2 Develop programs to perform word analysis using NLTK tool kit.
C604.3 Implement Natural Language Processing features using NLTK toolkit.
C604.4 Analyze NLTK toolkit to perform conversion of audio to text file.

List of Programs

Cycle 1:

1. Write a Python Program to perform text Tokenization
2. Write a Python Program to perform Stop word Removal
3. Write a Python program to implement Porter stemmer algorithm for stemming
4. Write Python Program for a) Word Analysis b) Word Generation
5. Create a Sample list for at least 5 words with ambiguous sense and Write a Python program to implement WSD

Case Study:
Perform preprocessing of amazon reviews dataset with stemming, tokenization, stop word removal and word sense.

Cycle 2:

6. Install NLTK tool kit and perform stemming
7. Create Sample list of at least 10 words POS tagging and find the POS for any given word
8. Write a Python program to Perform Morphological Analysis using NLTK library
9. Generate n-grams using NLTK N-Grams library
10. Implement N-Grams Smoothing
11. Using NLTK package to convert audio file to text and text file to audio files.

Case Study:
Perform sentiment analysis to find positive and negative reviews of products from amazon reviews dataset.

Textbooks

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.

2. Oreilly Practical natural Language Processing, A Comprehensive Guide to Building Real World NLP Systems.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI605PC	**Data Analytics Lab**	0	0	3	1.5

Pre-Requisite Python Programming Laboratory

Course Description:

This course helps to implement the fundamental concepts of data analytics and to learn the principles and methods of statistical analysis. Also, to build interesting patterns, analyze supervised and unsupervised models, and estimate the accuracy of the algorithms. Apply the various search methods and visualization techniques.

Course Outcomes: After successful completion of the course, students will be able to:

C605.1 Implement linear regression and logistic regression
C605.2 Apply the functionality of different classifiers
C605.3 Design visualization techniques using different graphs
C605.4 Develop descriptive and predictive analytics for different types of data

List of Experiments:

CYCLE 1:

1. Write a program to perform the following data preprocessing operations.
   a. Handling missing values
   b. Noise detection removal
   c. Identifying data redundancy and elimination
2. Develop an imputation model using mean strategy.
3. Write a Python program to determine the correlation between dependent variable (Salary) and independent variable (Experience) using Simple Linear Regression.
4. Write a program to implement Logistic Regression on given dataset.
5. Implement Decision Tree Induction for classification on Rainfall data. (weatherAUS.csv)
6. Implement a Random Forest Classifier on Rainfall data. (weatherAUS.csv)

CYCLE 2:

7. Write a program to implement ARIMA on given Time Series data.
8. Implement object segmentation using hierarchical-based methods
9. Visualize given data using the following different types of charts - Bar, Colum, Line, Scatter, 3D Cubes.
10. Perform Descriptive analytics on healthcare data.
11. Perform Predictive analytics on Product Sales data

Text Books:

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

Reference Books:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.

B. Tech. III Year II Sem

Course Code	Course Title	L	T	P	Credits
AI606PC	**DevOps Lab**	**0**	**0**	**4**	**2**

Course Description: This lab helps to develop a sustainable base for applications and ensure high scalability. DevOps aims to shorten the software development lifecycle to provide continuous delivery with high-quality.

Course Outcomes: After completion of this course, the student will be able to:

C606.1 Practice Source code management using GIT

C606.2 Build the environment for software application development using Jenkins.

C606.3 Apply different project management, integration and development tools

C606.4 Use Selenium tool for automated testing of application

List of Programs

Cycle 1:

1. Write code for a simple user registration form for an event.
2. Explore Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code in exercise 1.
4. Jenkins installation and setup, explore the environment.
5. Demonstrate continuous integration and development using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.

Cycle 2:

8. Integrate Kubernetes and Docker
9. Automate the process of running containerized applications for exercise 7 using Kubernetes.
10. Install and Explore Selenium for automated testing.
11. Write a simple program in JavaScript and perform testing using Selenium.
12. Develop test cases for the above containerized application using selenium.

Reference Books:

1. Joakim Verona., Practical DevOps, Packt Publishing, 2016.
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications.
3. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley.

B. Tech. III Year II Semester

Course Code	Course Title	L	T	P	Credits
*MC607	Intellectual Property Rights	3	0	0	0

Course Description: To provide the students with the conceptual framework and the theories underlying Organizational Behavior.

Course Outcomes: At the end of the course, the student will be able to

C607.1 Understand the fundamental aspects of Intellectual property Rights who are going to play a major role in development and management of innovative projects in industries.

C607.2 Examine Trademarks, Acquisition of Trade Mark Rights and its registration processes.

C607.3 Evaluate various aspects relating to copyrights and its procedure for registration processes.

C607.4 Evaluate with the Trade Secret Law, protection for submission, Unfair Competition.

C607.5 Evaluate on the International Developments in Intellectual Property Rights.

C607.6 Interpret about current trends in IPR and the steps taken by the Government of India in fostering IPR.

Unit – I Introduction to Intellectual property

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit – II Trade Marks

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Unit – III Law of copy rights

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit – IV Trade Secrets

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

Unit – V New development of intellectual property

New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

Text Books:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI701PC	**Deep Learning**	3	0	0	3

Pre - Requisites Artificial Intelligence, Machine Learning

Course Description :

This course covers concepts of machine learning, deep feed forward networks. Also explores about regularization, convolution networks, recurrent networks and debugging strategies with applications.

Course Outcomes : At the end of the course, the student will be able to

C701.1	Explore different machine learning algorithms and deep feed forward networks algorithms
C701.2	Evaluate different methods of regularization for deep learning.
C701.3	Analyze optimization methods to optimize the models.
C701.4	Explore basic structures of convolution networks and hyper parameters.
C701.5	Demonstrate various recurrent network structures and recursive network structures.
C701.6	Compare different network structures by analyzing hyper parameters & debugging strategies. Explore applications of deep learning.

Unit – I Machine Learning & Deep forward networks

Machine Learning Basics, Learning Algorithms, Capacity, Over fitting and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Stochastic Gradient Descent, Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

Deep Feed forward Networks Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms.

Unit – II Regularization for Deep Learning

Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop, and Manifold Tangent Classifier, Optimization for Training Deep Models, Learning vs Pure Optimization, Challenges in Neural Network Optimization.

Unit – III Convolution Networks

The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

Unit – IV Recurrent and Recursive Nets

Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long- Term Dependencies, Explicit Memory

Unit – V Practical Methodology & Applications

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data**,** Selecting Hyper parameters, Debugging Strategies, Example: Multi-Digit Number Recognition.

