CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
Kandlakoya, Hyderabad – 501 401
ACADEMIC REGULATIONS R 18
FOR CBCS & OUTCOME BASED B.TECH. REGULAR PROGRAMMES
(Effective for the students admitted into I year from the Academic Year 2018-19 onwards)

1.0 Under-Graduate Degree Programme in Engineering & Technology

CMR College of Engineering & Technology, Hyderabad offers 4 Years (8 Semesters) Bachelor of Technology (B.Tech.) degree Programme, under Choice Based Credit System (CBCS), with effect from the Academic Year 2018 - 19 andonwards, in the following Branches of Engineering.

S.No.	Branch
I.	Civil Engineering
II.	Electrical & Electronics Engineering
III.	Mechanical Engineering
IV.	Electronics &Communication Engineering
V.	Computer Science & Engineering
VI.	Information Technology
VII.	CSE- AI & ML
VIII.	CSE- Cybersecurity

2.0 Admission Procedure

2.1. Admissions will be done as per the norms prescribed by the Government of Telangana. The Government orders in vogue shall prevail.

2.2. The candidate should have passed the qualifying examination Intermediate or equivalent on the date of admission.

2.3. Seats in each program in the college are classified into Category–A (70% of intake) and Category-B (30%of intake) besides Lateral Entry. Category-A seats will be filled by the Convener, TS-EAMCET Admissions.Category-B seats will be filled by the College as per the guidelines of the Competent Authority.

2.4. Lateral Entry seats for 20% of the candidates from the approved strength of the course shall be admitted into the III Semester directly based on the rank secured by the candidate in TSECET in accordance with the guidelines from the Competent Authority.

2.5 The medium of instruction for the entire UG Degree Course in Engineering & Technology (E&T) shall be ENGLISH only.

3.0 B.Tech. Degree Course Structure

3.1 The B.Tech. Programmes of CMR College of Engineering & Technology are of semester pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having two Semesters (First/Odd and Second/Even). Each Semester shall have a minimum of 90 Instructional Days.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below. The Course Structure is organized based on the AICTE Model Curriculum for Under-Graduate Degree Courses in Engineering & Technology (Jan. 2018).

3.2.1 Semester Scheme:

Each UG Programme is of 4 Academic Years (8 Semesters), with the year being divided into two Semesters of minimum 90 Instructional days/Semester and in addition each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Curriculum/ Course Structure as suggested by AICTE are followed.

3.2.2 Course Credits:

The Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practicals Periods: Credits) Structure, based on the following general pattern.

- One Credit - for One hour/ Week/ Semester for Theory/ Lecture (L)/Tutorial Courses; and,
- One Credit - for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses

Other student activities like NCC, NSS, NSO, Induction Program, Study Tour, Guest Lecture etc., and other Courses identified as Mandatory Courses (MC) shall not carry Credits.

3.2.3 Course Classification:

All Courses offered for the UG Programme are broadly classified as:

(a) Foundation Courses (Fn C)

(b) Core Courses (Co C)

(c) Elective Courses (Eℓ C)

- **Foundation Courses** (Fn C) are further categorized as:
  i. HSMC (Humanities, SocialSciences and Management Courses)
  ii. BSC (Basic Science Courses)
  iii. ESC (Engineering Science Courses)
- **Core Courses** (Co C) and Elective Courses (Eℓ C) are categorized as PS (Professional Subjects), which are further subdivided as –
  i. PCC (Professional Core Courses)
  ii. PEC (Professional Elective Courses)
  iii. OEC (Open Elective Courses)
  iv. PROJ (Project)
- **Minor Courses** (1 or 2 Credit Courses, belonging to HSMC/ BSC/ ESC/ PCC as per relevance); and
- **Mandatory Courses** (MC - Non-credit oriented).

3.2.4 Course Nomenclature:

The Curriculum Nomenclature or Course-Structure Grouping for the each of the UG PROGRAMME E&T (B.Tech. Degree Programmes), is as listed below:

S. No.	Broad CourseClassificati-on	Course Group/ Category	Course Description	Suggested Breakup of Credits by

				AICTE(160)
1	**Foundation Courses (Fn C)**	**BSC – Basic Science Courses**	Includes - Mathematics, Physics and Chemistry Subjects	**25***
2		**ESC - Engineering Science Courses**	Includes fundamental engineering subjects	**24***
3		**HSMC – Humanities and Social Sciences including Management Courses**	Includes subjects related to Humanities, Social Sciences and Management	**12***
4	**Core Courses (Co C)**	**PCC– Professional CoreCourses**	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg.	**48***
5	**Elective Courses (Eℓ C)**	**PEC – Professional Elective Courses**	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engg.	**18***
6		**OEC – Open Elective Courses**	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline/ Department/ Branch of Engg.	**18***
7	**Core**	**Project**	B.Tech. Project or UG Project or UG Major Project	**15***
8		**Industrial Training/**	Industrial Training/ Internship/ UG	

	Courses	**Mini- Project**	Mini-Project/ Mini-Project	
9		**Seminar**	Seminar/ Colloquium based on core contents related to Parent Discipline/ Department/ Branch of Engg.	
10		**Mandatory Courses (MC)**	Mandatory Courses (non-credit)	**Nil**
Total Credits for B. Tech. Programme				**160**

* Minor variation is allowed as per need of the respective disciplines.

4.0 Course Work

4.1 A student, after securing admission, shall pursue the B.Tech. UG Programme in a minimum period of 4 Academic Years, and amaximum period of 8 Academic Years (starting from the Date of Commencement of I Year).

4.2 As suggested by AICTE, 'Mandatory Induction Programme' shall be offered for all the Branches of Engineering at the start of the I Year UG Degree Course, to enable the newly admitted students get acquainted with the new professional environment, to develop awareness and understanding of the engineering education requirements, and to get them prepared for the academic schedules ahead. The features, activities and pattern of the Induction Programme shall be as per the guidelines suggested in the AICTE Model Curriculum.

4.3 Each student shall Register for and Secure 160 Credits for the completion of the UG Programme and the Award of the B.Tech. degree in the respective branch of Engineering.

5.0 Course Registration

5.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him about the UG Programme, its Course Structure and Curriculum, Choice/Option for Subjects/ Courses for the purpose of registration, based on his competence, progress, pre-requisites and interest.

5.2 The Academic Section of the College invites 'Registration Forms' from students apriorie (before the beginning of the Semester), through 'on-line submissions', ensuring 'DATE and TIME Stamping'. The On-line Registration Requests for any 'Current Semester' shall be completed before the commencement of SEEs (Semester End Examinations) of the 'Preceding Semester'.

5.3 Students are advised to individually register for all the number of credits indicated in that semester workload of the respective UG Degree Course Structure - this is termed as the 'Semester Work Load' (SWL).

5.4 A student can apply for ONLINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his assigned Faculty Advisor, which should be submitted to the College Academic/Examination Section through the Head of the Department (a copy of the same is to be retained by the Head of the Department, Faculty Advisor and the student).

5.5 A student may be permitted to register for the courses in a semester of his choice subject to para 5.4 with the typical work load suggested in the course structure of that semester. A student may register for courses

over and above the courses listed in the course structure of the semester with possible additional courses of his choice, limited to a maximum of 3 Credits, based on his PROGRESS and SGPA/ CGPA, and completion of the 'PRE-REQUISITES' as indicated for various Subjects/ Courses in the Department Course Structure and Syllabus contents.

5.6 The choice for the 'additional' Courses above the typicalSWL must be indicated clearly, which needs the specific approval and signature of the Faculty Advisor/ Counselor and the HoD on the hard-copy.

5.7 If the Student submits ambiguous choices or multiple options or erroneous entries - during On-Line Registration for the 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, as applicable.

5.8 The Course Options exercised through 'ON-LINE' Registration are final and CANNOT be changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester and could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Course (subject to offering of such a Course), or for another existing Course (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5.9 Dropping of the Courses may be permitted ONLY AFTER obtaining the prior approval from the Faculty Advisor assigned and the Head of the department (subject to the retaining of the SWL), 'within 15 Days of Time' from the beginning of the current semester.

5.10 For Mandatory Courses like NCC/ NSS/ NSO etc., a 'Satisfactory Participation Certificate' from the concerned authorities for the relevant Semester is essential. No Marks or Grades or Credits shall be awarded for these activities.

6.0 Courses to be offered

6.1 A typical Section (or Class) Strength for each Semester shall be 60.

6.2 An Elective course may be offered to the Students, ONLY IF a Minimum of 20 Students (1/3 of the Section Strength) opt for the same. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

6.3 More than one teacher may offer the same Course (Laboratory/ Practicals may be included with the corresponding Theory Course in the same Semester) in any Semester. However, selection choice for students will be based on - 'first come first serve Basis and CGPA Criterion' (i.e., the first focus shall be on early on-line entry from the student for Registration in that Semester, and the second focus, if needed, will be on CGPA of the student). The decision of the Head of the department in this regard is final.

6.4 If more entries for Registration of a course come into picture, the Head of the Department shall decide on offering of such a Course.

7.0 Attendance Requirements

7.1 A student shall be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Courses (excluding Mandatory or Non-Credit Courses) for that Semester.

7.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid medical grounds, based on the student's representation with supporting evidence.Provision of such condonation is however limited to a maximum of 3 times during the maximum permissible UG study period.

7.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

7.4 Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

7.5 Students, whose shortage of attendance is not condoned in any Semester, are not eligible to appear for End Examinations of that Semester. Such students are detained and their registration for that Semester shall stand cancelled. They will not be promoted to the next Semester. They may seek re-registration for all those Courses registered in that Semester in which they got detained, by seeking re-admission for that Semester as and when offered; in case 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 Courses offered under that category.

8.0 Academic Requirements

The following Academic Requirements have to be satisfied, in addition to the Attendance Requirements mentioned in Item No.**7.**

8.1 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 35% marks (25 out of 70 marks)in the End Semester Examination, and a minimum of 40% of 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 '**P'** Grade or above in that Subject/ Course.

8.2 A student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to Technical Seminars, if he secures not less than 40% of the total marks to be awarded. The student would be treated as failed, if he -

(i) does not present the technical Seminars as required in the VI and VIII Semesters, or
(ii)Secures less than 40% of marks in Technical Seminar Evaluations.

He may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent Semester, as and when it is scheduled.

8.3 A Student will not be promoted from I Year to II Year, unless he fulfils the Attendance and Academic Requirements and secures a minimum of total 19 Credits of I Year, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.4 A Student will not be promoted from II Year to III Year, unless he fulfils the Attendance and Academic Requirements and secures a minimum of total 47 Credits up to IV Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.5 A Student will not be promoted from III Year to IV Year, unless he fulfils the Attendance and Academic Requirements and secures a minimum of total 72 Credits up to VI Semester, from all the relevant regular and supplementary examinations, whether he takes those examinations or not.

8.6A Student shall - register for all courses covering 160 credits as specified and listed (with the relevant Course Classifications as mentioned) in the course structure, put up all the Attendance and Academic requirements for 160 credits securing a minimum of 'P' Grade (Pass Grade) or above in each Course, and 'earn All 160 credits securing SGPA ≥ 5.0 (in each Semester), and CGPA (at the end of each successive Semester) ≥ 5.0, to successfully complete the UG Programme.

8.7 If a student registers for any 'additional courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 160 Credits as specified in the Course Structure of his Department, the performances in those 'additional Courses ' (although evaluated and graded) shall not be taken into account while calculating the SGPA and CGPA. For such 'additional Courses ' registered, the % of marks and the Letter Grade alone shall be indicated in the Grade Card as a performance measure subject to the completion of the Attendance and Academic Requirements as stated under Clauses 7.0 and 8.1 – 8.7.

8.8 Students who fail to earn 160 credits as per the course structure, and as indicated above, within 8 Academic Years from the Date of Commencement of their I Year shall forfeit their seats in B.Tech. Programme and their admissions shall stand cancelled.

8.9 When a Student is detained due to shortage of attendance in any Semester, he may re-register for that Semester, as and when offered, with the Academic Regulations of the Batch into which he re-registers. However, no Grade Allotments or SGPA/ CGPA calculations will be done for that entire Semester in which he got detained.

8.10 When a Student is detained due to lack of Credits in any year, he may re-register for the next year, after fulfilment of the Academic Requirements, with the Academic Regulations of the Batch into which he re-registers.

8.11 A student who is eligible to appear in the End Semester Examination in any Course, but was absent for it or failed (thereby failing to secure P Grade or above), may reappear for that Course at the supplementary examination as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Course will be carried over, and added to the Marks to be obtained in the supplementary examination, for evaluating his performance in that Course.

9.0 Evaluation - Distribution and Weightage of Marks

9.1 The performance of a student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory or Practicals or Seminar or Drawing/Design or Minor Course or Major Project Phase-I or Major Project Phase-II. These evaluations shall be based on CIE (Continuous Internal Evaluation) and SEE (Semester End Examination), and a Letter Grade corresponding to the % marks obtained shall be given.

9.2 For Theory subjects 30 marks are allocated for Continuous Internal Evaluation. Continuous Internal Evaluation during a semester is based on two internal examinations conducted during the semester. 70 marks are allocated for the Semester End Examination SEE.

(a) Each internal examination consists of two parts, part-A consisting of 5 short answer questions carrying two marks each, Part-B consisting of 3 essay type questions carrying 5 marks each with a total duration of 1 hour 40 minutes. The essay paper shall contain one question from each unit with internal choice. While the first internal examination shall be conducted from 1 to 2.5 units of the syllabus, the second internal examination shall be conducted on 2.5 to 5 units. Five (05) marks are allocated for Assignment (as specified by the subject teacher concerned). There will be two assignments in the semester for each course consisting of 5 marks each. The first Assignment should be submitted before the conduct of the first internal examination and second Assignment should be submitted before the conduct of the second internal examination.

(b) The total marks secured by the student in each internal examination are evaluated for 30 marks. The final marks secured in internal evaluation by each candidate are arrived at by giving a weightage of 70% to the best secured internal examination and 30% weightage to the least secured internal examination. A student who is absent from any assignment/ internal examination for any reason what so ever shall be deemed to have secured 'zero' marks in the test/ examination and no makeup test/ examination shall be conducted.

9.3 For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 40 internal marks, and 60 marks are assigned for Laboratory/Practical End Semester Examination (SEE).Out of the 40 marks for internals, day-to-day work in the laboratory shall be evaluated for 30 marks; and for the remaining 10 marks - internal practical test shall be conducted by the concerned laboratory teacher. For Practical Subjects, the end semester examination SEE shall be conducted with an external examiner and the laboratory teacher. The external examiner from other institutions or industry shall be appointed by the Controller of Examinations.

9.4 For the subjects having design and / or drawing, (such as Engineering Graphics, AutoCAD, Engineering

Drawing, Machine Drawing and Estimation etc.,) the internal evaluation carries 40 marks (the distribution is 20 marks for day-to-day work and 20 marks for internal examination)and 60 marks shall be for end semester examination.There shall betwo internal examinationsin a semester. The final marks secured by each candidate in the internal evaluation is arrived at by giving a weightage of 70% to the best secured internal examination and 30% weightage to the least secured internal examination.

9.5 **Open Electives (OE):** Students have to choose four Open Electives during the programme by meeting pre-requisite of the course if any. However, students cannot opt for open elective course if it is already studied by the student as part of Professional Elective or any other category. The Courses offered under Open Electives in an academic year will be reviewed and finalized by the College Academic Committee before the commencement of the academic year.

9.6 There shall be a Mini-Project-I/ Internship-I, to be taken up in the college or industry during the summer vacation after IV Semester examination. The Mini-Project-I/ Internship-I shall be evaluated during the V Semester. The Mini-Project-I/Internship-I shall be submitted in a report form and should be presented before a committee, which shall be evaluated for Satisfactory or Non-satisfactory. The committee consists of Head of the Department, the supervisor of Mini-Project-I/Internship-I, a senior faculty member of the department.

9.7 There shall be a Mini-Project-II/ Internship-II, to be taken up in the college or industry during the summer vacation after VI Semester examination. The Mini-Project-II/ Internship-II shall be evaluated during the VII Semester.The Mini-Project-II/ Internship-II shall be submitted in a report form and should be presented before a committee, which shall be evaluated for Satisfactory or Non-satisfactory. The committee consists of Head of the Department, the supervisor of mini project, a senior faculty member of the department.

9.8 There shall be a Technical Seminar-I presentation in VI Semester. For the Technical Seminar-I, the student shall collect the information on a specialized topic related to his branch other than Mini projects-I & II/ Internships-I & II/ Major Projects Phase-I & II topic with due approval of the Head of the department and prepare a technical report and submit to the department. The presentation demonstrating understanding of the topic and technical report shall be evaluated by a Departmental committee consisting of the Head of the department, Technical Seminar-I supervisor and a senior faculty member from the department. The Technical seminar will be evaluated for 100 marks.There shall be no SEE or external examination for the Technical Seminar-I.

9.9 There shall be a Technical Seminar-II presentation in VIII Semester. For the Technical Seminar-II, the student shall collect the information on a specialized topic related to his branch other than the Mini projects-I & II/ Internships-I & II/ Major Projects Phase-I & II topic with due approval of the Head of the department and prepare a technical report and submit to the department. The presentation demonstrating understanding of the topic and technical report shall be evaluated by a Departmental committee consisting of the Head of the department, Technical Seminar-II supervisor and a senior faculty member from the department. The Technical Seminar-II will be evaluated for 100 marks.There shall be no SEE or external examination for the Technical Seminar-II.

9.10 Each student shall start the Project Work during the VII Semester as per the instructions of the Project Guide/ Project Supervisor assigned by the Head of the Department.

a) The Project Work shall be divided and carried out in 2 phases : Phase – I (Project-I) during VII Semester, and Phase – II (Project-II) during VIII Semester, and the student has to prepare two independent Project Work Reports – one each during each phase. First Report shall include the Project Work carried out under Phase – I, and the Second Report (Final Report) shall include the Project Work carried out under Phase – I and Phase – II put together. Phase – I and Phase – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total100 marks allotted for each Phase of the Project Work, 40 marks shall be for the Continuous Internal Evaluation(CIE), and 60 marks shall be for the End Semester Viva-voce Examination (SEE). The marks earned under CIE for both Phases of the Project shall be awarded by the Project Guide/Supervisor (based on the continuous evaluation of student's performance during the two Project Work Phases/periods); and the marks earned under SEE shall be awarded by the Project Viva-voce Committee/ Board (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Phase - I, the Viva-voce shall be conducted at the end of the VII Semester, before the commencement of the semester End Examinations, at the Department Level by a Committee comprising of the HoD or One Professor and Supervisor (no external examiner), and the Project Phase – II Viva-voce (or Final Project Viva-voce) shall be conducted by a Committee comprising of an External Examiner, the Head of the Department and the Project Supervisor at the end of the VIII Semester, before the commencement of the semester End Examinations. The External Examiner shall be nominated by the CoE from the panel of 3 names of external faculty members (Professors or Associate Professors outside the College) submitted by the HoD.

d) If a student does not appear for any of the two Viva-Voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Phase-I and/or Project Phase-II Viva-voce examinations, as and when they are scheduled in that semester; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate. For the registration of Project Phase-II the student must have passed Project Phase-I.