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications.

Textbook:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.

Reference Books:

1. The Elements of Statistical Learning. Hastie, R. Tibshirani, and J. Friedman, Springer.
2. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.
3. Bishop. C.M., Pattern Recognition and Machine Learning, Springer, 2006.
4. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
5. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
6. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

B. Tech. IV Year I Semester

Course Code	Course Title	L	T	P	Credits
SM702MS	Professional Practice, Law and Ethics	3	0	0	2

Course Description: The Course provides the students with a comprehensive understanding of the legal and ethical frameworks that govern various professional fields. It explores the ethical principles and standards that guide professional conduct and decision-making processes.

Course Outcomes : At the end of the course, the student will be able to

C702.1 Understand the Professional Practice and Ethics needed for Engineering Professionals.

C702.2 Familiarize the various concepts in Law of Contract.

C702.3 Analyze the challenges of Law and its judicial interventions.

C702.4 Assess the regulatory aspects of negotiable instruments.

C702.5 Evaluate the Law relating to different types of Intellectual Property.

C702.6 Apply the various issues relating to professional practice, law and ethics aimed for overall development.

Unit – I

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics: Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

Unit – II

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

Unit – III

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Unit – IV

Negotiable Instruments Act - 1881: Negotiable Instruments- Promissory Note, Bills of Exchange, & Cheque, Parties to negotiable instruments, Types of endorsements, Holder- Holder in due course, Dishonour and discharge of negotiable Instruments, Offences by the companies.

Unit – V

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and

procedures in India; Law relating to Patents under Patents Act, 1970.
Formation of Company, Composition of Board of Directors, Roles and Responsibilities of Directors.

Textbooks

1. R. Subramanian, Professional Ethics, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.
3. N.D. Kapoor, Elements of Mercantile Law, Sultan Chand & Sons, 38th e, 2020

Reference Books

1. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
2. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
3. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI703PC	Nature Inspired Computing	2	0	0	2
Pre-Requisites	Artificial Intelligence, Natural Language Processing				

Course Description: This course covers concepts of computational techniques inspired by natural biological processes, including evolutionary computing, neuro computing, swarm intelligence, and artificial immune systems. It applies principles from nature to solve complex problems efficiently by learning and performing self-organization.

Course Outcomes: At the end of the course, the student will be able to

C703.1	Illustrate the fundamental concepts of evolutionary computing and its applications in problem solving.
C703.2	Apply learning algorithms in ANN to model and analyse complex systems.
C703.3	Analyse swarm intelligence techniques and ant colony optimization.
C703.4	Evaluate different Artificial Immune System (AIS) models for anomaly detection
C703.5	Design bio-inspired computing solutions using evolutionary algorithms for real-world applications.
C703.6	Analyze bio-inspired computing technique through case studies.

Unit – I Evolutionary Computing

Problem Solving as a Search Task, Hill Climbing and Simulated Annealing, Evolutionary Biology, Evolutionary Computing, The Other Main Evolutionary Algorithms, From Evolutionary Biology to Computing, Scope of Evolutionary Computing

Unit – II Neuro computing

The Nervous System, Artificial Neural Networks, Typical ANNS and Learning Algorithms, From Natural to Artificial Neural Networks, Scope of Neuro computing

Unit – III Swarm Intelligence

Ant Colonies, Swarm Robotics, Social Adaptation of Knowledge

Unit – IV Immune computing

The Immune System, Artificial Immune Systems, Bone Marrow Models, Negative Selection Algorithms, Clonal Selection and Affinity Maturation, Artificial Immune Networks, From Natural to Artificial Immune Systems, Scope of Artificial Immune Systems

Unit – V Bioinformatics

Pervasive Computing, Bioinformatics, Information Display, Noise in Foreign Exchange Markets.

Text Books:

1. Leandro Nunes de Castro - " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Albert Y.Zomaya - "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006

Reference Books:

1. Floreano, D. and C. Mattiussi -"Bio-Inspired Artificial Intelligence: The oriesethods, and Technologies" IT Press, 2008
2. Marco Dorrigo, Thomas Stutzle -" Ant Colony Optimization", Prentice Hall of India, New Delhi, 2005

B.Tech IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI711PE	Internet of Things Professional Elective - III	3	0	0	3

Pre - Requisite Operating Systems, Python Programming

Course Description: This course covers IoT concepts, including design, enabling technologies, and applications in areas like home automation, agriculture, and health. Students will develop Python programs, RESTful web APIs, and manage IoT systems with NETCONF and YANG, while working with devices like Raspberry Pi and cloud storage models.

Course Outcomes: At the end of the course, the student will be able to

C711.1	Analyse IoT concepts, enabling technologies, and deployment templates.
C711.2	Compare IoT and M2M, assess the role of SDN and NFV in IoT, and implement system management techniques using NETCONF, YANG, and SNMP.
C711.3	Apply Python data types, control flow, functions, and file handling techniques to develop programs for IoT applications.
C711.4	Utilize Python packages for IoT, including modules, classes, exceptions, and data/time operations, to build efficient IoT solutions.
C711.5	Build RESTful web APIs and Python-based applications for IoT solutions using IoT physical devices.
C711.6	Apply case studies in home automation, weather monitoring, air pollution monitoring, and agriculture to design IoT-based solutions for real-world applications.

Unit – I Introduction to Internet of Things

Introduction to Internet of Things - Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates, Applications of IoT.

Unit – II IoT and M2M Integration

IoT and M2M – M2M, Difference between IoT and M2M, SDN and NFV for IoT

IoT System Management with NETCOZF, YANG - Need for IoT system Management, Simple Network management protocol, Network operator requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG

Unit – III Building IoT Solutions with Python

GPIO Libraries for Hardware Interaction – Rpi.GPIO, gpiozero, WiringPi

Cloud Integration – Publishing Data, Building a web-based dashboard with freeboard, Sending and receiving data in real-time through internet with PubNub, Publishing messages with commands through PubNub cloud, Working with bi-directional communication.

Unit – IV Integrating IoT Devices with Cloud Infrastructure

IoT Physical Devices and Endpoints - Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry PI with Python, Other IoT devices.

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs, WAMP-AutoBahn for IoT, Xively Cloud for IoT, Python web application framework –Django, Designing a RESTful web AP

Unit – V IoT Applications

Case studies - Home Automation, Environment-weather monitoring-weather reporting- air pollution monitoring, Agriculture.

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
2. Building the Internet of Things: Implement New Business Models, Disrupt Competitors, and Transform Your Industry by Maciej Kranz, Wiley Publication, December 2016.
3. Raspberry Pi Cookbook: Software and Hardware Problems and Solutions by Simon Monk, O'Reilly Media, 4th Edition, 2023
4. Internet of Things with Python: Build exciting Internet of Things projects with Python by Gaston C. Hillar, Packt Publishing, 2016.

Reference Books:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.
2. The Internet of Things: A Survey by Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, and David Boyle, Elsevier Publication, 2014.

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI712PE	**Generative AI** **Professional Elective- II**	3	0	0	3

Pre - Requisites Machine Learning, Natural Language Processing

Course Description: This course covers concepts on generative AI basics, implementing generative ai applications, selecting best LLMs. Also learns project life cycle of LLM application, develop and deploy the generative ai model.

Course Outcomes: At the end of the course, the student will be able to

C712.1 Explore concepts of gen AI and importance of gen ai.

C712.2 Evaluate different large language models and identify the best model.

C712.3 Understand LLM project lifecycle and learn to select best LLM for problem statements.

C712.4 Explore various fine-tuning models and learn the usage of vector database.

C712.5 Analyze the Large Language Models and Transformers.

C712.6 Analyze different architectures of GenAI like ChatGPT, Google Bard.

Unit – I Introducing Gen AI

The Historical Context of Gen AI, The Role of Data in AI Projects, Explaining the Importance of Generative AI, Managing Gen AI Projects with a Cloud Data Platform.

Unit – II Understanding Large Language Models

Categorizing LLMs: Defining general-purpose LLMs, Using task-specific and domain-specific LLMs. Reviewing the Technology Behind LLMs: Introducing key terms and concepts, Explaining the importance of vector embeddings, Identifying developer tools and frameworks.

Unit – III LLM App Project Lifecycle

Defining the Use Case and Scope, Selecting the right LLM, Comparing small and large language models, Adapting LLMs to Your Use Case, Engineering prompts, Learning from context, Augmenting text retrieval, Fine-tuning language models, Reinforcement learning, Using a vector database.

Unit – IV Neural Networks to Large Language Models & Transformers

Neural Network–Based Language Models, RNN, LSTM, GRU, Encoder-Decoder, Transformer, Transformer Architecture, Architecture, Encoder-Decoder Architecture, Attention, Advantages and Limitations of Transformer Architecture.

Unit – V GenAI Architectures

ChatGPT: Architecture of ChatGPT, Contextual Embeddings in ChatGPT, Response Generation in ChatGPT, Strengths and Limitations. Google Bard: Elevating Transformer, Difference Between ChatGPT and Google Bard, Strengths and Weaknesses of Google Bard.

Text Books

1. Generative AI and LLMs, David Baum, Snowflake Special Edition,2024.
2. Applied Generative AI for Beginners, Akshay Kulkarni Adarsha Shivananda Anoosh Kulkarni Dilip Gudivada, Apress, 2023

Reference Books

1. Anand Vemula, Evaluating Generative AI: Principles, Methods, and Applications– 20 June 2024
2. Karthikeyan Sabesan, Sivagamisundari, Nilip Dutta, Generative AI for Everyone, BPB publications, 2025.

B.Tech IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI713PE	**Mobile Application Development** **Professional Elective – III**	3	0	0	3

Pre-Requisite JAVA programming, DBMS

Course Description: This course provides an in-depth introduction to the Android operating system, covering its architecture, development framework, SDK features, and best programming practices. Students will learn to design user interfaces, manage application components, handle events, work with persistent storage, and integrate databases using SQLite, preparing them for Android application development.

Course Outcomes: After successful completion of the course, students will be able to

C713.1 Explore Android OS features, development tools and life cycle management in building Android Applications.

C713.2 Build user interfaces using layouts, UI components, event handling, and fragments.

C713.3 Use intents and broadcast receivers for activity communication and notifications.

C713.4 Utilize persistent storage using files and shared preferences.

C713.5 Develop SQLite database applications with CRUD operations and content providers.

C713.6 Apply best practices for performance, usability, and device adaptability.

UNIT - I Introduction to Android OS and Lifecycle

Introduction to Android Operating System: Android/IOS OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc,Resources for different devices and languages, Runtime Configuration Changes

Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT - II User Interface & Fragments

Android User Interface: Measurements – Device and pixel density independent measuring unit.

Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components –Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT - III Intents and Broadcast Receivers

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT - IV Persistent Storage

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT - V Database

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

Text Books:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.

Reference Books:

1. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
2. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI714PE	**Cloud Computing Professional Elective-III**	3	0	0	3

Pre-requisite Operating Systems & Computer Networks

Course Description: This course introduces computing paradigms and cloud computing fundamentals, including architecture, deployment, and service models. The course also explores networking challenges, cloud service providers, security issues, and advanced cloud concepts.

Course Outcomes: At the end of the course student will be able to

C714.1	Identify cloud architecture, cloud management and computing paradigms.
C714.2	Demonstrate cloud deployment, service models and the key drivers behind technology.
C714.3	Understand virtualization, programming models and cloud software development
C714.4	Explore cloud networking and data center environments.
C714.5	Evaluate cloud service providers and networking challenges.
C714.6	Identify cloud security threats, analyse challenges, and apply advanced security concepts.

Unit – I Computing Paradigms & Fundamentals

Computing Paradigms, Cloud Computing Fundamentals, Cloud Computing Architecture and Management.

Unit – II Cloud Deployment Models & Service Models

Cloud Deployment Models, Cloud Service Models, Technological Drivers for Cloud Computing: SOA and Cloud, Multicore Technology, Web 2.0 and Web 3.0, Pervasive Computing, Operating System, Application Environment

Unit – III Virtualization & Programming Models for Cloud Computing

Virtualization, Programming Models for Cloud Computing: MapReduce, Cloud Haskell, Software Development in Cloud

Unit – IV Networking for Cloud Computing

Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs, Cloud Service Providers

Unit – V Security in Cloud Computing

Security in Cloud Computing, and Advanced Concepts in Cloud Computing

Text Book:

1. Chandrasekaran, K. Essentials of cloud computing. CRC Press, 2014.

Reference Books:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI731PE	**Internet of Things Lab** **Professional Elective - III**	**0**	**0**	**2**	**1**

Pre - Requisite Operating Systems, Python Programming

Course Description: This course teaches students to design IoT systems using Raspberry Pi, Arduino, and NodeMCU, including interfacing sensors and actuators. It also covers setting up Raspberry Pi OS, creating web applications with Django, and integrating MySQL databases for real-world IoT applications.