9.11 For NSS/ NSO Mandatory Courses and/or any other Mandatory Non-Credit Course offered in a semester, a 'Satisfactory Participation Certificate' shall be issued to the student from the authorities concerned, only after meeting the minimum attendance requirements in the Course. No Marks or Letter Grade shall be allotted for the Mandatory Courses.

10. 0. Semester End Examination (SEE)

10.1. Theory Courses

The end semester examination will be conducted for 70 marks which consist of Part-A and Part-B. The examination is for 3 hours duration. Question paper pattern is as follows.

Part-A: 20 Marks

There shall be 10 questions each carrying 2 Marks. (Two questions from each Unit)

Part-B: 50 Marks

There shall be 10 questions out of which 5 questions (Internal choice within a unit i.e. two questions from each unit out of which one question to be answered) are to be answered, each question carry 10 marks.

10.2. Laboratory Courses

Each laboratory course is evaluated for 60 marks. The examination shall be conducted by the laboratory teacher and one external examiner appointed by the Controller of Examinations from other institutions or industry in consultation with the Head of the Department.

10.3. Supplementary Examinations

The schedule for supplementary examinations shall be as notified by the institute from time to time.

10.4. For NCC/ NSS/ NSO types of Courses, and/or any other Mandatory Non-Credit Course offered in a Semester, a 'Satisfactory Participation Certificate' shall be issued to the Student from the concerned authorities, only after meeting minimum attendance requirements in the Course. No marks or Letter Grade shall be allotted for these activities and it will not be part of calculation of CGPA.

11.0. Grading Procedure

11.1.Marks will be awarded to indicate the performance of each student in each Theory Course, or Laboratory Course, or Technical Seminar, or Project etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination). As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed …

% of Marks Secured (Class Intervals)	**Letter Grade (UGC Guidelines)**	**Grade Points**
100% or below but not less than 85% (≥ 85% ,<= 100%)	**O (Excellent)**	**10**
Below 85% but not less than 70% (≥ 70% ,< 85%)	**A (Very Good)**	**9**
Below 70% but not less than 60% (≥ 60% ,< 70%)	**B (Good)**	**8**
Below 60% but not less than 55% (≥ 55% ,< 60%)	**C (above Average)**	**7**
Below 55% but not less than 50% (≥ 50% ,< 55%)	**D (Average)**	**6**
Below 50% but not less than 40% (≥ 40% ,< 50%)	**P (Pass)**	**5**
Below 40% (< 40%)	**F (FAIL)**	**0**

11.2 A student obtaining F Grade in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when

offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.

11.3. A Letter Grade does not imply any specific % of Marks.

11.4. In general, a student shall not be permitted to repeat any Course(s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'. However, he has to repeat all the Courses pertaining to that Semester, when he is detained (as listed in Items 8.10- 8.11).

11.5. A student earns Grade Point (GP) in each Course, on the basis of the Letter Grade obtained by him in that Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

11.6. The Student passes the Course only when he gets GP ≥ 5 (P Grade or above).

11.7. The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL 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

$$\textbf{SGPA} = \{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\} \ldots \textbf{For each Semester},$$

where **'i'** is the Course indicator index (takes into account all Courses in a Semester), 'N' is the no. of Courses '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 $\mathbf{i}^{th}$ Course, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that $\mathbf{i}^{th}$ Course.

11.8. The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over 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 Second Semester onwards, at the end of each Semester, as per the formula

$$\textbf{CGPA} = \{\sum_{j=1}^{M} C_j G_j\} / \{\sum_{j=1}^{M} C_j\} \ldots \textbf{for all S Semesters registered}$$

(ie., upto and inclusive of S Semesters, S ≥ 2),

Where 'M' is the Total no. of Courses (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards up to and inclusive of the Semester S (obviously M > N), '**j**' is the Course indicator index (takes into account all Courses from 1 to S Semesters), C_j is the no. of Credits allotted to the $\mathbf{j}^{th}$ Course, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that $\mathbf{j}^{th}$ Course. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

11.9. For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.

11.10. For Calculations listed in Item 11.5– 11.8, performance in failed Courses (securing F Grade) will also be taken into account, and the Credits of such Courses will also be included in the multiplications and summations. However, Non-Courses will not be taken into consideration.

12.0. Passing Standards:

12.1. A student shall be declared successful or 'passed' in a Semester, only when he gets a SGPA ≥ 5.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UG PROGRAMME, only when he gets a CGPA ≥ 5.00; subject to the condition that he secures a GP ≥ 5 (P Grade or above) in every registered Course in each Semester (during the entire UG PROGRAMME) for the Degree Award, as required.

12.2. A Student shall be declared successful or 'passed' in any Non-Credit Course, if he secures a 'Satisfactory Participation Certificate' for that Mandatory Course.

12.3. After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) 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, SGPA, and CGPA.

13.0. Declaration of Results

13.1 Computation of SGPA and CGPA are done using the procedure listed in 11.5 – 11.9.

13.2. For Final % of Marks equivalent to the computed final CGPA, the following formula may be used …

% of Marks = (final CGPA – 0.5) x 10

14.0. Award of Degree

14.1 A Student who registers for all the specified Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes all the examinations prescribed in the entire UG E&T Programme (UG PROGRAMME), 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 the B.Tech. Degree in the chosen Branch of Engineering as selected at the time of Admission.

14.2. A Student who qualifies for the Award of the Degree as listed in Item 14.1, shall be placed in the following Classes …

(a) Students with final CGPA (at the end of the UG PROGRAMME) ≥ 8.00, and fulfilling the following conditions -

(i) should have passed all the Courses in 'FIRST APPEARANCE' within the first 4 Academic Years (or 8 Sequential Semesters) from the Date of Commencement of his First Academic Year,

(ii) should have secured a CGPA ≥ 8.00, at the end of each of the 8 Sequential Semesters, starting from the I Year I Semester onwards,

(iii) should not have been detained or prevented from writing the End Semester Examinations in any Semester due to shortage of attendance or any other reason, shall be placed in '**FIRST CLASS with DISTINCTION'**.

(b) Students having final CGPA (at the end of UG PROGRAMME) ≥ 8.00 , but not fulfilling the above conditions shall be placed in 'FIRST CLASS'.

(c)Students with final CGPA (at the end of the UG PROGRAMME) ≥ 6.50 but < 8.00, shall be placed in 'FIRST CLASS'.

(d) Students with final CGPA (at the end of the UG PROGRAMME) ≥ 5.50 but < 6.50, shall be placed in 'SECOND CLASS'.

(e) All other Students who qualify for the Award of the Degree (as per Item 14.1), with final CGPA (at the end of the UG PROGRAMME) ≥ 5.00 but < 5.50, shall be placed in 'PASS CLASS'.

14.3. A student with final CGPA (at the end of the UG PROGRAMME) < 5.00 will not be eligible for the Award of the Degree.

14.4. Students fulfilling the conditions listed under Item 14.2(a) alone will be eligible candidates for - 'College Rank' and 'Gold Medal' considerations.

15.0. Withholding of Results

15.1 If the student has not paid fees to College at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the student may be withheld, and he 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.

16.0 Transitory Regulations

16.1 **For Students detained due to shortage of attendance and credits**

i) The Student who has not registered in a particular semester for any reason, or has been detained for want of attendance may be considered eligible for readmission to the same semester in the next Academic Year or subsequent academic years. The student who has been detained for lack of credits can be readmitted to the next Academic Year only on obtaining minimum required credits.

ii) A Student who has been detained in I year I Semester of R14/R15 Regulations due to lack of attendance shall be permitted to join I year I Semester of R18 Regulations and 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.

iii) A student who has been detained in II semester of I Year or any semester of II, III and IV years of R14/R15 regulations for want of attendance shall be permitted to join the corresponding semester of R18 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 R18 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester.

iv) A student of R14/R15 Regulations who has been detained due to lack of credits shall be promoted to the next Academic Year of R18 Regulations only after acquiring the required credits as per the corresponding regulations of his/her first admission. 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.

v) After re-admission the student is required to study the course as prescribed in the new regulations for the re-admitted programme at that level and thereafter.

vi) A student who has failed in any course(s) under any regulation has to pass those course(s) in the same regulations.

vii) In case the course(s) offered in subsequent semesters are repetitive, substitute courses identified by the BOS for replacement of completed courses by the students will be given. The students will be suggested to register the said substitute course(s) in the new regulation. One Internal examination for the substitute course(s) may be conducted before commencement of end semester examinations.

viii) The marks/credits/SGPA are transferred and converted (as per applicable regulations) for all subjects of old regulation if necessary and treated as successfully cleared in the new prescribed program course structure.

ix) For readmitted students the courses studied and cleared in earlier Regulation and not offered those courses in new applicable Regulation are not considered for SGPA & CGPA calculation when secured credits are greater than maximum credits for the award of degree.

x) The decision of BOS is final in case of any ambiguity in identifying the equivalent/substitute courses

xi) The decision of Academic council is final in case of any ambiguity in transitory regulations

16.2. **For Transferred Students**

i) The students seeking transfer to CMRCET from various other Universities/Institutions have to pass the failed course(s) which are equivalent to the course(s) of CMRCET, and also have to pass the course(s) of CMRCET which the students have not studied at the earlier institution. Further the students have passed some of the course(s) at the earlier institutions, and if the same course(s) are prescribed in different semesters of CMRCET and repeated, then substitute courses(with equal credits) identified by BOS may be given to the students

ii) For not cleared course(s) in the previous Institute, equivalent course(s) will be identified by the BOS for pursuing the same. The students will be suggested to pursue the course and to register the said equivalent course(s) in the new regulation and to qualify in examinations.

iii) Marks/Grades/Credits obtained in the courses completed in previous Institution are to be converted in to equivalent Grades/Credits/SGPA/CGPA as per CMRCET regulations.

iv) One Internal examination for the course(s) not studied in previous institution and taken as additional/substitute courses in CMRCET may be conducted before commencement of end semester examinations.

v) If necessary the student may be given additional course(s) in place of the course(s) studied in earlier Institution which are not part of CMRCET regulation to balance and meet the credit requirement for the award of degree as per applicable regulation

vi) The students who seek transfer to CMRCET from various other Universities/Institutions, and satisfy credits requirement as per earlier institution but not satisfy the credit requirements as per CMRCET after finalizing equivalent course(s), may be permitted to continue the programme. However such a student has to meet the requirement of credits for promotion to the next year as per CMRCET applicable regulations.

vii) For transferred students the courses studied and cleared in earlier Institution and not offered those courses in CMRCET are not considered for SGPA & CGPA calculation when secured credits are greater than maximum credits for the award of degree.

viii) In case of any ambiguity in identifying the equivalent/substitute courses, the decision of BOS is final.

ix) The decision of Academic council is final in case of any ambiguity in transitory regulations

17.0 Student Transfers

17.1 There shall be no Branch transfers after the completion of Admission Process.

17.2 Transfer of candidates from other Institutions will be governed by the regulations of Telangana State Government issued from time to time.

18.0 Scope

i) Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her", "hers".

ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor/ Principal is final.

v) The College 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 College Authorities.

ACADEMIC REGULATIONS FOR B.TECH. (LATERAL ENTRY SCHEME)

(ApplicableforthestudentsadmittedintoIIyearB.Tech.(Lateral EntryScheme) fromtheAcademicYear2019-20 and onwards)

1. **Eligibility foraward ofB. Tech.Degree(LES)**

1.1. The LES candidates shall pursue a course of study for not less than three academic years and not more thansixacademicyears.

1.2. The candidate shall register for 122 credits and secure 122 credits from II to IV-year B.Tech. Program (LES) for the award of B.Tech. Degree. They are exempted from the courses of I year offered to regular entry students.

1.3. The students, who fail to fulfill the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seats.

1.4. The attendanceregulationsof B.Tech.(Regular)shallbeapplicabletoB.Tech. (LES).

2. **Promotion Rule**

A student shall be eligible for promotion in B.Tech programme,if he/she acquires the minimumnumber of creditsasgivenbelow:

2.1. A student shall be promoted from II Year to III Year only if he/she fulfills the academic requirements of 24 credits out of 41credits (60% of average credits) up to II-year II Semester, from all the examinations, whether or not the candidate takes the examinations.

2.2. A student shall be promoted from III year to IV year only if he/she fulfills the academic requirements of 49 credits out of 83credits (60% of average credits) up to III Year II Semester from all the examinations, whetheror not the candidate takes the examinations.

2.3. A student shall register and put up minimum attendance in all 122 credits and earn all 122 credits to be eligible for the award of degree.

2.4. Students who fail to earn 122 credits as indicated in the course structure within six academic years from the year of their admission shall forfeit their seatin B.Tech.Course and their admission stands cancelled.

3. **Award of Class**

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

MALPRACTICE RULES

Disciplinary Action for Malpractices/Improper Conduct in Examinations

	Nature of Malpractices/ Improper conduct	**Punishment**
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell	Expulsion from the examination hall and cancellation of the performance in that subject only.

	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 he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate 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 candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
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 candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 candidate is to be cancelled.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate 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 candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles 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 after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive semesters from class work and all end semester Examinations. The continuation of the course by the candidate 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 him 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 or organizes a walk out or instigates others **to** examination hallwalk out, or threatens the officer- in-charge or any person on duty in or outside the examination hall of any injury**,** to his person or to any of his 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 his 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 candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates are also 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 of the script or any part thereof inside or outside	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate

	the examination hall.	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 candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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 candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate 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.	If the student belongs to the college, expulsion from the examination performance in that subject and all other subjects shall and cancellation of the candidate 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 candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the	Expulsion from the examination hall and

	examination hall.	cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for other 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 candidate has appeared including practical examinations and project work of that semester/year.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the College Academic Committee for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

Punishments to the candidates as per the above guidelines.

Malpractice identified at Spot center during valuation

1) The following procedure is to be followed in the case of malpractice cases detected during valuation, scrutiny etc. at spot center. Malpractice is detected at the spot valuation. The case is to be referred to the malpractice committee. Malpractice committee will meet and discuss/question the candidate and based on the evidences, the committee will recommend suitable action on the candidate.
2) A notice is to be served to the candidate(s) involved through the Principal to his address and to the candidate(s) permanent address regarding the malpractice and seek explanations.

3) The involvement of staff who are in charge of conducting examinations, invigilators valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing in correct or misleading information) that infringe upon the course of natural justice to one and all concerned at the examinations shall be viewed seriously and recommended for award of appropriate punishment after thorough enquire.

4) Based on the explanation and recommendation of the committee action may be initiated

5) **Malpractice committee:**

(a) Controller of Examinations Chairman

(b) Assistant Controller of Evaluation Member

(c) Chief Examiner of the Course/

	Subject Expert	Member
(d)	Concerned Head of the Department	Member
(e)	Concerned Invigilator	Member

****

CMR COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

DEPARTMENT OF AIML

Institute Vision.

To be a premier academic institution striving continuously for excellence in technical education , research and technological service to the nation.

Institute Mission.

- Create and sustain a community of learning in which students acquire knowledge and learn to apply it professionally with a concern for the society.
- Pursue and disseminate research findings and offer knowledge based technological services to satisfy the needs of society and the industry.
- Promote professional ethics, leadership qualities and socialresponsibilities.

Vision of the Department.

- To evolve as a centre of academic excellence in Computer Science & Engineering with Artificial Intelligence by building strong teaching and research environment.

Mission of the Department.

- To offer high quality graduate programs in computer science & Engineering with Artificial Intelligence education and to prepare students for professional career and/or higher studies globally.
- To develop self learning abilities and professional ethics to serve the society.

Program Educational Objectives (PEOs)

PEO I: Excel in their professional career and higher education in Computer Science & Engineering and chosen fields.

PEO II: Demonstrate leadership qualities, teamwork and professional ethics to serve the society

PEO III: Adapt to state of art technology through continuous learning in the areas of interest.

Program Outcomes

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.