Course Outcomes: At the end of the course, the student will be able to

C715.1	Develop the functionality of a Django application for weather station REST API.
C715.2	Develop a complete IoT web application using Django to interface with IoT sensors and store data in a MySQL database.
C715.3	Configure the Raspberry Pi OS and how to use Python to interface GPIO pins.
C715.4	Implement a working system that interfaces distance sensors, temperature sensors, and LEDs with Raspberry Pi, Arduino, and NodeMCU using programming.

LAB CYCLE-I

1. Create a DJANGO project and an app.
2. Create a DJANGO view for weather station REST API
3. Create DJANGO template
4. Configure MYSQL with DJANGO framework

Case Study

Develop a Django-based application that allows users to monitor and report climate data collected from various sensors (such as temperature, humidity, air quality, and pressure). The system will include an API for accessing the data, display the data on an interactive dashboard, and store all the data in a MySQL database.

LAB CYCLE-II

5. Installing OS on Raspberry Pi
   a) Installation using PiImager
   b) Installation using image file
      i. Downloading an Image
      ii. Writing the image to an SD card
      iii. using Linux
      iv. using Windows
      v. Booting up Follow the instructions given in the URL https://www.raspberrypi.com/documentation/computers/getting-started.html
6. Accessing GPIO pins using Python
   a. Installing GPIO Zero library. update your repositories list: install the package for Python 3:
   b. Blinking an LED connected to one of the GPIO pin
   c. Adjusting the brightness of an LED Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

7. Using Raspberry pi
   a. Calculate the distance using a distance sensor.
   b. Interface an LED and switch with Raspberry pi.
   c. Interface an LDR with Raspberrry Pi.
8. Using Arduino
   a. Calculate the distance using a distance sensor.
   b. Interface an LED and switch with Aurdino.
   c. Interface an LDR with Aurdino d. Calculate temperature using a temperature sensor.
9. Using Node MCU
   a. Calculate the distance using a distance sensor.
   b. Interface an LED and switch with Raspberry pi.
   c. Interface an LDR with Node MCU
   d. Calculate temperature using a temperature sensor.

Case Study

Create a temperature monitoring system that collects temperature data from an IoT-enabled sensor (e.g., Raspberry Pi, Arduino, or ESP32) and displays this data on a Django-powered web interface. The goal of this system is to allow users to monitor real-time temperature readings and store historical data for future analysis.

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

Reference Books:

1. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3 642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
2. 2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

B.Tech IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI732PE	**Deep Learning & Generative AI Lab (Professional Elective – III)**	0	0	2	1

Pre-Requisite Python Programming, Deep Learning, Natural Language Processing.

COURSE DESCRIPTION: This course provides hands-on experience in developing deep learning applications and generative ai applications with foundation models, transformers, encoder-decoder architectures. Also learns about existing architectures ChatGPT, Bard, Gemini, DeepSeek.

COURSE OUTCOMES: After successful completion of the course, students will be able to

C731.1 Develop applications by using CNN for computer vision based applications and image classification.

C731.2 Implement applications to work with natural language processing and autoencoders.

C731.3 Implement encoder – decoder models for text translation, text summarization.

C731.4 Develop text processing models and explore on text generation architectures.

CYCLE - 1

1. Setting up the Spyder IDE Environment and Executing a Python Program. Installing Keras, Tensorflow and Pytorch libraries and making use of them.
2. Applying the Convolution Neural Network on computer vision problems.
3. Image classification on MNIST dataset (CNN model with Fully connected layer).
4. Applying the Deep Learning Models in the field of Natural Language Processing.
5. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM.
6. Applying the Autoencoder algorithms for encoding the real-world data

CYCLE - 2

7. Train a Generative Adversarial Network (GAN) to generate synthetic images based on a given dataset, such as MNIST or CIFAR-10.
8. Implement an Encoder-Decoder architecture using RNN/LSTM for text translation, analyzing how the encoder captures input sequences and the decoder generates meaningful outputs.
9. Develop an Encoder-Decoder model with Attention for medical text summarization, evaluating how Attention improves context retention in long clinical documents.
10. Implement and compare Neural Network–Based Language Models for clinical text generation and medical report summarization.
11. Explore the Transformer and Encoder-Decoder architectures for medical text processing, utilizing Attention mechanisms to enhance context retention in clinical summaries.
12. Implement a text generation model using a Transformer-based architecture similar to ChatGPT, exploring contextual embeddings and response generation techniques.

B.Tech IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI733PE	**Mobile Application Development LAB (Professional Elective – III)**	0	0	2	1

Pre-Requisite Basic Knowledge of Java Programming

Course Description: This course provides hands-on experience in developing Android applications, covering fundamental concepts such as user input handling, layouts, and event listeners. The course includes practical applications of Android features like intents, notifications, database interactions, and shared preferences.

Course Outcomes: After successful completion of the course, students will be able to

C733.1 Develop Android applications using basic UI elements like Text View, Button, and Edit Text to take user input and display output.

C733.2 Implement complex layouts like Linear, Relative, and Grid Layouts to design functional user interfaces.

C733.3 Use fragments, fragment transactions, and rotation event listeners to create responsive Android applications that adjust to different screen orientations.

C733.4 Apply Android Intents, Notifications, and Shared Preferences for integrating external actions, storing data, and handling notifications.

CYCLE – 1

1. (a)Create an Android application that shows Hello + name of the user and run it on an emulator.

(b) Create an application that takes the name from a text box and shows hello message along with the name entered in the text box, when the user clicks the OK button.

2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date picker), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.

3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a “Back” button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on the right fragment instead of the second screen with the back button. Use Fragment transactions and Rotation event listeners.

4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.

5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.

6. Create an application that uses a text file to store usernames and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with a Login Failed message.

CYCLE - 2

7. Create a user registration application that stores the user details in a database table.

8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.

10. Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.

11. Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.

12. Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.

Text Books:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Cengage, 2013.

Reference Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI734PE	Cloud Computing Lab Professional Elective III	0	0	2	1

Pre - Requisite Programming for problem solving, Database Management Systems

Course Description: This lab provides hands-on experience in virtualization and cloud computing. Students will set up virtual machines, deploy cloud instances, and configure web servers. They will work with cloud databases like Amazon RDS and Google Cloud SQL. It also covers CloudSim, Hadoop setup, OpenStack VM deployment, and inter-VM file transfers.