***

CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
Kandlakoya, Hyderabad – 501 401
B. Tech (AI & ML) Course Structure-21, Regulation-18

Semester –I							
Course Code	**Category**	**Course Title**	**Hours/ Week**			**Credits**	**Total Contact Hours/ Week**
			L	T	P	C	
A30004	BSC	Linear Algebra and Calculus	3	1	0	4	4
A30009	BSC	Applied Physics	3	1	0	4	4
A30501	ESC	Programming for Problem Solving	3	0	0	3	3
A30313	ESC	Engineering Drawing	1	0	3	2.5	4
A30023	BSC	Applied Physics Lab	0	0	3	1.5	3
A30502	ESC	C Programming Lab	0	0	3	1.5	3
A30505	ESC	Basic Internet of Things Lab	0	0	2	1	2
A30020	HSMC	Introduction to Social Innovation	0	0	2	1	2
Total			**10**	**2**	**13**	**18.5**	**25**

Semester –II							
Course Code	**Category**	**Course Title**	**Hours /Week**			**Credits**	**Total Contact Hours/ Week**
			L	T	P	**C**	
A30005	BSC	Ordinary Differential Equations and Multivariable Calculus	3	1	0	4	4
A30001	HSMC	English	2	0	0	2	2
A30011	BSC	Engineering Chemistry	3	0	0	3	3
A30503	ESC	Data Structures & Algorithms	3	0	0	3	3
A30002	HSMC	English Language Communication Skills Lab	0	0	3	1.5	3
A30012	BSC	Engineering Chemistry Lab	0	0	3	1.5	3
A30504	ESC	Data Structures & Algorithms Lab	0	0	3	1.5	3
A30314	ESC	Engineering Workshop	0	0	3	1.5	3
A30019	BSC	Engineering Exploration &Practice	0	0	3	1.5	3
Total			**11**	**1**	**15**	**19.5**	**27**
Total Credits I year: 38							

Semester –III							
Course Code	**Category**	**Course Title**	**Hours / Week**			**Credits**	**Total Contact Hours/ Week**
			L	T	P	C	
A30007	BSC	Numerical Techniques & Probability Distributions	3	1	0	4	4
A30516	PCC	Operating Systems	3	0	0	3	3
A30513	PCC	Computer Organization & Architecture	3	1	0	4	4
A36201	PCC	Object Oriented Programming through Java	3	0	0	3	3
A30228	ESC	Basic Electrical Engineering	3	0	0	3	3
A30229	ESC	Basic Electrical Engineering Lab	0	0	3	1.5	3
A37301	PCC	Operating Systems lab	0	0	3	1.5	3
A36202	PCC	JAVA Lab	0	0	3	1.5	3
A30016	MC	Gender Sensitization	0	0	2	0	2
Total			**15**	**2**	**11**	**21.5**	**28**

Semester –IV							
Course Code	**Category**	**Course Title**	**Hours / Week**			**Credits**	**Total Contact Hours/ Week**
			L	T	P	C	
A37302	PCC	Mathematics for Machine Learning	3	0	0	3	3
A30509	PCC	Database Management systems	3	1	0	4	4
A37303	PCC	Artificial Intelligence	4	0	0	4	4
A30511	PCC	Design & Analysis of Algorithms	3	1	0	4	4
A30510	PCC	Database Management systems lab	0	0	3	1.5	3
A37304	PCC	Artificial Intelligence Lab	0	0	3	1.5	3
A37305	PCC	Python Programming Lab	0	0	3	1.5	3
A30021	HSMC	Social Innovation in Practice	0	0	2	1	2
A30015	MC	Soft Skills & Professional Ethics	0	0	2	0	2
Total			**13**	**2**	**13**	**20.5**	**28**
Total Credits II year: 42							

Semester –V

Course Code	Category	Course Title	Hours/week			Credits	Total Contact Hours/ Week
			L	T	P	C	
A36601	PCC	Machine Learning	4	0	0	4	4
A30525	PCC	Software Engineering	4	0	0	4	4
A36606	PCC	Computer Vision	4	0	0	4	4
A30519	PCC	Compiler Design	3	0	0	3	3
PE	PEC	Professional Elective-I	3	0	0	3	3
A36602	PCC	Machine Learning lab	0	0	3	1.5	3
A36607	PCC	Computer Vision lab	0	0	3	1.5	3
A30003	HSMC	Advanced English Communication Skills Lab	0	0	3	1.5	3
A30017	MC	Indian Constitution	2	0	0	0	2
A30018		Essence of Indian Traditional Knowledge					
Total			**20**	**0**	**9**	**22.5**	**29**
A37317	MC	Mini Project-I	During Summer Vacations / Non-Credit				
A37319		Summer Internship-I					

Semester –VI

Course Code	Category	Course Title	Hours/Week			Credits	Total Contact Hours/Week
			L	T	P	C	
A36608	PCC	Deep Learning	3	0	0	3	3
A36612	PCC	Natural language processing	3	0	0	3	3
A30514	PCC	Computer Networks	3	0	0	3	3
PE	PEC	Professional Elective-II	3	0	0	3	3
A30013	HSMC	Business Management & Financial Analysis	4	0	0	4	4
A36609	PCC	Deep Learning Lab	0	0	4	2	4
A37306	PCC	Natural language processing Lab	0	0	3	1.5	3
A37321	PROJ	Technical Seminar-I	2	0	0	2	2
A30014	MC	Environmental Sciences	2	0	0	0	2
A30556	MC	Cyber Security	2	0	0	0	2
A30022	MC	NCC/NSS	0	0	2	0	2
Total			**22**	**0**	**9**	**21.5**	**31**
Total Credits III Year: 44							

Semester –VII							
Course Code	**Category**	**Course Title**	**Hours / Week**			**Credits**	**Total Contact Hours/week**
			L	T	P	C	
PE	PEC	Professional Elective-III	3	0	0	3	3
	PEC	Professional Elective-IV	3	0	0	3	3
	PEC	Professional Elective-V	3	0	0	3	3
OE	OEC	Open Elective-I	3	0	0	3	3
	OEC	Open Elective-II	3	0	0	3	3
A37323	PROJ	Major Project Phase-I	0	0	6	3	6
Total			**15**	**0**	**6**	**18**	**21**
A37318	MC	Mini Project-II	During Summer Vacations / Non-Credit				
A37320		Summer Internship-II					

Semester –VIII							
Course Code	**Category**	**Course Title**	**Hours / Week**			**Credits**	**Total Contact Hours /week**
			L	T	P	C	
PE	PEC	Professional Elective-VI	3	0	0	3	3
OE	OEC	Open Elective-III	3	0	0	3	3
	OEC	Open Elective-IV	3	0	0	3	3
A37322	PROJ	Technical Seminar-II	2	0	0	2	2
A37324	PROJ	Major Project Phase- II	0	0	14	7	14
Total			**11**	**0**	**14**	**18**	**25**
Total Credits IV Year: 36							

Professional Electives			
Sl.No	**Subject Code**	**Name of the Subject**	**Category**
1	A30528	Data Warehousing and Data Mining	PEC-I
2	A36613	Advanced Python Programming	
3	A36615	High Performance Computing	
4	A36610	Internet Technologies	PEC-II
5	A37307	Randomized Algorithms	
6	A36623	Reinforcement Learning	
7	A37308	Internet of Things	PEC-III
8	A37309	Cryptography and Network Security	
9	A30540	Big Data Analytics	
10	A37310	Quantum Computing	PEC-IV
11	A37311	Expert Systems	
12	A37312	Pattern Recognition	
13	A37313	Ad-hoc & Sensor Networks	PEC-V
14	A37314	Augmented Reality & Virtual Reality	
15	A37315	Federated Machine Learning	
16	A37316	Cognitive Computing	PEC-VI
17	A36618	Robotics Process Automation	
18	A30545	Block Chain Technologies	

Open Electives		
Sl.No	**Subject Code**	**Name of the Subject**
1	A30554	Java Programming
2	A30531	Python Programming
3	A30555	Introduction to Database Management Systems
4	A30537	Data Analytics with R
5	A30557	Web Programming
6	A30542	Cloud Computing
7	A30538	Deep Learning
8	A30559	Introduction to Data Science
9	A30471	Principles of Electronic Communications
10	A30472	Basic Electronics Engineering
11	A30383	Fundamentals of Engineering Materials
12	A30377	Basics of Thermodynamics
13	A30258	Basics of Power Electronics & Drives
14	A30252	Power Generation Systems
15	A30160	Disaster Management and Mitigation
16	A30161	Remote Sensing and GIS
17	C30161	Logistics and Supply Chain Management
18	C30162	Knowledge Management
19	A30473	Image Processing
20	A30474	Digital Electronics
21	A30357	Fundamentals of Manufacturing Processes
22	A30379	Fundamentals of Automobile Engineering
23	A30259	Electrical & Hybrid Vehicles
24	A30260	Electrical Safety
25	A30162	Green Buildings
26	A30163	Air Pollution and Control
27	C30163	Management of Industrial Relations
28	C30164	Entrepreneurship
29	A30475	Data Communications
30	A30476	Microcontrollers & Applications
31	A30382	Fundamentals of Mechanical Engineering
32	A30378	Waste to Energy
33	A30253	Fuel Cell Technology
34	A30255	Energy Efficiency in Electrical Utilities
35	A30164	Basics of Civil Engineering
36	A30165	Sustainability Concepts in Civil Engineering
37	C30165	Basics of Insurance & Taxation
38	C30166	Business Ethics & Corporate Governance
39	A30477	Fundamentals of Embedded Systems
40	A30478	Sensors & Transducers

41	A30358	Industrial Safety Engineering
42	A30360	Work System Design
43	A30256	Energy Audit & Conservation
44	A30257	Nano Technology
45	A30166	Environmental Protection and Management
46	A30167	Alternate Building Materials
47	C30167	Marketing Management
48	C30168	Intellectual Property Rights

(A30004) LINEAR ALGEBRA AND CALCULUS
(Common to all branches)

B. Tech (AI & ML) I Semester

L	T	P	C
3	1	0	4

UNIT-I

Matrices: Types of matrices, Symmetric, Hermitian, Skew-symmetric, Skew-Hermitian, Orthogonal matrices, Unitary 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-homogeneous equations, Gauss elimination method, Gauss-Seidel iteration method.

UNIT -II

Eigen values and Eigen vectors: Eigen values, Eigen vectors and their properties, Diagonalization of a square matrix, Cayley-Hamilton theorem (without proof) - Inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and nature of the quadratic forms, Reduction of quadratic form to canonical form by linear and orthogonal transformations.

UNIT -III

Sequences &Series:

Sequence: Definition of a sequence, Limit, Convergent, Divergent and oscillatory sequences.
Series: Definition of a series, Convergent, Divergent and Oscillatory Series, Series of positive terms, Comparison test, P-test, D-Alembert's ratio test, Raabe's test, Cauchy's integral test, Cauchy's root test, Logarithmic test. **Alternating series:** Leibnitz test, Alternating convergent series, Absolute and conditionally convergence.

UNIT -IV

Calculus:

Mean value theorems: Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation and applications, Cauchy's mean value theorem, Taylor's series, Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (only in Cartesian coordinates), **Improper Integral:** Beta, Gamma functions and their applications.

UNIT -V

Multivariable calculus (Partial Differentiation and applications): Definitions of Limit and continuity, Partial differentiation, Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

TEXT BOOKS:

1. Higher Engineering Mathematics, (36th Edition), B.S. Grewal, Khanna Publishers, 2010
2. Advanced Engineering Mathematics, (9th Edition), Erwin kreyszig, John Wiley & Sons,2006.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics (3rd edition) by R.K. Jain & S.R.K. Iyengar, Narosa PublishingHouse, Delhi.
2. Calculus and Analytic geometry, (9th Edition), G.B. Thomas and R.L. Finney, Pearson, Reprint,2002.
3. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint,2008.
4. Higher Engineering Mathematics, (11th Reprint), Ramana B.V., Tata McGraw Hill New Delhi, 2010.
5. Engineering Mathematics – I, T.K.V. Iyengar, B. Krishna Gandhi &Others, EditionS. Chand

2013Yr.

6. Applied Mathematics for Engineers & Physicists (3rd edition) by Pipes &Harvill, McGraw HillInternation Book company.

COURSE OUTCOMES:

On completion of the course students will be able to

1. Solve linear system represented by matrices.
2. Obtain eigen values, eigen vectors and diagonalization of a square matrix.
3. Analyse the nature of sequence and series.
4. Verify mean value theorems & evaluation of improper integrals by using Beta and Gamma functions
5. Find maxima & minima of functions of several variables.

****END****

(A30009) APPLIED PHYSICS
(ECE, EEE, CSE)

B. Tech (AI & ML) I Semester

UNIT-I

L	T	P	C
3	1	0	4

Principles of Quantum and Statistical Mechanics: Waves and particles, de-Broglie hypothesis-Matterwaves, Davisson and Germer's Experiment, Heisenberg's Uncertainty principle, Physical significance of the wave function- (qualitative treatment) Schrödinger's time dependent and time independent wave equations, Particle in a one dimensional potential box- equations for energy and wave function,Concept of electron gas,Maxwell-Boltzmann, Bose –Einstein and Fermi–Dirac statistics(qualitative treatment). Density of energy states, Estimation of Fermi energy.

UNIT-II

Semiconductor Physics: Classification of materials into Conductors, Semiconductors &Insulators.Intrinsic Semiconductors-Concentration of electrons in the conduction band &concentration of holes in the valance band, Fermi level in intrinsic semiconductors, Law of mass action, Extrinsic semiconductors, N-Type semiconductor, Carrier concentration in N-Type semiconductors, P-Type semiconductors, Carrier concentration in P-Type semiconductors, drift and diffusion current, Hall effect.

UNIT-III

Physics of Semiconductor Devices: Formation of PN junction, Open circuit PN junction, Energy diagram of PN diode, I-V Characteristics of PN junction diode, Zener diode –breakdown mechanism and characteristics.
Radiative and Non-Radiative recombination, LED, Photo diode &Solar cell-working principle & Applications, Semiconductor photo detectors- PIN and Avalanche structure and their characteristics.

UNIT-IV

Lasers: Characteristics of lasers, Absorption, spontaneous and stimulated emission of radiation, Einstein's coefficients and relation between them, Population inversion, Lasing action, Ruby laser, Helium-Neon laser, Semiconductor diode laser, Applications of lasers.

Fiber Optics: Principle of Optical fiber, Construction of optical fiber, acceptance angle and acceptance cone, Numerical Aperture, Types of optical fibers: Single and Multimode fibers, Step Index optical fibers& Pulse dispersion (qualitative treatment)
Graded index optical fibers & Pulse dispersion (qualitative treatment), Attenuation in optical fibers, optical fiber communication, optical fiber sensors.

UNIT-V

Dielectric Properties: Electric dipole, Dipole moment, Relative permittivity, Polarization and polarizability, Electric susceptibility, Displacement vector, Electronic and Ionic polarization, Orientation polarization (qualitative treatment), Internal fields in solids, Clausius–Mossottiequation, Piezo electric and Pyro-electric materials, Ferro electric materials.
Magnetic Properties: Permeability, Field intensity, Magnetic field induction, Magnetization, Magnetic Permeability &Susceptibility, Classification of Dia, Para, Ferro, Ferri and Anti-Ferro magnetic materials on the basis of magnetic moment (qualitative treatment), Explanation of Hysteresis curveon the basis of Domain theory of Ferro magnetism.
Superconductivity: Introduction, Critical field, Meissner effect, Effect of Magnetic field, Type-I and Type-II Superconductors, Cooper pair, BCS Theory of superconductivity (Qualitative treatment), Applications of Superconductors

TEXT BOOKS

1. Engineering Physics by B.K. Pandey,S. Chaturvedi- Cengage Learning India Pvt. Ltd.,1st Edition,2012.

2. Engineering Physics by PK Palanisamy , SciTech Publications,3rd edition, 2015.

REFERENCES

1. Fundamentals of Physics by Halliday, R. Resnick and J. Walker,John Wiley and Sons,6th edition,2001.
2. Introduction to Quantum PhysicsbyEisberg and Resnick, John Wiley & Sons, 2nd edition, 1985.
3. Quantum mechanics by D.J Griffiths, Cambridge University press,2nd edition, 2017.
4. Principles of Lasers by O.Svelto, Plenum publishing Corporation,4th edition,1998.
5. Physics of Semiconductor devices by Simon.MSze and Kwok K . Ng, Wiley Student Edition,3rdedition,2006.

COURSE OUTCOMES

On completion of the course students will be able to:

1. Explain the basic concepts of quantum & statistical mechanics.
2. Describe the classification of solids and the properties of semiconductors. for device designing.
3. Understand the different semiconductor devices and circuits for optical communication
4. Interpret the basic properties of lasers and characteristics of optical fibers for modern communication
5. Aquaire knowledge on properties of dieectric,,magnetic materials & illustrate the basic principles ofsuperconductivity.

END

(A30501) PROGRAMMING FOR PROBLEM SOLVING
(Common to all branches)

B. Tech (AI & ML) I

L	T	P	C
3	0	0	3

SemesterUNIT -I

Introductory Concepts: Introduction to Computers, Computer Characteristics, Modes of Operation, Types of Programming Languages.
Idea of Algorithm: Steps to solve logical and numerical problems.

Representation of Algorithm: Flowchart/ Pseudo code with examples.

Algorithms to programs: Source code, variables (with data types), variables and memory locations, Syntax and Logical Errors in compilation, object and executable code
Introduction to C: Some Simple C Programs, Desirable Program Characteristics.

C Fundamentals: The C Character Set, Identifiers and Keywords, Data Types, Constants Variables and Arrays Declarations, Expressions, Statements, Symbolic Constants.
Preparing and Running a Complete C Program: Planning a C Program, writing a C Program, Entering the Program into the Computer, Compiling and Executing the Program, Error Diagnostics, Debugging Techniques.

Operators and Expressions: Unary Operators, Arithmetic Operators, Relational and Logical Operators, Bitwise Operators, Conditional Operator, Assignment Operators, Special Operators, Precedence & Associativity of Operators, Evaluation of Expressions.
Data Input and Output: Preliminaries, Single Character Input- The getchar Function, Single Character Output- The putchar Function, Entering Input Data- The scanf Function, More About the scanf Function, Writing Output Data- The printf Function, More About the printf Function, The gets and puts Functions.

UNIT -II

Control Statements: Preliminaries, Branching: The if-else Statements, looping: The while Statement, the do while Statement, the for Statement, Nested Control Structures, the switch Statement, the break Statement,the continue Statement, the goto Statement.
Arrays: Defining an Array, Processing an Array, Multidimensional Arrays.

UNIT -III

Functions: A Brief Overview, defining a Function, accessing a Function, Function Prototypes, Passing Arguments to a Function, Recursion, Passing Arrays to Functions.

Program Structure: Storage Classes- Automatic Variables, External Variables, Static Variables andRegister Variables, Multi files Programs, More about Library Functions.
Strings: String Handling Functions, Sample C Programs without using library functions.

UNIT -IV

Pointers: Fundamentals Pointer Declarations, Passing Pointers to Functions, Pointers and One-Dimensional Arrays, Dynamic Memory Allocation, Operations on Pointers, Pointers and Multidimensional Arrays, Arrays of Pointers, Passing Functions to other Functions, More about Pointer Declarations.
Structures and Unions: Defining a Structure, processing a Structure, User Defined Data Types- typedef & Enumerations, Structures and Pointers, Passing Structures to Functions, Bit fields, Self-Referential Structures and Unions.

UNIT -V

Data Files: Opening and Closing a Data File, creating a Data File, Processing a Data File, Unformatted Data Files and Command Line Parameters.
Searching and Sorting: Linear and Binary Search, Bubble Sort, Selection Sort and Insertion Sort.

Text Books

1. Byron Gottfried, Schaum's Outline series, "Programming with C", McGraw-Hill.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, CengageLearning, (3rd Edition)

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language,Prentice Hall of India.
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression).
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition.

Course Outcomes

The student shall be able

1. Write algorithms and to draw flowcharts for solving problems.
2. Convert the algorithms/flowcharts to C programs.
3. Code and test a given logic in C programming language.
4. Decompose a problem into functions and to develop modular reusable code.
5. Write C programs using arrays, pointers, strings and structures and performSearching and sorting the data.

****END****

(A30313) ENGINEERING DRAWING

B. Tech (AI & ML) I Semester

L	T	P	C
1	0	3	2.5

Unit – I

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance; Conic Sections (Using eccentricity method only) Cycloid, Epi cycloid and Hypocycloid.

Unit – II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines (Excluding traces of lines) Projections of Plane regular geometric figures. (Excluding Auxiliary Planes and traces of planes)

Unit – III

Projections of Solids: Projection of regular solids- cube, Cylinder, prisms, pyramids, cone (Excluding Auxiliary Planes).

Unit-IV

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Solids and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts and combinations

Unit-V

Transformation of Projections: Conversion of Isometric Views to Orthographic Views and Vice-versa.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

Reference Books:

1. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

Course Outcomes.

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

1. Understand and apply the use of engineering curves in tracing the part of different machine components.
2. Evaluate the concepts of projections and acquire knowledge of visualization skills and convert it intopictorial representation.
3. Create and analyze the 3-D objects of machine components in real world.
4. Explore and evaluate the internal architecture of product by section and development of surfaces.
5. Create and imagine the solid and real objects in real world with axonometric projection.

****END****

(A30023) APPLIED PHYSICS LAB

B. Tech (AI & ML) I Semester

L	T	P	C
0	0	3	1.5

(Any 8 experiments are to be performed)

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.
2. Solar Cell:To study the V-I Characteristics of solar cell.
3. Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.
4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carryingcoil.
5. Hall effect: To determine Hall co-efficient of a given semiconductor.
6. Photoelectric effect: To determine work function of a given material.
7. LASER: To study the characteristics of LASER sources.
8. Optical fibre: To determine the Numerical aperture of a given fibre and bending losses of Opticalfibres.
9. LCR Circuit: To determine the Quality factor of LCR Circuit.
10. Diffraction grating: Determination of wavelength of a source (LASER).
11. Determination of Planck's constant using LED.
12. R-C Circuit: To determine the time constant of R-C circuit.

LABORATORY MANUAL:

1. Laboratory Manual of Engineering Physics by Dr.Y. Aparna&Dr.K. VenkateswaraRao (V.G.SPublishers).
2. Laboratory Manual of Engineering, Published by CMR College of Engineering & Technology

COURSE OUTCOMES

On completion of the course students will be able to

1. Explain the concept of oscillations and resonance.
2. Determine energy gap of a semiconductor diode, Planck's constant and magnetic fields.
3. Describe the characteristics of semiconductor devices
4. Design new experiments in engineering.
5. Evaluate the basic properties of lasers and optical fibers.

END

(A30502) C PROGRAMMING LAB
(Common to all branches)

L	T	P	C
0	0	3	1.5

B. Tech (AI & ML) I Semester

Lab 1: Familiarization with programming environment
i. Write a simple C program to display "Hello, World!" on the screenii Identify various parts in C program.
iii. Compile & Run the C- Program using various Compilers.
iv. Identify Syntax Errors and correct them.

Lab 2: Simple computational problems using arithmetic expressions i.Write a C program to find the roots of a quadraticequation.
ii.Write a C program to convert centigrade toFahrenheit.

Lab 3:
i.Write a C program to find maximum of given threenumbers.
ii.Write a C program to find the factorial of a positiveinteger.

Lab 4:
i.Write a C program to determine if the given number is a prime number or not.
ii.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 print the Fibonacci sequence up to n^{th}term.

Lab 5:
i.Write a C program to generate all the prime numbers between 1 and n, where n is avalue supplied by theuser using Sieve of Eratosthenesalgorithm.
ii. Write a C program to convert a positive integer to a roman numeral. Ex. 11 isconverted toXI.

Lab 6:
i.Write a C program to print the Pascal trianglespyramidii.Write a C program to calculate the followingseries
a) Sin(x) b) Cos(x) c)log(x)

Lab 7:
i.Write a C program that reads two matrices and uses functions to perform the following:
a) Addition of two matrices b) Multiplication of two matrices c) Transpose of a Matrix.
ii. Define four pointer variables, one each of type char, short, int, float. Fill these pointers by allocate memory of required size by calling malloc () function. Read data from the user and fill in the memory(allocated using malloc ()). Finally display the data

Lab 8:
Write a C program to read N students data (Rollo, Name, Marks1, Marks2, Marks3)and find the topper(Use array of structures and implement usingfunctions).

Lab 9:

i. Write a C program that reads 15 names each of up to 30 characters, stores them in an array and use anarray of pointers to display them in ascending (ie. alphabetical) order.

ii. Two's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C programto find the 2's complement of a binarynumber.

Lab 10:

i. Write a C program to display the contents of a file to standard outputdevice. ii. Write a C program which copies one file to another, replacing all
lowercase characters with their uppercaseequivalents

Lab 11:

i. Write a C program that uses non-recursive functions to count the number ofpalindromes in a givenstring.

ii. Write a C program to replace a substring with another in a given line oftext.

Lab 12:

i. Write C programs for implementing the followingmethods
a) BubbleSort b) Selection Sort c) BinarySearch

Additional Programs:

1. Write a C program that implements the Insertion sort method to sort agiven list of integers in ascendingorder.
2. Write a C program that uses functions to perform the following operations:
   To insert a sub-string into a given main string from a givenposition.
   To delete n characters from a given position in a givenstring.
3. Write a C program to compare two files, printing the first line where theydiffer.4. Write a C program to reverse the first n characters in a file.
   The file name and nare specified on the command line. Use fseek ()function
5. Write a C program to merge two files into a third file (i.e., the contents of the firstfile Followed bythose of the second are put in the third file)

REFERENCE BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, CengageLearning,(3rdEdition)
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall ofIndia
4. R.G. Dromey, How to solve it by Computer, Pearson (16thImpression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, PearsonEducation.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill,

4thEditionCourse outcomes

The student shall be able

1. To test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion.
3. To use arrays and structures to formulate algorithms and programs.
4. To apply programming to solve matrix addition and multiplication problems and searchingand sorting problems.
5. Create, read and write to and from simple text and binary files and verifythroughexecution.

A30505) BASIC INTERNET OF THINGS LAB
(Common to all branches)

B. Tech (AI & ML) I Semester

L	T	P	C
0	0	2	1

Lab Requirements:

Raspberry Pi3 single board Computer, Android SDK, Eclipse IDE, JDK1.8.

Week 1: Introduction to IoT

- Definition of IoT
- History of IoT
- IoT Architecture
- Enabling Technologies for IoT
- Fundamental characteristics of IoT
- Benefits and Applications of IoT
- Introduction to Basic Components

Basic Components				
Jumper wires	LEDs (Light Emitting Diodes)	Resistors	Potentiometer	Diode,
Photo resistor	Buzzer	Temperature Sensor	DC Motor	Push Button
RC Servo	Relays	Breadboard		

Week 2: Programming in python

- Introduction to Python
- Python Installation
- Understanding Python Basics
- Using Arithmetic in your programs
- Learning about Loops

Week 3: Platform Based Development – Raspberry Pi

Introduction to Raspberry Pi

- Why Raspberry Pi?
- Setting up the Raspberry Pi
- Python on Raspberry Pi

Week 4: Basic Experiments Level-1

Demonstration of the following Experiments
Experiment 1: Your First Circuit – To Blink an LED (Light Emitting Diode)Experiment 2: To Blink an RGB LED

Additional Experiments (optional)

Experiment 1: To read the temperature and display the same in serial monitor.(use LM35 Temperature sensor)
Experiment 2: To make an LED glow when controller detects a button pressed.

Week 5: Basic Experiments Level -2

Demonstration of the following Experiment

Experiment 1: To control an LED according to the range of analog input sensed using photo resistor. (useLight DependantResistor (LDR))

Additional Experiments (optional)

Experiment 1: To interface the Liquid Crystal Display (LCD) with the Raspberry Pi3 to display thecharacters on the LCD.

Week 6: Basic Experiments Level -3

Demonstration of the following Experiment

Experiment1: To interface the Ultrasonic Sensor with the Raspberry Pi3 to determine the distance of anobject from the sensor.

Additional Experiments (optional)

Experiment1: To interface the Infrared sensor with the Raspberry Pi3 to sense the path is clear/indicate thepresence of any obstacles.

Week 7: Introduction to Android

- Introduction to Android
- Explain the structure of Android App.

Experiment 1: Create Hello World application with Android.

Week 8

Experiment 1: Create Application to change the Background Color and Background Image
Experiment 2: Explain simple User interface components in Android and create simple Application

Week 9

Experiment 1: Create an application that display color or image as background when selected the radiobuttons or checkboxes
Experiment 2: Create an Application to perform addition, Subtraction, multiplication, division.

Week 10

Explain what is activity, intent and its functions.
Experiment 1: Create an application with Android intent.

Week 11

Experiment 1: Create a simple android application with the following event handlers.

a) On Click
b) On Key Down

c) On Focus changed

Week 12

Experiment 1: Explain about Toast, Create Application with User defined Toast Notifications.
Additional Experiment: Create login page by using login activity

Reference Books:

1. ArshdeepBahga, VijayMadisetti, Internet of Things: A Hands-On Approach, Orient BlackswanPrivate Limited - New Delhi; First edition (2015)
2. John Horton, Android Programming for Beginners, PACKT publications.

Course Outcomes

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

1. Identify and differentiate various components used in IoT Architecture.
2. Write & execute programs in python programming language
3. Use Python programming language to interface with Raspberry
4. Demonstrate the various real time applications using Raspberry Pi
5. Create and Deploy Mobile applications using Android

END

(A30020) INTRODUCTION TO SOCIAL INNOVATION

(Common for all branches)

B. Tech (AI & ML) I Semester

L	T	P	C
0	0	2	1

UNIT 1

Community Study: Types and features of communities- Rural, Suburban, Urban and regional, Service based learning, Aims of community-based projects, Community visits.

UNIT 2

Social Innovation across Four Sectors: The four sectors – the non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors.

UNIT 3

Stages of Social Innovation: Social organizations and enterprises, social movements, politics and government, markets, academia, philanthropy, social software and open source methods, common patternsof success and failure.

UNIT 4

Engineering Ethics: Introduction to ethics, moral values, significance of professional ethics, code of conduct for engineers, identify ethical dilemmas in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

UNIT 5

Steps forPatent filing and Startups, poster presentation.

References:

1. Social Entrepreneurship for the 21st Century: Innovation Across the Non Profit, Private and PublicSectors; Georgia Levenson Keohane; Tata McGraw Hill
2. Social Enterprises: An Organizational Perspective edited; Benjamin Gidron, YeheskelHasenfeld;Palgrave Macmillan
3. Engineering Ethics: An Industrial Perspective; Gail Baura; Elsevier
4. Intellectual Property and Financing Strategies for Technology Startups; Gerald B. Halt, Jr., John C.Donch, Jr., Amber R. Stiles, Robert Fesnak; Springer
5. Fundamentals of Intellectual Property (English) 1st Edition (Paperback, Dr. Kalyan C. Kankanala)Publisher: Asia Law House ISBN: 9789381849514, 938184951X Edition: 1st Edition, 2012.
6. Indian Patent Law (English, Paperback, Kalyan C. Kankanala) Publisher: Oxford University Press-New Delhi, ISBN: 9780198089605, 0198089600 Edition: 2012.

Course Outcomes:

On Completion of the course, the students will be able to

1. Identify community issues through community Intearction
2. Illustrate the factors affecting social innovation in various sectors
3. Analyze the stages of scoial innovation for a community problem
4. Adopt the ethical values in implementing the Social innovation
5. Describe the process of property rights and patent filing.

END

(A30005) ODEs AND MULTIVARIABLE CALCULUS
(Common to all branches)

B. Tech (AI & ML) II Semester

L	T	P	C
3	1	0	4

UNIT-I

First Order ODE: Exact, Linear and Bernoulli's differential equations, Applications, Newton's law of cooling, Law of natural growth and decay.
Equations not of first degree: Equations solvable for p, Equations solvable for y, Equations solvable for x and Clairaut's type.

UNIT -II

Ordinary Differential Equations of Higher Order: Second and higher order linear differential equations with constant coefficients, Non-Homogeneous terms of the type $e^{ax}, \sin ax, \cos ax,$ polynomials in x , $e^{ax}V(x)$ and $x^n V(x)$, Method of variation of parameters, Equations reducible to linear ODE with constant coefficients, Legendre's equation, Cauchy-Euler equation.

UNIT -III

Multivariable Calculus (Integration): Evaluation of Double Integrals (Cartesian and polar coordinates), Change of order of integration (only Cartesian form), Evaluation of Triple Integrals, Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals, **Applications:** Areas (by double integrals) and volumes (by double integrals and triple integrals).

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. Theorems of Green's, Gauss and Stoke's(without proofs) and their applications.

TEXT BOOKS :

1. Higher Engineering Mathematics, (36th Edition), B.S. Grewal, Khanna Publishers, 2010
2. Advanced Engineering Mathematics, (9th Edition), Erwin kreyszig, John Wiley & Sons,2006.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics (3rd edition) by R.K. Jain & S.R.K. Iyengar, Narosa PublishingHouse, Delhi.
2. Differential Equations with Applications & Historical Notes(2ndEdi) by George F Simmons, TataMc. graw Hill Publishing Co Ltd.
3. Advanced Engineering Mathematics(8thEdition) by Kreyszig, John Wiley & Sons Publishers
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry(9thEdition), Pearson, Reprint, 2002
5. Mathematics for Engineering and Scientists (6th Edi), by. Alan Jeffrey, 2013, Chapman & Hall

6. /CRC
7. Engineering Mathematics – I by T.K.V. Iyengar, B. Krishna Gandhi & Others, 2012 Yr. Edition S.Chand.
8. Differential Equations (3rd Ed), S. L. Ross Wiley India, 1984.

COURSE OUTCOMES:

On completion of the course students will be able to

1. Determine first order differential equations and obtain solutions.
2. Solve higher order linear differential equations using various methods.
3. Evaluate areas and volumes using multiple integrals.
4. Evaluate Gradient, Divergence, Curl and directional derivatives.
5. Evaluate integrals by converting line to surface integral and surface to volume integrals.

****END****

(A30001) ENGLISH

B. Tech (AI & ML) II Semester

L	T	P	C
2	0	0	2

UNIT-I:

Reading: On the Conduct of Life: William Hazlittfrom "Language and Life:A Skills Approach" Published by Orient Black Swan, Hyderabad.
Grammar: Prepositions

Vocabulary: Word Formation I: Introduction to Word Formation
Writing: Clauses and Sentences

UNIT-II:

Reading: The Brook: Alfred Tennyson from "Language and Life: A Skills Approach" Published by OrientBlack Swan, Hyderabad**.**
Grammar: Articles

Vocabulary: Word Formation II: Root Words from Other Languages
Writing: Punctuation

Life Skills: Self Improvement- 'How I Became a Public Speaker': George Bernard Shah

UNIT-III:

Grammar: Noun-Pronoun Agreement, Subject-Verb Agreement
Vocabulary: Word Formation III: Prefixes and Suffixes from Other Languages
Writing: Principles of Good Writing

Life Skills: Time Management- 'On Saving Time': Seneca

UNIT-IV:

Grammar: Misplaced Modifiers
Vocabulary: Synonyms and Antonyms**Writing:** Essay Writing

Life Skills: Innovation- Muhammad Yunus – A biography

UNIT –V:

Reading: Politics and English Language: George Orwell from "Language and Life: A Skills Approach" Published by Orient Black Swan, Hyderabad.
Grammar: Clichés, Redundancies Vocabulary: Common Abbreviations
Writing: Writing a Summary

TEXTBOOKS:

1. A Text book entitled **"Language and Life: A Skills Approach"** Published by Orient Black Swan,Hyderabad. ISBN:978-93-5287-422-4

REFERENCES:

1. Practical English Usage. Michael Swan. OUP. 1995
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

COURSE OUTCOME:

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

1. Apply the rules of Noun-Pronoun Agreement, Subject-Verb Agreement in sentence formation.
2. Identify the Root Words from other Languages and describe the methods of word formation inEnglish Language.
3. Employ Synonyms, Antonyms, Affixation and Acronyms in writing and speaking correct English
4. Compose essays and summaries in English and apply time management skills to make best use oftime.
5. Apply the public speaking skills in giving presentations and speeches in English

END

(A30011) ENGINEERING CHEMISTRY

	L	T	P	C
B. Tech (AI & ML) II	**3**	**0**	**0**	**3**

SemesterUNIT-I

Molecular Structure and Theories of Bonding:

Introduction, Concept of atomic and molecular orbitals, Linear combination of atomic orbitals (LCAO), Molecular orbitals of diatomic molecules, Molecular orbital energy level diagrams of diatomic molecules- N_2, O_2 and F_2, π molecular orbitals of butadiene and benzene.

Crystal Field Theory (CFT):

Salient features of CFT, Crystal field splitting patterns of transition metal ion d-orbitals- tetrahedral, octahedral and square planar complexes.

UNIT-II

Electrochemistry:

Introduction**,** Conductance- Specific conductance, Equivalentconductance, Molar conductance and their inter relationship, Numerical problems, Electrochemical cell, Electrode potential, Standard electrode potential and E.M.Fof the cell, Nerns't equation- derivation and applications, Types of electrodes- Quinhydrone electrode, Calomel electrode and Glass electrode. Electro chemical series and its applications . Concept of concentration cells, Electrolytic concentration cell and numerical problems, Batteries- primary (Lithium cell), secondary (Lead acid storage battery and Lithium ion battery) and Fuel cells(H_2-$O_2$and methanol-oxygen).

Corrosion:

Causes and effects of corrosion, Theories of chemical and electrochemical corrosion, Mechanism of electrochemical corrosion, Pilling-Bedworth rule, Types of corrosion- Galvanic, Waterline and Pitting corrosion, Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection, Sacrificial anode and Impressed current cathodic methods, Surface coatings- Metallic coatings, hot dipping, galvanizing and tinning,Electroplating- Copper plating andelectrolessplating - Nickel plating.

UNIT –III

Spectroscopic Techniques and Applications:

Principles of spectroscopy and selection rules, Applications of UV-Visible spectroscopy, Vibrational and rotational spectroscopy (IRspectroscopy)-Applications, Nuclear magnetic resonance-Chemical shift, Splitting pattern and Integration, Introduction to magnetic resonance imaging.

UNIT-IV

Water Technology:

Sources of water, Impurities in water, Hardness of water, Temporary and permanent hardness, Units of hardness, Estimation of temporary and permanent hardness of water, EDTA method, Numerical problems, Potable water treatment-Specifications, Steps involved in treatment-Sedimentation, Coagulation, Filtration, Sterilization, Desalination of Brackish Water, Reverse Osmosis and Electro dialysis.