Course Outcomes:

C734.1	Install and configure virtual machines, set up OS environments, and run basic C programs
C734.2	Deploy cloud services by creating EC2 instances, setting up web servers, and developing web apps on Google App Engine
C734.3	Simulate cloud environments using CloudSim, implement scheduling algorithms, and manage virtual machines with OpenStack
C734.4	Set up cloud databases using Amazon RDS and Google Cloud SQL, and configure a Hadoop single-node cluster for basic tasks

List of Programs

Cycle 1:

1. Install Virtualbox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance.
4. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Cycle 2:

6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count.
9. Create a database instance in the cloud using Amazon RDS.
10. Create a database instance in the cloud using Google Cloud SQL.

Text Book:

1. Essentials of cloud Computing: K. Chandra sekhran, CRC press, 2014

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI721PE	**Quantum Computing**	**3**	**0**	**0**	**3**

Pre - Requisites Basic knowledge on Mathematics, Physics, Programming & Data Structures.

Course Description: This course explains History of Quantum Computing, Background Mathematics, Background Physics, Qubit, Quantum Algorithms and Noise and error correction.

Course Outcomes: At the end of the course, the student will be able to

C721.1 Analyze the mathematical and physical foundations of quantum computing. (BTL-4)

C721.2 Apply qubit concepts and quantum circuits to design computations. (BTL-3)

C721.3 Apply qubit operations to design basic quantum circuits. *(BTL-3)*

C721.4 Design single and multi-qubit gates for efficient circuit construction. (BTL-6)

C721.5 Evaluate quantum algorithms like Grover's and Deutsch-Jozsa. (BTL-5)

C721.6 Develop quantum error correction and fault-tolerant techniques. (BTL-6)

Unit – I History of Quantum Computing

History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations, **Quantum Parallelism and its Advantages.**

Unit – II Background Mathematics & Background Physics

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. **Background Physics:** Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

Unit – III Qubit

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

Unit – IV Quantum Algorithms

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm, and Introduction to Hybrid Quantum-Classical Algorithms.

Unit – V Noise and error correction:

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation.

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Book:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge.

Reference Books:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II.
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

B.Tech IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI722PE	**Reinforcement Learning Professional Elective-IV**	3	0	0	3

Pre-Requisites Artificial Intelligence

Course Description: This course explains the fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks. Also explains about optimization problems, prediction algorithms and generalization algorithms.

Course Outcomes: After successful completion of the course, the student will be able to:

C722.1 Demonstrate multi armed bandit , Thomson sampling algorithms.

C722.2 Explore on Markov decision problems and bellman optimization methods

C722.3 Demonstrate Bellman optimization methods for real time problems.

C722.4 Examine bootstrapping techniques and model free control algorithms.

C722.5 Analyze bootstrapping methods and model free control algorithms.

C722.6 Apply generalization algorithms and policy search methods for real time scenarios.

UNIT -1 Probability and Linear Algebra based Problems

Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sub linear regret, UCB algorithm, KL-UCB, Thompson Sampling.

UNIT -2 Markov Decision Problem and Bellman's Optimization

Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration & policy iteration

UNIT -3 Reinforcement Learning prediction algorithms

The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation.

UNIT -4 Bootstrapping

Bootstrapping; TD(0) algorithm; Convergence of Monte Carlo and batch TD(0) algorithms; Model-free control: Q-learning, Sarsa, Expected Sarsa

UNIT -5 Generalization Algorithms

n-step returns; TD(λ) algorithm; Need for generalization in practice; Linear function approximation and geometric view; Linear TD(λ). Tile coding; Control with function approximation; Policy search; Policy gradient methods; Experience replay; Fitted Q Iteration; Case studies

Text Books:

1. Reinforcement learning: An introduction, First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020.
2. Statistical reinforcement learning: modern machine learning approaches, First Edition, Sugiyama, Masashi. CRC Press 2015.

Reference Books:

1. Bandit algorithms," First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020
2. Reinforcement Learning Algorithms: Analysis and Applications," Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021

B.Tech IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI723PE	**Semantic Web**	3	0	0	3

Professional Elective – IV

Pre - Requisites Node JS, Web Programming

Course Description: This course covers web intelligence, knowledge representation, and ontology engineering. It explores XML, RDF, web services, and semantic search technologies. Students learn to develop intelligent web applications using ontologies and structured data.

Course Outcomes: After successful completion of the course, the student will be able to:

C723.1 Demonstrate the characteristics of Semantic Web.

C723.2 Outline SOAP and UDDI in web services

C723.3 Explore Resource Description Framework and features

C723.4 Understand the fundamentals of XML and style sheets.

C723.5 Illustrate the use of Taxonomies and Ontologies for logical knowledge representation.

C723.6 Learn about web graph processing and search engines.

UNIT-I Introduction to Semantic Web

Introduction to Semantic Web, the Business Case for the Semantic Web, XML and Its Impact on the Enterprise**.**

UNIT-II Web Services

Web services Uses, Basics of Web Services, SOAP, UDDI, Orchestrating Web Services, Securing Web Services, Grid Enabled and Semantic Web of Web Services.

UNIT-III Resource Description Framework

Features, Capturing Knowledge with RDF. XML Technologies: XPath, The Style Sheet Family: XSL, XSLT, and XSL FO, XQuery, XLink, XPointer, XInclude, XMLBase, XHTML, XForms, SVG.

UNIT-IV Taxonomies and Ontologies

Taxonomies and Ontologies: Overview of Taxonomies, Defining the Ontology Spectrum, Topic Maps, Overview of Ontologies, Syntax, Structure, Semantics, and Pragmatics, Expressing Ontologies Logically, Knowledge Representation.

UNIT-V Semantic Web Application & Search Technology

Semantic Web Application: Semantic Web Services, e-Learning, Semantic Bioinformatics, Enterprise Application Integration, Knowledge Base.

Semantic Search Technology: Search Engines, Semantic Search, Semantic Search Technology, Web Search Agents, Semantic Methods, Latent Semantic Index Search, TAP, Swoogle.

Text Books:

1. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management by Michael C. Daconta, Leo J. Obrst , Kevin T. Smith, Wiley Publishing, Inc,2003
2. Peter Mika, Social Networks and the Semantic Web, Springer,2007.

Reference Books:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley Interscience,2008
2 Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons,2006.

B. Tech. IV Year I Sem

Course Code	Course Title	L	T	P	Credits
AI724PE	**Game Theory** **Professional Elective-IV**	3	0	0	3

Pre - Requisites Data Structures , Design and Analysis of Algorithms, Mathematics

Course Description: This course covers concepts of an in-depth understanding of game theory, covering strategic interactions, equilibrium concepts, and rational decision-making. It explores Nash equilibrium, extensive and repeated games, bargaining models, and the role of knowledge in equilibrium formation.