Industrial water treatment, Boiler Troubles-Scales andsludges, Caustic embrittlement, Boiler corrosion, Priming and foaming. Hot lime and cold lime soda process-Numerical problems, Zeolite process and Ion exchange process. Internal conditioning methods like Phosphate, Carbonate, Calgon and Colloidal conditioning.

UNIT-V

Stereochemistry:

Representations of three-dimensional structures, Structural isomers and stereoisomers, Configurations and symmetry, Chirality- Enantiomers, Diastereomers, Optical activity, Absolute configurations and conformational analysis of n-butane.

Organic Reaction Mechanisms and Synthesis of a Drug Molecule:

Introduction, Substitution reactions- Nucleophilic substitution reactions (Mechanisms of SN^1 and SN^2 reactions, Addition Reactions-Electrophilic and nucleophilic addition reactions, Addition of HBr to propene, Mar kownikoff and anti markownikoff'sadditions, Grignard additions on carbonyl compounds, Elimination reactions- Dehydrohalogenation of Alkyl halides, Shetzeff rule.
Oxidation reactions- Oxidation of Alcohols using $KMnO_4$ and chromic acid, Reduction reactions-reduction of carbonyl compounds using $LiAlH_4$, $NaBH_4$, Synthesis of a commonly used drug molecules (Paracetamoland Ibuprofen).

Text Books:

1. "Engineering Chemistry", P.C Jain and Jain Monika,DhanpatRai Publication Company, 16th Edition,2015.
2. Text Book of Engineering Chemistry by A.Jaya Shree, Wiley India Pvt. Ltd, New Delhi.

Reference Books:

1. University chemistry, by B. H. Mahan, Narosa Publication.1998.
2. Chemistry: Principles and Applications, by M. J. Sienko and R.A. Plane, McGraw-Hill, 3rd edition,1980.
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell, McGraw-Hill, 3rdrevised edition, 1983.
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan.
5. Physical Chemistry, by P. W. Atkins, W.H. Freeman and Company, 5th Edition, 1994.
6. "Text Book of Engineering Chemistry", B.Rama Devi, Ch. VenkataRamana Reddy and PrasanthRath,Cengage Learning 2017.
7. "Organic Chemistry", Morison and Boyd, Pearson publications, 7th Edition 2011.
8. Organic Chemistry: Structure and Function by K.P.C.Volhardt and N.E.Schore,5thEditionhttp://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes:

After completion of the course students will be able to

1. Explain the benefits of treated water as source in steam generation in industrial applications
2. Describe how electrochemical concepts can be used in various practical applications, like batteries,fuel cells etc.Explain the chemical applications of electricity
3. Apply knowledge of corrosion science to problems in materials engineering, explain various methods of prevention of corrosion of metals.
4. Analyze microscopic chemistry in terms of atomic and molecular orbitals
5. List major chemical reactions that are used in the synthesis of drugs.

****END****

(A30503) DATA STRUCTURES & ALGORITHMS

(Common to ECE, CSE, EEE, IT,CSM,CSC)

L	T	P	C
3	0	0	3

B. Tech (AI & ML) II

SemesterUNIT - I

Data Structures: Introduction, classification of Data structures, ADT and applications, Over view of List and its operations.

Linked Lists: Representation in memory, Operations of Singly Linked List: Traversing, Searching, Insertion, Deletion and Reverse, Doubly Linked List and its Operations, Circular Linked Lists and its Operations.

UNIT - II

Stacks: Stack ADT and its implementations, Applications of Stacks: Infix to Postfix Conversion and Postfix evaluation – Corresponding algorithms.

Queues: Queue ADT and its implementations, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues- Corresponding Algorithms.

UNIT - III

Trees: Basic Tree Terminologies, Representations, types of Binary Trees: Threaded Binary Tree, Binary Search Tree, AVL Tree and their operations: Insertion Deletion, Traversal.

UNIT – IV

Graphs: Basic Terminologies, Representations, Graph traversal algorithms.

Dictionaries: Dictionary as a linear list and its operations-Insertion, Deletion, Searching, Hash tables, Hash Functions, Collision Resolution Techniques-Linear Probing, Quadratic Probing, and Double Hashing.

UNIT V

Sorting: Quick Sort, Merge Sort, Heap Sort, comparison of techniques.

Pattern Matching Algorithms: Brute-Force Algorithm and Knuth-Morris-Pratt Algorithm.

Text books:

1. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures in C, Second Edition UniversitiesPress.
2. Thomas H. Cormen Charles E. Leiserson, Introduction to Algorithms, PHI Learning Pvt. Ltd. Thirdedition.

Reference books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark AllenWeiss, Addison-Wesley Publishing Company
2. E.Balagurusamy , Data Structures Using C, McGraw Hill Education; First edition

Course Outcomes:

On completion of the course students will be able to

1. Use data structure concepts for realistic problems.
2. Identify appropriate data structure for solving computing problems in respective language
3. Develop algorithms, operations on queues, stacks and Linked Lists.
4. Demonstrate the representation and traversal techniques of graphs and their applications
5. Analize and Implement searching and sorting algorithms

END

(A30002) ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

B. Tech (AI & ML) II Semester

L	T	P	C
0	0	3	1.5

English Language Communication Skills Labshall have **two** parts

A. **Computer Assisted Language Learning (CALL) Lab**
B. **Interactive Communication Skills (ICS) Lab**

INTRODUCTION:

The Language Lab focuses on the production and practice of sounds of language and familiarizes thestudents with the use of English in everyday situations and contexts.

EXERCISE – I

CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session

EXERCISE – II

CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.
ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing Others – Greetings – Apologies – Requests – Social and Professional Etiquette - TelephoneEtiquette.

EXERCISE – III

CALL Lab: Minimal Pairs- Word accent and Stress Shifts.
ICS Lab: Descriptions – Place, Person, Object

EXERCISE – IV

CALL Lab: Intonation and Common errors in Pronunciation.
ICS Lab: Extempore- Public Speaking

EXERCISE – V

CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice
ICS Lab: Giving Directions

COURSE OUTCOMES:

At the end of the lab session, learner comprehends, acquaints and adopts the following.

1. Illustrates How to Work in Teams and demonstrates Soft Skills and Communication Skills well.
2. Minimizes the usage of Mother Tongue and Apprises Neutral Accent
3. Prepares for employability skills
4. Speaks English Confidently and does Presentations with self-confidence
5. Distinguishes between Sympathy and Empathy

(A30012) ENGINEERING CHEMISTRY LAB

L	T	P	C
0	0	3	1.5

B. Tech (AI & ML) II semester

1. Estimation of Hardness of water by EDTA method.
2. Estimation of Alkalinity of water.
3. Estimation of Copper by Colorimetric Method.
4. Conductometric Titration of a strong acid vs a strong base.
5. Conductometric Titration of a week acid vs a week base.
6. Potentiometric Titration of a strong acid vs a strong base.
7. Potentiometric Titration of week acid vs a week base.
8. Preparation of Paracetmol and Asprin.
9. Determination of Viscosity of a Liquid.
10. Determination of Surface Tension of a liquid.
11. Adsorption of acetic acid on Activated charcoal.
12. Estimation of iodine in table salt.
13. Thin Layer Chromatography (Ortho-Nitro phenol &Para-Nitro phenol).
14. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.

Course outcomes:

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

1. Predict the extent of hardness range present in water sample and its consequences in industrialoperations
2. Prepare drugs like Aspirin and Paracetmol
3. Estimate the strength of solutions, pH of various solutions
4. Evaluate the viscosity and surface tension of liquids
5. Employ the conductometric and potentiometric titrations

REFERENCES:

1.Engineering Chemistry Lab Manual, Glaze Publishers 2018.
2.Engineering chemistry by B. Rama Devi & Ch. VenkataRamana Reddy;
Cengage Learning, 2012.
3.A Textbook of Engineering Chemistry, SashiChawla, DhanapathRai& Sons.

****END****

(A30504) DATA STRUCTURES & ALGORITHMS LAB(Common to ECE, CSE, EEE, IT)

B. Tech (AI & ML) II Semester

L	T	P	C
0	0	3	1.5

Lab 1: Write a C program to perform the following operations on the givenarray
(i) insert element in specific position in toarray
(ii) Delete random element fromarray
(iii) Reverse the arrayelements

Lab 2: A) Write a C program to implement Single linkedlist
i) Insertion ii) Deletion iii) Display
B) Write a C program to implement Circular linkedlist
i) Insertion ii) Deletion. iii)Display

Lab 3: A) Write a C program to implement Doubly linkedlist
i) Insertion ii) Deletion. iii)Display
B) Write C programs to implement Stack ADTusingi)Array ii) LinkedList

Lab 4:

A. Write a C program that uses stack operations to convert a given infix expression in to its postfixequivalent. (Display the role ofstack).
B. Write a C program for Evaluation of postfixexpression.
.

Lab 5: Write C programs to implement Queue ADT using
i) Array ii) Linked List

Lab 6: Write a C program to implement Binary search tree
i) Insertionii) deletioniii) Traversals

Lab 7:

Write a C program to implement binary search tree Non - recursively traversals
i) Pre- Order ii) Post –Orderiii) In-Order

Lab 8:

(A) Write a C Program to Check if a Given Binary Tree is an AVL Tree or Not
(B) Write a C program to find height of a Binary tree
(C) Write a C program to count the number of leaf nodes in a tree.

Lab 9:

Write a C program for implementing Graph traversal
i) DFS ii) BFS

Lab 10:

A) Write a C program to implement different hash methods
B) Write a C program to implement the following collisionresolving
i) Quadratic probing. ii) Linear Probing

Lab 11:

Write C programs for implementing the following Sorting methods and display the important steps.
i) Quick Sort ii) Heap sort

Lab 12:

Write a C program for implementing pattern matching algorithms
i) Knuth-Morris-Pratt ii) Brute Force

Additional

1. Implement the priority queue using Heap
2. Write a C Program to Implement Merge sort
3. Write a C program to implement AVL tree
   i) Creation ii) Deletion iii) Traversals
4. Write a function to reverse the nodes of a linked list
5. Write a C program to implement 2-3-4 tree operations
6. Write a C program to implement B tree operations
7. Write a C program to implement B+ tree operations

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures in C, Second Edition UniversitiesPress.
2. Thomas H. Cormen Charles E. Leiserson, Introduction to Algorithms, PHI Learning Pvt. Ltd. Thirdedition.
3. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark AllenWeiss, Addison-Wesley Publishing Company
4. E.Balagurusamy Data Structures Using C, McGraw Hill Education; First edition

Course Outcomes

At the end of the course the student will be able to

1. Write and execute C-programs to implement Linked List Data Structures
2. Evaluate postfix expressions by implementing in C-language
3. Implement Non- linear Data Structures in C-language
4. Implement various sorting techniques in C-language
5. Test various pattern matching algorithms by implementing in C-language.

END

(A30314) ENGINEERING WORKSHOP

B. Tech (AI & ML) II

L	T	P	C
0	0	3	1.5

SemesterI Trade for

Exercise:

(Two experiments each from any six trades of the following)

1. Carpentry
2. Fitting
3. Tin-smithy
4. House-wiring
5. Foundry
6. Plumbing
7. Welding
8. Black smithy

II Trades for Demonstration and Exposure:

1. Power tools
2. Machine Tools- Turning on Lathe and other Operations on Lathe.,

TEXT BOOK:

1. Workshop Manual, Second edition/ P Kannaiahand K L Narayana/ Scitech publishers

Course Outcomes

On completion of the course students will be able to:

1. Design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint.and various basic prototypes in the trade of fitting such as Straight fit, V- fit etc.
2. make various basic prototypes in the trade of Tin smithy such as rectangular tray, and funnel
3. Perform various basic House Wiring techniques such as connecting one lamp with two switch,ceiling fan etc.
4. design and model various basic prototypes in the trade of Welding such as Lap joint, Butt joint etc
5. Design and model various basic prototypes in the trade of blacksmithy,foundry and plumbing.

END

(A30019) ENGINEERING EXPLORATION & PRACTICE
(Common to all branches)

B. Tech (AI & ML**) II**

L	T	P	C
0	0	3	1.5

SemesterModule 1

Introduction to Engineering and Engineering Study: Introduction to Engineering and Engineering Study:

Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer.

Module 2

Engineering Design: Engineering Design Process, Multidisciplinary facet of design, Importance of analysis in engineering design, general analysis procedure, Pair wise comparison chart, Introduction to mechatronics system, generation of multiple solution, decision matrix, Concepts of reverse engineering

Module 3

Mechanisms: Basic Components of a Mechanism, Degrees of Freedom or Mobility of a Mechanism, 4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism.

Module 4

Platform based development: Introduction to various platform-based development, programming and its essentials, Introduction to transducers and actuators and its interfacing. Concepts of reverse engineering
Data Acquisition and Analysis: Types of Data, Descriptive Statistics techniques as applicable to different types of data, Types of graphs as applicable to different types of data, Usage of data acquisition tools fordescriptive statistics, Data Acquisition, Exporting acquired data to analysis using visual representation.

Module 5

Project Management: Introduction, Significance of teamwork, Importance of communication in engineering profession, Project management tools: Checklist, Timeline, Gantt Chart, Significance of documentation

Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment, carbon footprint

References:

1. Engineering Fundamentals: An Introduction to Engineering (MindTap Course List) 5th Edition by Saeed Moaveni
2. Software Project Management (SIE), (Fifth Edition); Bob Hughes,MikeCotterell,Rajib Mall; Published by Tata McGraw-Hill Education Pvt. Ltd (2011) ; ISBN 10: 0071072748 ISBN 13: 9780071072748
3. A Ghosh and AK Malik: Theory of Mechanism and Machine; East West Press (Pvt) Ltd., New Delhi.
4. Arduino Cookbook, 2nd Edition by Michael Margolis: O'Reilly Media
5. Data Acquisition and Analysis - Building an Excel Budget Forecast Workbook by Andrew Greaney (Kindle Edition)ISBN: 1521903468

6. Concepts in Engineering Design – 2016; by Sumesh Krishnan (Author), Dr. Mukul Shukla (Author),Publisher: Notion Press

Course Outcomes:

On Completion of the course, the students will be able to

1. Explain the importance of engineering profession in the world.
2. Identify multi-disciplinary approach required in solving an engineering problem
3. "Build a mechanism for a given application"
4. Design a mechatronic system using arduino and electronic components
5. Analyze engineering solution from sustainability perspectives.

END

(A30007) NUMERICAL TECHNIQUES & PROBABILITY DISTRIBUTIONS

B. Tech (AI & ML) III

T	P	C
3	1	0	4

Semester UNIT-I:

NUMERICAL METHODS-I

Solution of polynomial and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-False method.

Interpolation: Finite differences, Forward differences, Backward differences, Central differences, Symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation, Gauss's forward and backward formulae, Lagrange's method of interpolation.

UNIT-II: NUMERICAL METHODS-II

Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rules.

Numerical Solutions of Ordinary Differential Equations -Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order.

UNIT-III: LAPLACE TRANSFORMS

Laplace transform of standard functions, First shifting theorem, 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 transforms of special functions, Laplace transform of periodic functions. Inverse Laplace transform by different methods, Convolution theorem (without Proof), Solving ODEs by Laplace transform method.

UNIT- IV:

RANDOM VARIABLES & DISTRIBUTIONS

Random Variables: Discrete and continuous random variables.

Distributions: Binomial distribution, Poisson distribution and their Properties, Normal distribution, Sampling distribution of means (- known and unknown).

UNIT- V:TEST OF HYPOTHESIS

Test of hypothesis, Null hypothesis, Alternative hypothesis, Type-I & II errors, Critical region, Confidential interval for the mean & proportions. Test of hypothesis for large samples, Single mean, Difference between the means, Single proportion and difference between the proportions. Test of hypothesis for Small samples, Confidence interval for the t- distribution, Tests of hypothesis t -test, F-test, $\chi 2$- test, goodness of fit.

TEXT BOOKS:

1. Higher Engineering Mathematics (36th edition) by B.S. Grewal, Khanna Publishers.
2. Fundamentals of Mathematical Statistics (11th Edition) by S.C. Gupta& VK Kapoor, Sultan Chand &Sons.

1. Advanced Engineering Mathematics (3rd edition) by R.K. Jain & S.R.K. Iyengar, Narosa PublishingHouse, Delhi.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, 4h Edition, Prentce Hall of India Pvt. Ltd.
3. Advanced Engineering Mathematics (9th edition) by Erwin Kreyszig John Wiley & Sons Publishers.
4. Probability & Statistics by T.K.V. Iyengar, B. Krishna Gandhi & Others, 2015 Yr. Edition S. Chand.
5. Applied Mathematics for Engineers & Physicists (3rd edition) by Pipes & Harvill, McGraw HillInternation Book company.

COURSE OUTCOMES:

On completion of the course students will be able to:

1.Find the root of given equation and estimate unknown value using interpolation.2.Find numerical solutions of ordinary differential equations.
3.Solve ordinary differential equations using Laplace transform. 4.Analyse random variables involved in probability models.
5.Test hypothesis for large and small samples.

END

(A30516) OPERATING SYSTEMS

B. Tech (AI & ML) III Semester

L	T	P	C
3	0	0	3

UNIT-I

Operating System Introduction, Structures - Simple Batch, Multi-programmed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls.

UNIT –II

Process and CPU Scheduling- Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads, and Interposes Communication, Scheduling Criteria, Scheduling Algorithms, Multiple - Processor Scheduling.

System call interface for process management-fork, exit, wait, waitpid, exec

UNIT –III

Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.

Process Management and Synchronization- The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors. Inter process Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT –IV

Memory Management and Virtual Memory- Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT -V

File System Interface and Operations-Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. usage of open, create, read, write, close, lseek, stat, ioctl, system calls

Text Books:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, GregGagne7th Edition, John Wiley
2. Advanced programming in the Unix environment, W.R. Stevens, Pearsoneducation.

Reference Books:

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

Course Outcomes

Students shall be able to

1.Describe the components of computer and their respective roles in computing.2.Explain process concepts and CPU Scheduling Algorithms

3.Demonstrate the Mutual exclusion, deadlock detection and Inter ProcessCommunications.

4.Analyze various memory management and allocation methods.5.Discuss File System Interface and Operations.

****END****

(A30513) COMPUTER ORGANIZATION & ARCHITECTURE

	L	T	P	C
B. Tech (AI & ML) III	**3**	**1**	**0**	**4**

SemesterUnit-1

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs

Unit-II

Data representation: signed number representation, fixed and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit-III

Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit-IV

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency

Unit-V

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by CarlHamacher, McGraw Hill HigherEducation.

Reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw- Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Outcomes

On completion of the course students will be able to

1. Describe basic computer organization
2. Explain the design of Control Unit.
3. Illustrate Data representation in computer's memory
4. Describe Input-Output, Memory Organization.
5. Distinguish between RISC and CISC Instruction Set.

END

(A36201) OBJECT ORIENTED PROGRAMMING THROUGH JAVA

B. Tech (AI & ML) III

L	T	P	C
3	0	0	3

SemesterUnit-I

Introduction to Object Oriented Programming: Need for Object Oriented Programming - Characteristics of Object-Oriented Languages, Objects, Overloading, Overriding Functions and Object Polymorphism, Inheritance, Abstraction, Interfaces, java introduction & language fundamentals
Packages: Defining, Creating and Accessing a Package, Understanding Class path, Importing Packages

Unit-II

Inner Classes: Use of Inner Classes, Local Inner Classes, Anonymous Inner Classes, Static Inner Classes, Example.
Exception Handling: Dealing with Errors, Benefits of Exception Handling, The Classification of Exceptions, Exception Hierarchy, Checked Exceptions and Unchecked Exception, Usage of Try, Catch, Throw, Throws, and Finally, Re-Throwing Exceptions, Exception Specification, Built in Exceptions, Creating Own Exception Sub Classes.

Unit-III

Multithreading: Difference Between Multiple Processes and Multiple Threads, Thread States, Creating Threads, Interrupting Threads, Thread Priorities, Synchronizing Threads, Inter-Thread Communication,Producer Consumer Pattern.
File I/O: Streams-Byte Streams, Character Streams, Text Input /Output, Binary Input/output, File Management using File Class

Unit-IV

Collection Framework in Java: Introduction to Java Collections, Overview of Java Collection Frame Work, Generics, Commonly used Collection Classes-Array List, Vector, Hash Table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, Calendar and Properties.
Connecting to Database: JDBC Type I To IV Drivers, connecting to a Database, querying a Database and Processing the Results, Updating Data With JDBC.

Unit-V

GUI Programming with Java: Introduction to Scala and Swing, Hierarchy for Swing and Scala Components, ContainersJFrame, JApplet, JDialog, JPanel, Overview of Some Swing Components, JButton, JLabel, JTextfield, JTextarea, Simple Swing Applications, Layout Management- Layout Manager Types- Border Grid and Flow. Event Handling: Events, Event Sources, Event Classes, Event Listeners, Relationship Between Event Sources and Listeners, Delegation Event Model, Examples: Handling a Button Click, Handling Mouse Events, Adapter Classes.

Textbooks

1.Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.2.Programming Development in Java, BarbaraLiskov, Addison-Wesley

References

1. Data Abstraction and Problem Solving with Java: Walls and Mirrors by Frank M. Carrano and Janet J. Prichard
2. Java for Programming, P.J. Dietel Pearson Education
3. Object Oriented Programming through Java, P. Radha Krishna, and UniversitiesPress.
4. Thinking in Java, Bruce Eckel, Pearson Education
5. Programming in Java, S. Malhotra and S. Choudhary, Oxford University Press

Course Outcomes

On completion of the course students will be able to

1. Write & execute programs using JAVA Programming Language Syntax
2. Use Java API functions to write and execute programs for problem solving.
3. Demonstrate the usage of Java Exception handling mechanisms.
4. Write and execute Java applications using Java String Buffer Class
5. Design Java Applications using JAVA GUI components and test them byexecution.

(A30228) BASIC ELECTRICAL ENGINEERING

B. Tech (AI & ML) III

L	T	P	C
3	0	0	3

SemesterUNIT-1

DC Circuits: Circuit Concept–R-L-C parameters–Voltage and Current sources Ohm's law, Kirchhoff's laws, types of sources, source transformations, V-I relation for passive elements ,series parallel circuits, star- delta and delta –star transformations, mesh and nodal analysis, network theorems –super position, thevenin's, maximum power transfer theorem, simple problems.

UNIT-2

AC Circuits: Representation of sinusoidal waveforms, waveforms and basic definitions, RMS and Average values of the alternating quantity, form factor and peak factor, phasor representation of alternating quantities, the 'j' operator and phasor algebra, Analysis of AC circuits with single basic network elements. Single phase series circuits. Three phase circuits –phase sequence, star and delta connection, relation between line and phase voltage and currents in a balanced system.

UNIT-3

DC Machines:

DC Generators -Principle and operation, constructional details, types, EMF equation, DC Motor- Principle and operation, Principle and operation, types, Torque equation, Losses and Efficiencyin DC Generators and Motors, Speed control of DC Motors

UNIT-4

Transformer:

Single phase transformer-Principle and operation, construction details, Ideal transformer andpractical transformer, equivalent circuit, losses, OC and SC Test, Efficiency and Regulation, simple problems. Three phase transformer-Classification.

UNIT-5

AC Machines:

Three phase induction Motor: Generation of rotating magnetic field, Principle and operation, constructional details, types, Concept of slip, significance of torque slip

characteristic, problemson slip, rotor frequency, rotor EMF and Torque. Principle and operation of Alternator, Singlephase induction motors – Classification.

TEXT BOOKS:

1. Basic concepts of Electrical Engineering, PS Subramanyam, BS Publications.
2. Basic Electrical Engineering, S.N. Singh, PHI.

REFERENCE BOOKS:

1. Basic Electrical Engineering, Abhijit Chakrabarthi, Sudiptanath, Chandrakumar Chanda, Tata-McGraw- Hill.

2. Principles of Electrical Engineering, V. K Mehta, Rohit Mehta, S. Chand Publications.
3. Basic Electrical Engineering, T.K. Nagasarkar and M.S. Sukhija, Oxford University Press.
4. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
5. Basic Electrical Engineering by D.P. Kothari, I.J. Nagrath, McGraw-Hill.

Course Outcomes

On completion of the course, students will be able to

1. Apply Kirchoff 's Laws & network reduction techniques.
2. Explain AC fundamentals of single & three phase circuits,
3. Categorize DC machines, operation and its characteristics, with the help of testsand speed control methods.
4. Acquire the knowledge of operation and performance Analysis of transformers
5. Analyze three phase induction motor operation with their characteristics &acquire the knowledge of alternators and single-phase Induction motors.

****END****

(A30229) BASIC ELECTRICAL ENGINEERING LAB

L	T	P	C
0	0	3	1.5

B. Tech (AI & ML) III

SemesterPART A:

1. Verification of KCL and KVL.
2. Verification of Superposition theorem
3. Verification of Maximum power transfer theorem.
4. Verification of Thevenin ‘s theorem.
5. Time Response of First Order RC/RL Network for periodic, non-sinusoidal inputs- timeconstant andsteady state error determination

PART B:

1. Magnetization characteristics of D.C. Shunt generator.
2. Speed control of DC motor.
3. Swinburne ‘s Test on DC shunt machine.
4. Brake test on DC shunt motor.
5. OC and SC tests on Single-phase transformer.
6. Brake test on 3-phase Induction motor.
7. Load Test on single phase Transformer

Note: Any 10 of the above experiments are to be conducted.

Course Outcomes

On Completion of the course, students will be able to

1. Verify KCL & KVL.
2. Verify different theorems.
3. Analyze time response of RC/RL networks.
4. Acquire the knowledge of different tests conducted on DC machines
5. Acquire the knowledge of performance of single-phase transformers and ThreePhaseInduction Motors

**END*

(A37301) OPERATING SYSTEMS LAB

B. Tech (AI & ML) III Semester

L	T	P	C
0	0	3	1.5

(Software Requirements- Open source Linux/Unix Operating system with vi editor and GNU/gcc compiler.)

Course Objectives:

- To familiarize students with the architecture of OS.
- To provide necessary skills for developing and debugging CPU Scheduling algorithms.
- To elucidate the process management and scheduling and memory management.
- To explain the working of an OS as a resource manager, file system manager, process manager,memory manager, and page replacement tool.
- To provide insights into system calls, file systems, deadlock handling andIPC

List of Experiments

Week-1

1. Demonstrate the Installation & Configuration of Linux Operating Systems.
2.Explorethe following Linux File System commands
i)pwd ii)cd iii)mkdir iv)rmdir v)ls vi)cp vii) mv viii) rm ix) cat x) more xi)grep

Week-2

(Basic Shell Programming-Variables, Special Variables, Arrays, Operators, Decision making statements,Loop statements, Loop Control statements, I/O Redirection)

1.Write a Linux shell script program to create and print the value of variables
2.Write aLinux shell script program to print program name using command line argument
3.Write aLinux shell script program to read two integer numbers and print the sum, difference, product.4.Write a Linux shell script to print multiplication table.

Week -3: Simulate the following CPU Scheduling Algorithmsa). FCFS b). SJF c). Priority d). Round Robin

Week-4: Simulate Banker's Algorithm for Deadlock Avoidance.

Week-5: Simulate Memory Management Technique.
a) Paging b) Segmentation

Week -6: Simulate the following Page Replacement Algorithmsa). FIFO b). LRU c). OPTIMAL
Week -7: Simulate the following File Allocation Strategiesa). Sequential b). Indexed c. Linked
Week-8: Simulate the following disk scheduling algorithmsa). SCAN b). CSCAN c). SSTF
Week -9: Write a C program to simulate the following contiguousmemory allocation techniques
a). First-fit b) Best-fit c) Worst-fit
Week -10: Write programs using the I/O system calls of UNIX/LINUX operating system (open, read,write, close, fcntl, seek, stat, opendir, readdir)

Week 11:

a) Write a C program to simulate producer-consumer problem using semaphores.
b) Write a C program to simulate the concept of Dining-Philosophers problem

Week 12: Write C programs to illustrate the following IPC mechanisms
a) Pipes b) FIFOs c) Message Queues d) SharedMemory

Text Books:

1. Unix Shell Programming,Yashavant Kanetkar, BPB publications
2. Advanced programming in the Unix environment, W.R. Stevens, Pearson education.

Reference Books:

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

Course Outcomes:

Students shall be able to

1. Write shell scripts to automate the tasks
2. Trace different CPU Scheduling algorithm.
3. Implement Bankers Algorithms to Avoid and prevent the Dead Lock
4. Evaluate Page replacement algorithms
5. Illustrate the file organization techniques
6. Implement Inter process communication using shared memory and message queues.

****END****

(A36202) JAVA LAB

(Common to CSE-CS, CSE-AI&ML)

B. Tech (AI & ML) III Semester

L	T	P	C
0	0	3	1.5

Week 1:

1. Write a java program that works as a simple calculator for the +,-,*,/,%operations using classes and objects in java.
2. Write a java program to find result of a given arithmetic expression? (EX: if you given arithmetic expression like 10+20-24*4/2-4.5= it should print7.5)

Week 2:

3. Write a program to demonstrate the following
i) Super, Final ii) Single inheritance iii) Multi –level inheritance
4. Write a program to demonstrate the usage of method overriding, calling super class constructor in derivedclass.

Week 3:

5. Write a java program to create an abstract class named **shape** that contains two integers and an empty method named printarea (). Provide three classes named Rectangle, Triangle and Circle such that each one of these classes extends the class Shape. Each one of the classes contains only the method printarea () that prints the area of the given shape.

Week 4:

6. Write a program to demonstrate method overloading and constructor overloading.
7. Write a program to demonstrate polymorphism using interface (interface in package P1 and class inpackage P2)

Week 5: Exception handling in java

8. Implement pre-defined exceptions
9. Implement user defined exceptions

Week 6:

10. Develop a scala and swing component in java that displays a simple message.
11. 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 Num2 is displayed in the result fields when the division button is clicked. If Num1 or Num2 were not an integer, the program should throw a Number Format Exception. If Num2 were Zero the program should throw an Arithmetic Exception. Display the exception in a message dialog box.

Week 7:

12. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second. if the generated value is even, second thread computes the square of the number and prints. If the generated value is odd, the third thread will print the value of cube of the

Week 8:

13. Write a java program to demonstrate Generic class and generic methods
14. Write a java to perform string operations using sting buffer class and its methods.

Week 9:

15. 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 selected color initially, there is no message shown.

Week 10:

16. 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).

Week 11:

17. Write a java program that connects to a data base using JDBC and does add, delete, modify and retrieve operations.

Week12

18. Implement the week 10 program with database instead of a text file.
19. Write a java program that takes tab separated data (one record per line) from a text file and inserts theminto a database.

Textbooks

1. Java Fundamentals- A Comprehensive introduction, Herbert schildt and Dale skrien, TMH.
2. Programming Development in Java, Barbara Liskov, Addison-Wesley

References

1. Java for programming, P.J. Dietel Pearson education (OR) Java: How to Program P.J. Dietel and H.M. Dietel, PHI
2. Data Abstraction and Problem Solving with Java: Walls and Mirrors by Frank M. Carrano and Janet J. Prichard
3. Object Oriented Programming through java, P. Radha Krishna, Universities Press.
4. Thinking in Java, Bruce Eckel, Pearson Education
5. Programming in Java, S. Malhotra and S. Choudhary, Oxford University Press

Course Outcomes

On completion of the course students will be able to

1. Write & execute programs using JAVA Programming Language Syntax
2. Use Java API functions to write and execute programs for problem solving.
3. Demonstrate the usage of Java Exception handling mechanisms.
4. Write and execute Java applications using Java String Buffer Class
5. Design Java Applications using JAVA GUI components and test them byexecution.

(A30016) GENDER SENSITIZATION

B. Tech (AI & ML) III

L	T	P	C
0	0	2	0

SemesterUNIT-I:

Understanding Gender

Lesson 1 – Gender: Why should we study it?
Lesson 2 – Socialization: Making Women, Making Men
Lesson 12 – Just Relationships: Being together as Equals

UNIT-II:

Gender and Biology

Lesson 4 – Missing Women: Sex selection and its consequences Lesson 10 – Gender Spectrum: Beyond the Binary
Lesson 13 – Additional Reading: Our Bodies, Our Health

UNIT-III:

Gender and Labour

Lesson 3 – Housework: The Invisible Labour
Lesson 7 – Women's Work: Its Politics and Economics

UNIT-IV:

Issues of Violence

Lesson 6 – Sexual Harassment: Say No! Lesson 8 – Domestic Violence: Speaking Out Lesson 11 – Thinking about Sexual Violence

UNIT-V:

Gender Studies

Lesson 5 – Knowledge: Through the Lens of Gender
Lesson 9 – Who's History? Questions for Historians and Others.

COURSE OUTCOMES

Students shall be able to

1. Identify realities of gender discrimination prevalent in the society at all levels.
2. Infer and discuss historical evidences, perspective and voices of discrimination against women in allsocieties and civilizations.
3. Identify, protest and overcome the evils of body shaming.
4. Analyze discrimination and exploitation of women labour in domestic as well as social sphere. Learners infer women's rights, women's wage disparities, women's issues and demonstrate these grievances through law.
5. Identify different types of sexual exploitation; sexual violence and marital violence show empathy towards victims of such violence and generate public opinion in face of any exploitation.

****END****

(A37302) MATHEMATICS FOR MACHINE LEARNING

B. Tech (AI & ML) IV

L	T	P	C
3	0	0	3

SEMUnit-I

Introduction: System of linear equations, Matrices, Solving system of linear equations, vector spaces, linear independence, basis and rank, linear mapping, affine spaces

Analytic Geometry: Norms, Inner products, lengths and distances, angles, and orthogonality, orthonormalbasics, orthogonal complement, inner product of functions, orthogonal projections, rotations.

Unit-II

Matrix Decomposition: Determinant and trace, eigen values and eigen vectors, Choleskydecompositions,Eigendecomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Phylogeny

Vector Calculus: Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series

Unit-III

Probability and Distributions: Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Summary Statistics and Independence, Gaussian Distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization

Model and Data: Data, models and learning, empirical risk minimization, parameter estimation,probabilistic modelling, and inference, directed graphical model, model selection

Unit-IV

Linear Regression: Problem Formulation, Parameter Estimation, Bayesian linear regression, maximumlikelihood as orthogonal projection

Dimensionality Reduction with Principal Component Analysis: Problem setting, Maximum variance perspective, projection perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective

Unit-V

Density Estimation with Gaussian Mixture Models: Gaussian Mixture Model, Parameter Learning viaMaximum Likelihood, EM Algorithm, Latent-Variable Perspective

Classification with Support Vector Machines: Separating Hyperplanes, Primal Support Vector Machine,Dual Support Vector Machine, Kernels, Numerical Solution

TEXTBOOK:

Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning

REFERENCE BOOKS:

1.ML and Ai Academy, Machine Learning Math: A Complete Guide to Machine Learning for

Beginnerswith Tensorflow. This Book Explains How to Build Artificial Intelli

2. Dirk P. Kroese, Zdravko Botev, Thomas Taimre, RadislavVaisman, Data Science and Machine LearningMathematical and Statistical Methods

Course Outcomes

After undergoing this course, the students will be able to:

1. Apply analytical geometrics
2. Solve Vector Calculus, eigen values and vectors
3. Apply probability and distribution and understanding of the data selection.
4. Evaluate linear regression analysis and principal component analysis
5. Apply Density Estimation with Gaussian Mixture Models and Classification with Support VectorMachines

END

(A30509) DATABASE MANAGEMENT SYSTEMS

B. Tech (AI & ML) IV Semester

L	T	P	C
3	1	0	4

Unit-I:

Database System Applications: Database system vs file system, view of data, data abstraction, instances and schemas, data models, the ER model, relational model, other models, database languages, DDL, DML, database users and administrator, transaction management, database system structure, storage manager, the query processor, data base design and ER diagrams, beyond ER design entities, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER Model

Unit-II:

Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical data base design, introduction to views, destroying,altering tables and views.

Form of basic SQL query, examples of basic SQL queries, introduction to nested queries, correlated nested queries, set comparison operators, aggregation operators, NULL values, comparison using null values, logical connectivity's, AND, OR and NOT, impact on SQL constructs, outer joins, disallowing NULL values

Unit-III:

Relational Algebra: Selection and projection, set operations, renaming, Joins, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus. Schema refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, dependency preserving decomposition, schema refinement in database design, multi valued dependencies, FOURTH normal form, FIFTH normal form.

Unit-IV:

Transactions: 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.

Unit-V:

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

Text Books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S.Sudarshan, McGraw-Hill.
2. " Database Management Systems",3rd Edition by Johannes Gehrke and RaghuRamakrishnan, McGraw-Hill.

Reference Books:

1 "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, ComputerScience press.

2 "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson

Education.
3 "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu,Addison-Wesley.