Course Outcomes: At the end of the course, the student will be able to

C724.1	Understand the core principles of game theory, strategic interactions, and rational decision-making.
C724.2	Analyze mixed, correlated, and evolutionary equilibria in game-theoretic models.
C724.3	Identify and rationalize dominated actions by eliminating weak actions.
C724.4	Evaluate the role of knowledge, common knowledge, and information in equilibrium concepts.
C724.5	Apply extensive-form and bargaining game strategies to decision-making scenarios.
C724.6	Study repeated games, folk theorems, and long-term strategic interactions.

Unit – I Introduction to Game Theory

Introduction- Game Theory, Games and Solutions, Game Theory and the Theory of Competitive Equilibrium, Rational Behaviour, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation

Nash Equilibrium- Strategic Games, Nash Equilibrium, Examples, Existence of a Nash Equilibrium, Strictly Competitive Games, Bayesian Games: Strategic Games with Imperfect Information.

Unit – II Mixed, Correlated, and Evolutionary Equilibrium

Mixed, Correlated, and Evolutionary Equilibrium -Mixed Strategy Nash Equilibrium, Correlated Equilibrium, Evolutionary Equilibrium Rationalizability and Iterated Elimination of Dominated Actions- Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions.

Unit – III Knowledge and Equilibrium

Knowledge and Equilibrium -A Model of Knowledge Common Knowledge, Can People Agree to Disagree? Knowledge and Solution Concepts, The Electronic Mail Game

Unit – IV Extensive Games & Bargaining Games

Extensive Games with Perfect Information -Extensive Games with Perfect Information, Subgame Perfect Equilibrium, Two Extensions of the Definition of a Game, The Interpretation of a Strategy, Two Notable Finite Horizon Games.

Bargaining Games -Bargaining and Game Theory, A Bargaining Game of Alternating Offers, Subgame Perfect Equilibrium, Variations and Extensions.

Unit – V Repeated Games

Repeated Games - The Basic Idea Infinitely Repeated Games vs. Finitely Repeated Games, Infinitely Repeated Games: Definitions, Strategies as Machines, Trigger Strategies: Nash Folk Theorems, Punishing for a Limited Length of Time: A Perfect Folk Theorem for the Limit of Means Criterion, Punishing the Punisher: A Perfect Folk Theorem for the Overtaking Criterion, Rewarding Players Who Punish:

Text Books:

1. A course in Game Theory, M. J. Osborne and A. Rubinstein, MIT Press.2020.

Reference Books:

1. Game Theory, Roger Myerson, Harvard University Press,2018.
2. Game Theory, D. Fudenberg and J. Tirole, MIT Press,2016.

B.Tech IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI811PE	Social Network Analytics	3	0	0	3
	Professional Elective – V				

Pre - Requisite Web Technologies

Course Description: This course explores social media networks, their structures, and analysis techniques using tools like NodeXL. It includes case studies on various platforms such as email, Twitter, Facebook, YouTube, and wikis to understand network visualization, interaction patterns, and collaboration.

Course Outcomes: After successful completion of the course, the student will be able to:

C811.1 Understand the role of social media and networks in enhancing digital collaboration.
C811.2 Explore social network structures using mapping techniques.
C811.3 Demonstrate NodeXL for network visualization and metrics.
C811.4 Learn to Filter and cluster data for network analysis.
C811.5 Examine case studies on email, Twitter, and Facebook.
C811.6 Interpret content interaction on YouTube and Wiki..

UNIT-I Introduction

Social Media and Social Networks Social Media: New Technologies of Collaboration Social Network Analysis: Measuring, Mapping, and Modelling collections of Connections.

UNIT-II NodeXL

NodeXL, Layout, Visual Design, and Labelling, Calculating and Visualising Network Metrics, Preparing Data and Filtering, Clustering and Grouping.

UNIT-III Email and Twitter

Email: The lifeblood of Modern Communication. Thread Networks: Mapping Message Boards and Email Lists Twitter: Conversation, Entertainment and Information

UNIT-IV Facebook applications

Visualizing and Interpreting Facebook Networks, WWW Hyperlink Networks

UNIT-V Youtube and Wiki

You Tube: Contrasting Patterns of Content Interaction, and Prominence.
Wiki Networks: Connections of Creativity and Collaboration

Text Books:

Hansen, Derek, Ben Sheiderman, Marc Smith, Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.

Reference Books:

Marshall Sponder, Social Media Analytics: Effective Tools for Building, Interpreting and Using Metrics, 1st Edition, MGH, 2011

Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability, Sybex, 2009.

B. Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI812PE	**Federated Machine Learning** **Professional Elective -V**	3	0	0	3

Pre - Requisite Machine Learning

Course Description: This course covers concepts of privacy preserving concepts, distributed machine learning,

Course Outcomes: At the end of the course, the student will be able to

C812.1 Understand the basics on privacy-preserving machine learning

C812.2 Analyze the key concepts of Distributed machine learning and FL

C812.3 Understand the key concepts and applications of HorizontalFL and Vertical FL

C812.4 Motivates the intensive mechanism design for FL

C812.5 Analyze the concepts of federated reinforcement learning

C812.6 Investigate the practical uses & implementations of federated reinforcement learning

Unit – I Evolutionary Computing

Problem Solving as a Search Task, Hill Climbing and Simulated Annealing, Evolutionary Biology, Evolutionary Computing, The Other Main Evolutionary Algorithms, From Evolutionary Biology to Computing, Scope of Evolutionary Computing

Unit – II Neuro computing

The Nervous System, Artificial Neural Networks, Typical ANNS and Learning Algorithms, From Natural to Artificial Neural Networks, Scope of Neuro computing

Unit– III Swarm Intelligence

Ant Colonies, Swarm Robotics, Social Adaptation of Knowledge

Unit – IV Immune Computing

The Immune System, Artificial Immune Systems, Bone Marrow Models, Negative Selection Algorithms, Clonal Selection and Affinity Maturation, Artificial Immune Networks, From Natural to Artificial Immune Systems, Scope of Artificial Immune Systems

Unit – V Bioinformatics

Bioinformatics related applications, Information Display related applications

Text Books:

1. Federated Learning, Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and HanYu Synthesis Lectures on Artificial Intelligence and Machine Learning 2019.

B. Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI813PE	**Augmented Reality & Virtual Reality (Professional Elective-V)**	3	0	0	3

Pre - Requisite Computer Graphics, UI Design

Course Description: This course covers the fundamentals of Augmented Reality (AR) and Virtual Reality (VR), computer vision applications, software architecture, human physiology and perception related to vision and hearing, and interaction modalities in both real and virtual environments.