Course Outcomes

On completion of the course students will be able to

1. Explain the significance of Database Management Systems.
2. Write SQL queries to interact with RDBMs.
3. Describe various Normal Forms of Relations.
4. Evaluate various concurrency control protocols
5. Classify Indexing Techniques based on prime attributes.

****END****

(A37303) Artificial Intelligence

B. Tech (AI & ML) IV SEM

L	T	P	C
4	0	0	4

Unit - I

Introduction: Introduction, What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art.

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit - II

Problem-solving : Solving Problems by Searching, Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

Beyond Classical Search : Local Search Algorithms and Optimization Problems: Hill-climbing search

,Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations

Unit - III

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

Game Playing : Adversarial Search, Games, Optimal Decisions in Games, The minimax algorithm, Optimal decisions in multiplayer games, Alpha–Beta Pruning.

Unit - IV

Logic and Knowledge Representation : Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic.

First-Order Logic : Representation Revisited ,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 and Lifting, Forward Chaining, Backward Chaining, Resolution.

Unit - V

Classical Planning:

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

Probabilistic Reasoning:

Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Inference in Bayesian Networks.

TEXTBOOK:

1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig,2010, Pearson Education
2. 2. Natural Language processing and Information Retrieval: U.S. Tiwary, Tanveer Siddique, 1stedition, Oxform University Press.

REFERENCE BOOKS:

1.Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009.
2.Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010.
3.Artificial intelligence, Patrick Henry Winston, 1992, Addition We

Course Outcomes
Students shall be able to

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Solve basic AI based problems.
3. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledgerepresentation, and learning.
4. Apply AI techniques to real-world problems to develop intelligent systems.
5. Select appropriately from a range of techniques when implementing intelligent systems.

END

(A30511) DESIGN AND ANALYSIS OF ALGORITHMS

B. Tech (AI & ML) IV Semester

L	T	P	C
3	1	0	4

Unit-I

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

Unit-II

Fundamental Algorithmic Strategies – I: Divide and Conquer, Greedy, and Dynamic Programming, methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Strassen's Matrix Multiplication, Bin Packing, job sequencing with deadlines, Huffman codes, Knapsack, OBST, Matrix chain multiplication, TSP.

Unit-III

Fundamental Algorithmic Strategies – II: Branch and Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, N-Queens, 0/1 Knapsack, TSP, Sum of sub sets, Graph coloring, Hamiltonian cycle.

Unit-IV

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

Unit-V

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Game tree, min-max search Standard NP-complete problems and Reduction techniques.

Text books:

1. Fundamentals of Algorithms – E. Horowitz et al.
2. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivestand Clifford Stein, MIT Press/McGraw-Hill.

Reference books:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael TGoodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Course Outcomes

On completion of the course students will be able to

1. Explain various asymptotic notations to measures the performance of an algorithm.
2. Discuss algorithms design strategies
3. Apply Graph & Tree algorithms for real world applications
4. Describe various computability Classes
5. Illustrate P & NP –Type Problems

****END****

(A30510) DATABASE MANAGEMENT SYSTEMS LAB

B. Tech (AI & ML) IV Semester

L	T	P	C
0	0	3	1.5

Week-1: Working with DDL, DML, DCL and Key Constraints

(Creation, Altering and Dropping of Tables and Inserting Rows into a Table (Use Constraints While Creating Tables) Examples Using Select Command.)

Week-2: Working with Queries and Nested QUERIES

(Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints)

Week-3: Working with Queries USING Aggregate Operators & views

Queries using Aggregate Functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY,HAVING and Creation and Dropping of Views

Week-4: Working with Conversion Functions & String Functions

Queries using Conversion Functions (to_char, to_number and to_date), String Functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), Date Functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)

Week-5: Working with Triggers using PL/SQL

Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Week-6: Working with PL/SQL Procedures

Programs Development using Creation of Procedures, Passing Parameters IN and OUT of PROCEDURES.

Week-7: Working with LOOPS using PL/SQL and Exception Handling Program Development using WHILE LOOPS, Numeric FOR LOOPS, Nested Loops using ERROR Handling, BUILT-IN Exceptions, USE Defined Exceptions, RAISE- APPLICATION ERROR

Week-8: Working with Functions Using PL/SQL

Program Development using Creation of Stored Functions, Invoke Functions in SQL Statements and Write Complex Function

Week-9: Working with CURSORS

Develop Programs using Features Parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of Clause and CURSOR Variables

Week-10: Working with PL/SQL Packages

Program development using Packages.

Week-11: Case Study-I

Design & Implementation of Library Management System

Week-12: Case Study-II

Design & Implementation of Hospital Management System

Reference books:

1. Oracle PL/SQL by Example, Benjamin Rosenzweig, Elena Silvestrova, PearsonEducation 3rd Edition

2. Oracle Database LogG PL/SQL Programming, Scott Urman, Tata Mc- Graw Hill.
3. SQL and PL/SQL for Oracle 10g, Black Book, Dr .P.S. Deshpande.

Course Outcomes

On completion of the course students will be able to

1. Demonstrate the usage of SQL statements for the creation, manipulation of data in the Database.
2. Write & execute queries on the given Database
3. Write & Execute PL/SQL programs for a given application
4. Develop & Demonstrate the usage of Cursors in PL/SQL
5. Design & Implement a given Enterprise Database

**END*

(A37304) Artificial Intelligence Lab

B. Tech (AI & ML) IV SEM

L	T	P	C
0	0	3	1.5

Note: Use Open-Source Software Tools, Programming Languages (C, Java, or Python etc)to perform the experiments or to implement Algorithms.

List of Experiments:

1. Write a program to implement Water Jug Problem
2. Write a program to solve Tower of Hanoi Problem.
3. Write a program to implement to find goal node in a graph and print the shortest pathusing
   a) DFS or BFS
   b) Uniform Cost search
4. Write a program to find shortest path to reach given node using A* and AO*.
5. Program to Implement Tic-Tac-Toe game using Python.
6. Write a program to find the solution for wampus world problem.
7. Write a Program to Implement Travelling Salesman Problem using heuristic searchapproach.
8. Write a Program to Implement Monkey Banana Problem.
9. Write a Program to Implement Missionaries-Cannibals Problems.
10. Write a Program to implement 8-Queens Problem.
11. Write a Program to Implement simple map coloring problem using CSP
12. Write a Program to Implement Hill Climbing Algorithm.
13. Write a Program to Implement Hill-climbing to solve 8- PuzzleProblem
14. Implementation of Simulated Annealing Algorithm

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and PeterNorvig, 2010, Pearson Education.

REFERENCE BOOKS:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGrawHill, 3rd ed.,2009.
2. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010.
3. Artificial intelligence, Patrick Henry Winston, 1992, Addition We

Course Outcomes:

After completion of the course, students will be able to

1. Implement basic AI algorithms.

2. Implement and apply AI techniques for problem solving using various searchalgorithms.
3. Implement and apply AI techniques for game playing.
4. Formulate real-world problems as state space problems, optimization problems orconstraint satisfaction problems.
5. Select and apply appropriate algorithms and AI techniques to solve complex problems.

END

(A37305) PYTHON PROGRAMMING LAB

(Common to CSE-DS,AI&DS,AI&ML)

L	T	P	C
0	0	3	1.5

B. Tech (AI & ML) IV SEM

Course Objectives:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language.
- To understand the fundamentals of Python programming concepts and its applications.
- To understand the object-oriented concepts using Python in problem solving.

(Software Requirements-Open-source Anaconda IDE for Python programming)

Week 1:

(Python Language Fundamentals-Installation -Identifiers, Reserved Words,Data Types,Type Casting,Immutability, Arithmetic Operators, Relational Operators, Logical operators, Bitwise operators, Assignment operators, Special operators

Experiment-1: Install Anaconda open-source framework for python.
Experiment-2: Write a program to display 'Hello World'.

Experiment-3: Explore various IDEs for python program development.

Experiment-4: The volume of a sphere with radius r is 4/3 πr^3. Write a Python program tofind the volume of a sphere with radius 5?

Experiment-5; Write a python program to find minimum and maximum of given threenumbers.

Experiment-6: Suppose the cover price of a book is $24.95, but bookstores get a 40% discount. Shipping costs $3 for the first copy and 75 cents for each additional copy. Write apython program to compute

the total wholesale cost for 60 copies?.

Experiment-7: Write a Python Program to Find the Square Root of a number with out usingsqrt function.

Experiment-8: Python Program to Convert Celsius To Fahrenheit.

Week 2:

(Mathematical Functions, Input and Output statements, Command Line Arguments, String Functions, Flow Control Statements-Conditional Statements, Transfer Statements, IterativeStatements)

Experiment-1: Write a Python program to find area of circle.

Experiment-2: Write a program to read Employee data from the keyboard and print that data.Experiment-3: Write a program to read 3 float numbers from the keyboard with , separator and print their sum.

Experiment-4: Write a Program to display Command Line Arguments.

Experiment-5. Write a Python program to take a single digit number from the key board andprint is value in English word?.

Experiment-6. Write a Python Program to check whether an n-digit integer is an Armstrongnumber or not.

Experiment-7. Write a Python program to display *'s in pyramid style(also known asequivalent triangle).

Experiment-8. Write a Python Program to Display the multiplication Table.

Week 3:

(Functions-Built in functions,user defined functions,Parameters,return statement,returning multiple values from function,type of arguments,Types of variables-global,local.Recursive functions,Lambda functions,filter function,reduce function,Function aliasing,Function decorators,Generators)

Experiment-1: Write a python function to find factorial of given number?

Experiment-2: Write a program to create a lambda function to find square of given number?Experiment-3: Lambda Function to find biggest of given values.

Experiment-4:Program to filter only even numbers from the list by using filter() function?

Week 4:

(Working with Strings-Defining String, Multi-line Strings,Accessing characters of a string,Mathematical operators for strings, Membership operator, Comparison of Strings, Removing spaces from the string, Finding Substring, String replacement, Splitting of Strings, Changing cases of a string, Formatting the strings)

Experiment-1: Write a program to accept some string from the keyboard and display itscharacters by index wise(both positive and negative index).

Experiment-2: Write a program to access each character of string in forward and backwarddirection by using while loop?

Experiment-3: Program to display all positions of substring in a given main string.Experiment-4: Write a program to reverse the given String.

Week 5:

(Python Data Structures-List:Creating a list-Accessing elements of a List, Traversing the List, List Manipulation, Ordering the elements of a List, Mathematical Operators for List objects, Membership Operator, Nested Lists, List Comprehensions, Python Data Structures- Tuple: Creating a Tuple, Accessing the elements of a tuple, mathematical operators for tuple

,Tuple packing and Unpacking)

Experiment-1:Write a Python program to display unique vowels present in the given word.Experiment-2: Write a Python program to Count the Occurrence of an Item in a List.

Experiment-3: Write a Python program to segregate even and odd numbers from the givenlist of numbers.

Experimnet-4: Write a Python program to find the cumulative sum of elements of the list.Experiment-5: Python program for adding a Tuple to List and Vice-Versa.

Experiment-6: Write a Python program to perform the summation of all elements of eachtuple from the list of tuples.

Experiment-7: Write a Python program to multiply adjacent elements of a tuple. Experiment-8: Write a Python program to find the maximum element in the tuple list.

Week 6:

(Python Data Structures-**Set**: Creating a Set object, functions of set, Mathematical operations on set, Membership Operators,Set Comprehension, **Dictionary:** Creating a Dictionary Object, accessing data from the dictionary, updating dictionaries, Deleting from dictionary, Functions on dictionary, dictionary comprehension)

Experiment-1.Write a Python program to perform set operations.

Experiment-2:Write a program to print different vowels present in the given word? Experiment-3:Write a Python program to generate powers of 2 using set comprehensions. Experiment-4: Write a program to eliminate duplicates present in the list using set Experiment-5: Write a Python program to enter name and percentage marks in a dictionaryand display information on the

console.

Experiment-6: Write a program to take dictionary from the keyboard and print the sum ofvalues?

Experiment-7: Write a program to find number of occurrences of each letter present in thegiven string using dictionary.

Experiment-8: Write a program to accept student name and marks from the keyboard andcreates a dictionary. Also display student marks by taking student name as input?

Week 7:

(Python-File Handling-Types of Files, Opening a file, closing a file, properties of File object, writing data to text file, Reading character data from text files, seek (), tell() functions.Python Modules-Creating Modules, Accessing members, module aliasing, member aliasing, reloading a module,The special variable:_name_. Working with Math, random modules, Python Packages.)

Experiment-1: Write a program to check whether the given file exists or not. If it is availablethen print its content?

Experiment-2: Write a python Program to print the number of lines,words and characterspresent in the

given file?

Experiment-3: Program to read image file and write to a new image file?
Experiment-4: Write a python program to read and write to a

C

SV file.

Experiment-5: Create a module **fibo.py** containing Fibonacci(**n**) function(s) and import fibomodule in a python script to print Fibonacci series upto**n**.

Experiment-6: Write a python program to print all the contents of a given module. Experiment-7: Write a python program to create a package containing two or modules.Experiment-8:Write a python program to import module from a package created in Experiment-3.

Week 8:

(NumPy: Installing NumPy, Ndarray Object, Datatypes, Array Attributes, Array manipulation, Indexing & Slicing, broadcasting)

Experiment-1: Create an array of all the even integers from 10 to 50

Experiment-2: Write a program to multiply two matrices of size (100, 100) in two methods:

(a) by using `np.dot(mat_1, mat_2)` and (b) by using for-loops. Compare the time ofexecution in both the cases.

Experiment-3: find the most frequent value in an array? Experiment-4: Find the nearest value from a given value in an array

Week 9:

(NumPy-Mathematical functions, Arithmetic Operations, statistical functions, MatrixLibrary, Linear Algebra, I/O with Numpy)

Experiment-1:Create a 4X2 integer array and Prints its attributes

Experiment-2:Consider a matrix **M** of size (n,n) . Flatten this into a 1-dimensional arrayand compute mean and standard deviation of **M** in two ways.

1. Apply the element wise operation as defined below:

$$zi=(xi-\mu)/\sigma$$

where xi, μ, σ are elements, mean and standard deviation of flattened matrix **M**

respectively. And z is the output vector.

2. Compute the mean and standard deviation of z and compare them with the mean andstandard deviation of **M** .
Reason about the above comparison

Experiment-3: Print max from axis 0 and min from axis 1 from the 2-D array.

Experiment-4: Create a function which creates an n×n array with (i,j) -entry equal to i+j.

Week 10:

(Python Pandas library: Introduction, Data structures-Series, Dataframe, Panel. Basic pandasfunctions, Descriptive statistics, Reindexing, Iteration, Sorting.)

Experiment-1: create a series from a list, numpy array and dictionary? Experiment-2: convert the index of a series into a column of a dataframe?

Experiment-3: Create two series A and B and get the items of series A not present in series B?

Experiment-4: convert a numpy array to a dataframe of given shape?

Week 11:

(Pandas Statistical functions: Window functions,Aggregate functions, Missing data,Groupby, Merging/Joining)

Experiment-1: Create a dataframe and check if a dataframe has any missing values?Experiment-2: Count the number of missing values in each column?

Experiment-3: Replace missing values of multiple numeric columns with the mean?

Experiment-4: Consider the following data

data= {'Gender':['m','f','f','m','f','m','m'],'Height':[172,171,169,173,170,175,178]};

Splitting the data into separate groups: Male and Female, and find the average Height of eachgroup.

Week 12:

(Python Matplotlib Library:Introduction,Pyplot,Plotting,Markers,Line,Labels,Grid,Subplot,Scatter,Bars,Histograms,Pie Charts)

Experiment-1: Write a Python program to draw a line with suitable label in the x axis, y axisand a title.

Experiment-2: Write a Python programming to display a bar chart of the popularity of Programming Languages. Use different color for each bar.

Programming languages: Java, Python, PHP, JavaScript, C#, C++
Popularity: 22.2, 17.6, 8.8, 8, 7.7, 6.7

Experiment-3: Write a Python programming to create a pie chart with a title of the popularityof programming Languages.

Programming languages: Java, Python, PHP, JavaScript, C#, C++
Popularity: 22.2, 17.6, 8.8, 8, 7.7, 6.7

Experiment-4:

Write a Python program to draw a scatter plot comparing two subject marks of Mathematicsand Science. Use marks of 10 students.

Sample data:

Test Data:

math_marks = [88, 92, 80, 89, 100, 80, 60, 100, 80, 34]

science_marks = [35, 79, 79, 48, 100, 88, 32, 45, 20, 30]

marks_range = [10, 20, 30, 40, 50, 60, 70, 80, 90, 100]

Additional Experiments:

Case Study

Exploratory Data Analysis is an approach in analyzing data sets to summarize their main characteristics, often using statistical graphics and other data visualization methods. EDA assists Data science professionals in various ways:-

1 Getting a better understanding of data
2 Identifying various data patterns

3 Getting a better understanding of the problem statement

Perform EDA on iris data set(https://www.kaggle.com/arshid/iris-flower-dataset)

1. Checking Introductory Details About Data
2. Get the details about various statistical data like Mean, Standard Deviation, Median,Max Value, Min Value.
3. Removing duplicate rows/columns, filling the void entries with values like mean/median of the data, dropping various values, removing null entries.
4. Convert the raw data into a visual form, such as a map or graph, to make data easierfor us to understand and extract useful insights.

Reference Books:

1. Allen B. Downey, “Think Python”, 2nd edition, SPD/O’Reilly, 2016.
2. Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill, 2018.
3. Kenneth A. Lambert, B.L. Juneja, “Fundamentals of Python”, CENGAGE, 2015.
4. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019.

Web links:

1. https://docs.python.org/3/tutorial/modules.html#packages
2. https://www.includehelp.com/python/programs.aspx.
3. https://www.anaconda.com/products/individual
4. https://www.jetbrains.com/pycharm/

Course Outcomes

Students shall be able to:

1. Design solutions to computational problems using Python programming languageconstructs.
2. Write python programs to manipulate string objects.
3. Use appropriate Data structures to organize and manipulate data items. 4.Design modular application using python module & package concepts. 5.Develop application to read and write from various file formats.

*****END*****

(A30021) SOCIAL INNOVATION IN PRACTICE

(Common for all branches)

B. Tech (AI & ML) IV

L	T	P	C
0	0	2	1

SemesterUNIT 1

Identify community issues to be addressed, Requirements Analysis: Extensive Userrequirements analysis, Generating effective System Requirement document.

UNIT 2

Social Innovation – Case Studies

Presentation of the case studies with a focus on impact and vision on society.