Course Outcomes: At the end of the course students will be able to

C813.1 Understand augmented reality, display models and tracking technologies
C813.2 Explore AR computer vision techniques and AR software architectures.
C813.3 Describe virtual reality, virtual world geometry, light & optics
C813.4 Understand human vision, visual perception, and apply rendering techniques.
C813.5 Analyze motion in real and virtual worlds, assess social interactions in VR
C813.6 Understand sound physics and auditory rendering in AR/VR

Unit – I Augmented Reality, Displays & Tracking

Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields **Displays** - Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays.

Tracking - Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

Unit – II Computer Vision, Interaction & Software Architectures

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

Interaction - Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

Software Architectures - AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

Unit – III Virtual Reality, Geometry & Light and Optics

Introduction to Virtual Reality - Defining Virtual Reality, History of VR, Human Physiology and Perception.

The Geometry of Virtual Worlds - Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations.

Light and Optics - Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

Unit – IV Human Vision, Visual Perception & Rendering

The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color

Visual Rendering: Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

Unit – V Motion in Real and Virtual Worlds

Motion in Real and Virtual Worlds - Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection.

Interaction - Motor Programs and Remapping, Locomotion, Social Interaction

Audio - The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Textbooks:

1. Augmented Reality: Principles & Practice by Schmalzier / Hollerer, Pearson Education India; First edition , ISBN-10: 9332578494
2. Virtual Reality, Steven M. LaValle, Cambridge University Press

Reference Books:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, ISBN 978- 1484236178
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA.

B.Tech IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI814PE	Web Security (Professional Elective –V)	3	0	0	3

Pre-Requisite HTML, Fundamental Security Concepts, Database and Basic SQL Queries

Course Description: This course explores fundamental and advanced concepts in web and database security, including risk analysis, cryptography, privacy protection, web server security, access control models, and security re-engineering techniques. Students will gain practical insights into securing web applications, databases, and mobile environments while understanding future trends in privacy and data protection.

Course Outcomes: After successful completion of the course, students will be able to

C814.1 Understand web security challenges, risk analysis, and best practices in securing web applications.

C814.2 Apply cryptographic techniques and legal considerations to enhance web security.

C814.3 Analyse privacy risks, server security, and techniques for securing web applications

C814.4 Evaluate database security models, trust management, and security issues in data warehouses.

C814.5 Design and implement security re-engineering techniques, database watermarking, and damage recovery mechanisms.

C814.6 Assess future trends in privacy-preserving database publishing and mobile security enforcement.

UNIT - I Introduction to web security

The Web Security, The Web Security Problem, Risk Analysis and Best Practices

Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification

UNIT - II Privacy Techniques

The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

UNIT- III Database Security & Issues

Database Security: Recent Advances in Access Control, Access Control Models for XML, Database

Issues in Trust Management and Trust Negotiation, Security in Data Warehouses and OLAP Systems.

UNIT- IV Security Re-engineering for Databases

Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities

UNIT - V Future Trends Privacy in Database Publishing

Future Trends Privacy in Database Publishing: A Bayesian Perspective, Privacy-enhanced Location Based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

Textbooks:

1.Web Security, Privacy and Commerce Simson G Arfinkel, Gene Spafford, O'Reilly.

2. Handbook on Database security applications and trends Michael Gertz, Sushil Jajodia.

B. Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI821PE	**Speech And Video Processing** **Professional Elective- VI**	3	0	0	3

Pre - Requisite Mathematical Foundations, Machine Learning.

Course Description: This course provides a comprehensive understanding of speech and video processing techniques, covering fundamental signal processing concepts, feature extraction, recognition models, and advanced applications in machine learning. The course explores speech production, speech recognition, video segmentation, motion estimation, and tracking while integrating traditional signal processing methods with modern AI-based approaches.

Course Outcomes: At the end of the course student will be able to

C821.1	Understand the fundamental principles of speech production, spectral analysis, and linear predictive modeling.
C821.2	Apply feature extraction techniques and classification models for automatic speech recognition.
C821.3	Analyze multi-dimensional signals and transforms for digital image and video processing.
C821.4	Describe concepts of multi-dimensional sampling and its impact on system performance.
C821.5	Evaluate motion estimation methods for video processing, including differential and transform-domain approaches.
C821.6	Understand different segmentation and tracking techniques for motion analysis in video applications.

UNIT - I Speech processing concepts

The speech production mechanism, Discrete time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and non-linear filter banks, spectral estimation of speech using DFT. Linear Prediction analysis of speech.

UNIT- II Speech recognition

Feature extraction for speech, static and dynamic feature for speech recognition, MFCC, LPCC, Distance measures, vector quantization models, Gaussian Mixture model, HMM

UNIT- III Multi-Dimensional Signals and Systems

Multi-Dimensional Signals, Multi-Dimensional Transforms, Multi-Dimensional Systems, Multi-Dimensional Sampling Theory, Sampling Structure Conversion

Digital Images and Video: Human Visual System and Color, Digital Video

UNIT- IV Motion Estimation

Image Formation, Motion Models, 2D Apparent-Motion Estimation, Differential Methods, Matching Methods, Nonlinear Optimization Methods, Transform-Domain Methods, 3D Motion and Structure Estimation.

UNIT - V Video Segmentation and Tracking

Image Segmentation, Change Detection, Motion Segmentation, Motion Tracking, Image and Video Matting, Performance Evaluation

Textbooks:

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series,2019.

2. Digital Video processing, A Murat Tekalp, 2nd edition, Prentice Hall,2016.

Reference Books:

1. Discrete-time speech signal processing: principles and practice, Thomas F. Quatieri, Coth, 2020.

2. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson

Education, 2016

B. Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI822PE	**Robotic Process Automation Professional Elective-VI**	3	0	0	3

Pre-Requisites Elements of Computer Science, UI Design

Course Description: This course introduces Robotic Process Automation (RPA) using UiPath, covering workflow automation, UI interactions, and data handling. It also includes error management, bot deployment, and maintenance for efficient automation solutions.

Course Outcomes: At the end of the course student will be able to

C822.1	Understand the fundamentals of Robotic Process Automation (RPA), including its components, UiPath platform, and advanced UI interaction techniques.
C822.2	Apply and Develop automation workflows using sequences, flowcharts, control flow mechanisms, and data manipulation techniques.
C823.3	Apply control handling techniques to interact with UI elements, utilize OCR, and integrate plugins for advanced automation.
C824.4	Build efficient automation solutions by managing user events, deploying assistant bots, and utilizing exception handling, debugging, and logging techniques.4
C825.5	Evaluate and enhance automation efficiency by applying best practices in project organization, workflow reusability, and state machine utilization
C826.6	Manage RPA bot deployment through publishing, orchestration, license management, and version updates for efficient automation maintenance.

UNIT - I Robotic Process Automation & UI Path

Robotic Process Automation: Introduction, Scope and techniques of automation, Robotic process automation, Components of RPA, RPA platforms, About UiPath

UIPath Stack Uipath Studio, Uipath Robot, Types of Robots, UiPath Orchestrator

UIPath Studio Projects, User interface

The User Interface: Task recorder, Advanced UI interactions: Input methods, Output methods.

UNIT - II Sequence, Flowchart, Control Flow & Data

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control Flow, various types of loops and decision making

Data Manipulation: Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, File operation with step-by-step example, CSV/Excel to data table and vice versa.

UNIT - III Taking Control of the Controls , Plugins and Extensions

Taking Control of the Controls: Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Handling events, revisit recorder, When to use OCR, Types of OCR available, How to use OCR

Plugins and Extensions: Terminal Plugin, SAP Automation, Citrix automation and Credential management

UNIT - IV User Events, Assistant Bots, Exception Handling, Debugging, and Logging

Handling User Events and Assistant Bots: Assistant bots, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event

Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting

UNIT - V Managing, Maintaining & Deploying

Managing and Maintaining the Code: Project organization, nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines, or Sequences, Using config files

Deploying and Maintaining the Bot: Publishing using publish utility, using Orchestration Server to control bots, deploy bots, License Management, Publishing and Managing updates

Textbooks:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition

Reference Books:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

B.Tech IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI823PE	**Cryptography and Network Security** **Professional Elective - VI**	**3**	**0**	**0**	**3**

Pre - Requisites Cyber Security, Computer Networks

Course Description: The course provides comprehensive understanding of security and cryptography concepts, covering both symmetric and asymmetric encryption techniques. It explores authentication mechanisms, key management, transport and network security, email security, and real-world cryptography applications.

Course Outcomes: At the end of the course, the student will be able to

C823.1	Illustrate fundamental security concepts, types of attacks and cryptography techniques.
C823.2	Analyze symmetric and asymmetric encryption algorithms for secure communication.
C823.3	Evaluate authentication mechanisms, cryptographic hash functions, and digital signatures.
C823.4	Demonstate transport and network security protocols like SSL/TLS, SSH, and IEEE 802.11.
C823.5	Assess email security mechanisms and IP security protocols for secure communication.
C823.6	Apply cryptographic principles to real-world case studies like secure transactions and virtual elections.

Unit – I Security & Cryptography Concepts

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security **Cryptography Concepts and Techniques**: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

Unit – II Symmetric & Asymmetric Ciphers

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

Unit – III Authentication Codes &Key management

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), **Message authentication codes**: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. **Key Management and Distribution**: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

Unit – IV Transport and Network Security

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

Unit – V Email Security & Cryptography Applications

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, Internet Key Exchange

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

Textbooks:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition,2013.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition,2008.

Reference Books:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition,2008.

2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition,2010.

3. Information Security, Principles, and Practice: Mark Stamp, Wiley India,2006.

B.Tech. IV Year II Sem

Course Code	Course Title	L	T	P	Credits
AI824PE	Conversational AI	3	0	0	3

Professional Elective – VI

Pre-Requisites Machine Learning, Natural Language Processing

Course Description: This course explains to understand the different techniques of natural language processing and study the fundamental role of machine learning in building conversational systems and to know the various applications of conversational systems and its future development.

Course Outcomes: After successful completion of the course, the student will be able to:

C824.1 Understand the basic concepts, history, and current state of dialogue systems.
C824.2 Build rule – based dialogue systems using suitable architecture, method and tools.
C824.3 Explore reinforcement learning and the representation of dialogue using Markov Decision Processes (MDPs) and Partially Observable MDPs (POMDPs).
C824.4 Attain knowledge of processes and frameworks for evaluating task oriented and open-domain dialogue systems using various metrics.
C824.5 Assess advanced techniques and frameworks for dialogue system optimization.
C824.6 Develop neural dialogue systems for task – oriented and open – domain applications.

UNIT - 1 Introducing Dialogue Systems

Introduction of Dialogue System, History of Dialogue Systems, Present- Day Dialogue Systems, Modeling Conversation Dialogue Systems, Designing and Developing Dialogue Systems.

UNIT – 2 Rule-Based Dialogue Systems: Architecture, Methods, and Tools

Dialogue Systems Architecture, designing a Dialogue System, Tools for Developing Dialogue Systems, Rule Based Techniques in Dialogue Systems Participating in the Alexa Prize.

UNIT - 3 Statistical Data – Driven Dialogue Systems

Motivating the Statistical Data Driven Approach, Dialogue Components in the Statistical Data-Driven Approach, Reinforcement Learning(RL), Representing Dialogue as a Markov Decision Process, From MDPs to POMDPs, Dialogue State Tracking, Dialogue Policy, Problems and Issues with Reinforcement Learning in POMDPs.

UNIT - 4 Evaluating Dialogue Systems

Process of Evaluation ,Evaluating Task Oriented Dialogue Systems, Evaluating Open Domain Dialogue Systems, Evaluation Frame works - PARADISE, Quality of Experience (QoE), Interaction Quality, Best Way to Evaluate Dialogue Systems.

UNIT - 5 End-to-End Neural Dialogue Systems

Neural Network Approaches to Dialogue Modeling, A Neural Conversational Model, Introduction to the Technology of Neural Dialogue, Retrieval-Based Response Generation, Task-Oriented Neural Dialogue Systems, Open-Domain Neural Dialogue Systems, Some Issues and Current Solutions, Dialogue Systems: Datasets, Competitions, Tasks, and Challenges.

Textbooks:

1. Michael Mc Tear,"Conversational AI: Dialogue Systems,Conversational Agents, and Chat bots", Second Edition, Moran and Claypool Publishers, 2020.

Reference Books:

1. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", O'REILLY, 2016.

SUSTAINABLE DEVELOPMENT GOALS

01 NO POVERTY

02 ZERO HUNGER

03 GOOD HEALTH AND WELL-BEING

04 QUALITY EDUCATION

05 GENDER EQUALITY

06 CLEAN WATER AND SANITATION

07 AFFORDABLE AND CLEAN ENERGY

08 DECENT WORK AND ECONOMIC GROWTH

09 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

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