UNIT 3

Process of Social Innovation

Prompts – identifying needs, Proposals – generating ideas, Prototyping – testing the idea inpractice,

UNIT 4

Sustaining-developing a business model, Scaling and diffusion-growing social innovations, Systematic change.

UNIT 5

Report writing, Documentation and Panel presentation

Reference Books:

1. Requirements Analysis: From Business Views to Architecture; David C. Hay; PrenticeHall Professional
2. Social Enterprises: An Organizational Perspective edited; Benjamin Gidron,YeheskelH
3. Social Enterprise Law: Trust, Public Benefit and Capital Markets By Dana BrakmanReiser & Steven A. Dean

Course Outcomes:

On Completion of the course, the students will be able to

1. Identify several social issues to be addressed
2. Analyse the impact of social innovations on the society
3. Analyze the process of scoial innovation for a community problem
4. Develop a scalable business model.
5. Analyse the feasibility and economical factors

END

(A30015) SOFT SKILLS & PROFESSIONAL ETHICS

	L	T	P	C
B. Tech (AI & ML) IV	**0**	**0**	**2**	**0**

SemesterUNIT-I:

Business Communication Skills:

English Language Enhancement the Art of Communication.

UNIT-II:

Intrapersonal & Interpersonal Relationship Skills:

- Intrapersonal Relationships
- Interpersonal Relationships – To be an Effective Team Player

UNIT-III:

Campus to Company:

- Corporate Dressing
- Corporate Grooming
- Business Etiquette
- Communication Media Etiquette

UNIT-IV:

Group Discussions, Interviews and Presentations:

- Group Discussions
- Interviews
- Presentations

UNIT-V:

Entrepreneurial Skills Development:

- Goal Setting
- Entrepreneurial Skills – Awareness and Development

REFERENCES

1. UNLEASH the power within Soft Skills – Training Manual (Infosys Campus Connect)

Course Outcomes

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

1. Express themselves with proper pronunciations and sentence construction
2. Demonstrate a strong teamwork and be a team player
3. Develop a strong personal etiquette
4. Demonstrate good leadership qualities
5. Recognize and identify basic English grammar

END

(A36601) MACHINE LEARNING

B. Tech- AI&ML V Semester

L	T	P	C
4	0	0	4

Unit 1:

Introduction: What is machine learning, Examples of machine learning applications: learning association, classification, regression, unsupervised learning, reinforcement learning.
Supervised Learning: Learning a class from examples, Vapnik-Chervonekis (VC) dimension, Noise, Learning multiple classes, regression, Model selection and Generalization, Dimensions of supervised machine learning algorithm.

Unit-2

Bayesian Decision Theory: Introduction, classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules.
Parametric Methods: Introduction, Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, k-NN, SVM, Regression, Tuning Model complexity: Bias/variance Dilemma, Model Selection Procedures.

Unit-3

Dimensionality Reduction: Introduction, Subset Selection, Principle Component Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant analysis.
Clustering: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models. Supervised Learning after Clustering, Hierarchical Clustering. Choosing the Number of Clusters.

Unit-4

Decision Trees: Introduction, Univariate Trees: Classification, Regression, Pruning, Learning Rules from Data, Multivariate Trees.
Linear Discrimination: Introduction, Generalizing the linear model, geometry of the linear discriminant, pairwise separation, Parametric discrimination, Gradient Descent, Logistic Discrimination, Discrimination by regression.

Unit-5

Multilayer Perceptron: Introduction, Perceptron, training a perceptron, Learning Boolean Functions, Multilayer perceptron's, MLP as a universal approximator, Backpropagation algorithm, training procedures.

Combining Multiple Learners: Bagging, Boosting.

Text Books:

1. Ethem Alpaydın, Introduction to Machine Learning, Second Edition, The MIT Press

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.

2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Course Outcomes

After studying this course, students will be able to

1.Explain the supervised learning techniques

2. Use Bayesian decision theorem &parametrice methods on various ML applications

3. Solve higher dimension problems in the data and use of non supervised learning techniques

4. Apply decision tree on various ML applications and use of discriminant analysis

5 Interpret the neural networks and its techniques.

***END**

(A30525) SOFTWARE ENGINEERING

B.Tech -AI&ML V SEM

L	T	P	C
4	0	0	4

Unit-I

Introduction to Software Engineering: The evolving role of software, changing nature of software, A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process. Agile process, Agile process models.

Unit-II

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. System models: Context models, behavioral models, data models, object models, structured methods

Unit-III

Design Engineering: Design process and design quality, design concepts, the design model,
Architectural Design Styles and patterns. Conceptual model of UML, basic structural modeling, use case diagrams, class diagrams, sequence diagrams, collaboration diagrams, component diagram

Unit-IV

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. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

Unit-V

Estimation: observations on estimation, the project planning process, Empirical estimation models. Risk management: Reactive Vs proactive risk strategies, Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, Change Management: software configuration management, The SCM Repository, The SCM Process.

Text Books:

1.Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition,
Mc Graw Hill International Edition.
2.Software Engineering-Sommerville, 7th edition, Pearson Education.
3.The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

References:

1.Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
2.Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3.Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education

Course Outcomes

On completion of the course students will be able to

1. Identify the need to engineer a software system

2. Choose appropriate process model to develop a software system
3. Analyze customer requirements and prepare Software Requirement Specification (SRS)
4. Design software system for the given SRS using appropriate design methodology
5. Perform test planning and test execution for a given system using relevant techniques

.

****END****

(A36606) COMPUTER VISION

B.Tech AI&ML V SEM

L	T	P	C
4	0	0	4

UNIT-I

Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing. Image Formation Concepts.

Fundamentals of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models. Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.

UNIT–II

Image Processing Concepts: Sampling and Quantization, Image Enhancement: Intensity transformations, contrast stretching, histogram equalization, Spatial filtering: Smoothing filters, sharpening filters, Frequency domain filtering,

Color Image Processing: Color Fundamentals and Color models-The RGB Color Model, The CMY and CMYK Color Models.

UNIT–III

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Basic Morphological Algorithms: Hole filling, connected components, Thinning and skeletons.

Image Segmentation:

Edge detection, thresholding, Region growing, segmentation by clustering, Watershed algorithm, Active contour models, Texture feature based segmentation.

UNIT-IV

Feature Extraction:

First and second order edge detection operators, Localized feature Extraction, detecting Image curvature, shape features, Describing Neighborhood using SIFT and HOG feat ures, Introduction to Hough Transform, shape skeletonization, Boundary detection.

Object Tracking: Exhaustive vs. Stochastic Search, Shapes, Contours, and Appearance Models. Mean-shift tracking; Contour-based models descriptors, Moments, Texture descriptors.

UNIT–V

Object Modeling & Detection:

Fundamental matrix / Epipolar geometry, Adaboost approaches: Face Detection / Recognition Large Datasets; Attention models. Applications: physical rehabilitation and training, human-machine interaction, Surveillance, Object detection, etc.

Text Books:

1. David Forsyth and Jean Ponce, Computer Vision: A modern Approach, Prentice Hall India 2004:
2. "Digital Image Processing", Rafael C.Gonzalez, Richard E. Woods, etl , TMH , 2nd Edition 2010

Reference Books:

1. E.R. Davies, Machine Vision, Theory Algorithms Practicalities, Elsevier 2005
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision. Brooks/Cole / Thomson 1999

3. Russell and Norvig: AI: A modern Approach, Prentice Hall 2000.

Course Outcomes Students shall be able to

1. Explain Sampling, Quantization, echniques
2. Discuss Sampling and Quantization, Image Enhancement
3. Discuss image segmentation and image morphology.
4. Describe feature Extraction and perform object tracking.
5. Perform Object modeling & detection.

(A30519) COMPILER DESIGN

B.Tech. AIML V Sem.

L	T	P	C
3	0	0	3

Prerequisites

1. A course on "Formal Languages and Automata Theory".
2. A course on "Computer Organization and architecture".
3. A course on "Computer Programming and Data Structures".

Course Objectives:

- Introduce the major concepts of language translation and compiler design and impart the knowledge of practical skills necessary for constructing a compiler.
- Topics include phases of compiler, parsing, syntax directd translation, type checking use of symbol tables, code optimization techniques, intermediate code generation, code generation and data flow analysis.

Course Outcomes:

- Demonstrate the ability to design a compiler given a set of language features.
- Demonstrate the the knowledge of patterns, tokens & regular expressions for lexical analysis.
- Acquire skills in using lex tool & yacc tool for devleoping a scanner and parser.
- Design and implement LL and LR parsers
- Design algorithms to do code optimization in order to improve the performance of a program in terms of space and time complexity.
- Design algorithms to generate machine code.

UNIT – I

Introduction: The structure of a compiler, the science of building a compiler, programming language basics
Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of a Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers.

UNIT - II

Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators.

UNIT - III

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's.
Intermediate-Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.

UNIT - IV

Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection.

Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation

UNIT - V

Machine-Independent Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs.

TEXT BOOK:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman.

REFERENCE BOOKS:

1. Lex & Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Compiler Construction, Louden, Thomson.

(A30528) DATA WAREHOUSING AND DATA MINING
(PROFESSIONAL ELECTIVE-I)

B. Tech CSE(AI&ML) V Sem

L	T	P	C
3	0	0	3

UNIT -I

Data Warehousing: Introduction to Data warehouse, differences between operational Database Systems and warehouses, Data Warehouse Architecture and its components , Data Warehouse Characteristics, ETL, Multi-Dimensional data model, Schema Design-Star-Snowflake-Galaxy Schema, Fact Table, Types of fact tables, Dimension Table characteristics, OLAP Cube and Operations, OLAP Server Architecture-ROLAP,MOLAP,HOLAP.

UNIT –II

Introduction to Data Mining: Introduction, what is data mining, Definition, KDD process, issues in Data Mining, Data mining Tasks.

Data Preprocessing: Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Data transformation, Discretization, Concepts Hierarchy Generation, Measures of Similarity and Dissimilarity-Basics

UNIT –III

Association Rule Mining: Problem Definition, Frequent Item Set Generation, The Apriori principle, Support and Confidence measure, Association Rules Generation: Apriori Algorithm, FP-Growth Algorithms, Compact Representation of Frequent Item Set (Maximal and Closed Frequent Item sets).

UNIT –IV

Classification: Problem definition, General approaches to solve Classification problems, Evaluation of a Classifier, Classification techniques, Decision Tree -Decision tree construction, Methods for Expressing attribute test condition, Measures for selecting the Best Split, Algorithm for Decision tree Induction, Naive Bayes Classifiers, Bayesian Belief Networks, K -Nearest neighbor classification algorithm & characteristics.

UNIT –V

Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, K-Means Clustering, K-Means additional Issues, PAM Algorithm, Hierarchical Clustering Agglomerative methods and divisive methods, Basic Agglomerative Hierarchical clustering algorithms, Specific techniques, Key issues in Hierarchical Clustering, Strengths and Weakness, Outlier Detection

Text Books:

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber Harcourt India.

2. Introduction to Data Mining –Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education

Reference Books:

1. Data Mining Techniques – Arun K Pujari, University Press.

2. Data Warehousing in the Real World – Sam Anahory& Dennis Murray. Pearson Edn Asia.

3. Data Warehousing Fundamentals – PaulrajPonnaiah Wiley Student Edition

Course Outcomes

1. Explain why the data warehouse in addition to database systems.

2. Perform the pre-processing of data and apply mining techniques on it.

3. Identify the association rules, classification and clusters in large data sets.

4. Solve real world problems in business and scientific information using data mining.

5.Compare and Contrast various Clustering Algorithms.

****END****

(A36613)Advanced Python Programming
(PROFESSIONAL ELECTIVE-I)

L	T	P	C
3	0	0	3

B.Tech CSE(AI&ML) V Sem

Unit-1

Python Fundamentals: Python Character Set ,Python Tokens, Keywords, Identifiers, Literals, Operators Variables and Assignments, Input and Output in Python, Program control flow, functions, modules, packages, class and objects ,Object oriented Programming.

File Operations: Text and Bytes files, Opening a file, Reading and Writing Files, Other File tools, Ms-Excel,

Unit-2

Basic numerical processing using Python: Introduction to numpy , Creation of vectors and matrices , Matrix manipulation Indexing and Slicing

Basic data analysis using Python: Introduction to Pandas , Pandas data structures – Series and DataFrame , Data wrangling using pandas , Loading a dataset into a dataframe , Selecting Columns from a dataframe, Selecting Rows from a dataframe , Adding new data in a dataframe ,Deleting data from a dataframe.

Unit-3

SCIPY: Introduction to SciPy, Create function, modules of SciPy, Introduction to NLTK Library in Python.

MATPLOTLIB: Scatter plot,Bar charts, histogram,Stack charts, Legend title Style, Figures and subplots, Plotting function in pandas,Labelling and arranging figures,Save plots .

Unit-4

Database programming using Python:Connecting to a database (mysql) using Python ,Sending DML and DDL queries and processing the result from a Python.
Introduction to Flask, Basic application structure, templates, webforms.

Unit-5

GUI programming: Installing PyQT, Introduction, pop-up alert, dialogues: dumb dialogues, standard dialogs, smart dialogs, main window, handling user actions, Using Qt designer, data handling and custom file formats, Layouts and multiple documents, events, clipboard, drag and drop, custom widget, item-based graphics, rich text and printing. Creating an application for concurrency converter.

Web scraping: Installing beautiful soup, running beautiful soup, Scraping Webpages

Text Books:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs,2011, CengageLearning.
2. Think Python First Edition, by Allen B. Downey, Oriellypublishing
3. Web Scraping with Python by Ryan Mitchell, Published by O'Reilly Media

Reference Books:

1. Introduction to Computation and Programming Using Python. JohnV. Guttag, The MIT Press.
2. James Payne, Beginning Python using Python 2.6 and Python 3,Wrox publishing
3. Paul Gries, Practical Programming: An Introduction to ComputerScience using Python 3, The Pragmatic Bookshelf, 2ndedition
4. Flask Web Development by Miguel Grinberg by O Reilly

(A36615) HIGH PERFORMANCE COMPUTING
(PROFESSIONAL ELECTIVE-I)

B.Tech CSE(AI&ML) V Sem

L	T	P	C
3	0	0	3

Unit-I

History, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming, CUDA OpenCL / OpenACC, Kernels Launch parameters, Thread hierarchy, Warps/Wavefronts, Threadblocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple Programs.

Unit-II

Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

Unit-III

Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU

Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

Unit-IV:

Debugging GPU Programs. Profiling, Profile tools, Performance aspects

Streams: Asynchronous processing, tasks, Task-dependence, overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Unit-V:

Case Studies

Image Processing, Graph algorithms, Simulations, Deep Learning Dynamic parallelism, Unified Virtual Memory, Multi-GPU, processing, Peer access, Heterogeneous processing

Textbooks

1. David Kirk and Wen-mei Hwu, Programming Massively Parallel Processors: A Hands-On Approach, 2nd Edition, Publisher: Morgan Kaufman, 2012, ISBN: 9780124159921.

2. Shane Cook, CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Course outcomes

1. Define terminology commonly used in parallel computing, such as efficiency and speedup.
2. Describe common GPU architectures and programming models.
3. Implement efficient algorithms for common application kernels, such as matrix multiplication.
4. Given a problem, develop an efficient parallel algorithm to solve it.

5. Given a problem, implement an efficient and correct code to solve it, analyze its performance, and give convincing written and oral presentations explaining the achievements.

(A36602) MACHINE LEARNING LAB

B.Tech- AI&ML V Sem

L	T	P	C
0	0	3	1.5

LAB EXPERIMENTS

Note: Use Open-Source Software Tools, Programming Languages (Java, Python.R. etc) to perform the experiments or to implement the Machine Learning Algorithms.

1. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
2. Write a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
4. Write a program to implement Support Vector Machine algorithm to classify the iris data set. Print both correct and wrong predictions.
5. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
6. Apply Hierarchical Clustering algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
9. Write a program to implement AdaBoost algorithm to classify the iris data set. Print both correct and wrong predictions.
10. Perform model aggregation on MNIST digit dataset.

Text Books:

1. Ethem Alpaydın, Introduction to Machine Learning, Second Edition, The MIT Press

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Course Outcomes

The student will be able to

1. Develop machine learning models on point data using Naïve bayes, SVM, decision tree, and k-NN.
2. Compare and contrast the EM and k-Means clustering algorithm
3. Construct the ML models using hierarchical clustering.
4. Develop neural networks and apply back propagation
5. Develop ensemble techniques for the prediction of problem.

****END****

(A36607) COMPUTER VISION LAB

B.Tech -AI&ML V SEM **LAB EXPERIMENTS**

L	T	P	C
0	0	3	1.5

Note: Use any tool like OpenCV/ Scilab

1. Write programs for the following

   a) Loading and displaying an image.
   b) Reading and writing video files.
   c) Image enhancement.
2. Write a code for basic Statistical Analysis of Images(To find sum , average , standard deviation , min and max)
3. Write a program study contrast adjustment of a given image
4. Write a code to apply Different Filtering Operations on Images.
5. Write a code to apply morphological operations like dilation, erosion, opening and closing on the given image.
6. Write a code for detection of an edge / curvature in a given image and curve fitting
7. Write a code to implement SURF / SIFT / HOG detector
8. Implement histogram calculation and equalization for the given image.
9. Write a code to perform 2-D spatial transformation to image
10. Convert the input image from RGB color space to CMY and HSV color space.
11. Write a code for feature Extraction from Images.
12. Write a code for basic Shape Analysis of an image.
13. Write a program to reduce dimensionality using PCA for the given images.
14. Write a code for object detection using Hough transform / Template matching.
15. Object classification using SVM / Adaboost classifier .
16. Object tracking using Kalman filter approach.
17. Face Detection Algorithm Implementation.

Text Books:

1. David Forsyth and Jean Ponce, Computer Vision: A modern Approach, Prentice Hall India 2004:

2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2008

Reference Books:

1. E.R. Davies, Machine Vision, Theory Algorithms Practicalities, Elsevier 2005

2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision. Brooks/Cole / Thomson 1999

3. Russell and Norvig: AI: A modern Approach, Prentice Hall 2000.

4. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge Univ Press 2000

Course Outcomes:

After completion of the course, students will be able to

1. Understand fundamental image processing techniques required for computer vision.
2. Employ various image enhancement and edge detection techniques.
3. Extract features using Histogram Processing, Color.
4. Apply basic segmentation, morphological operations and Hough transformation.
5. Evaluate various pattern classification techniques.

END

(A30003) ADVANCED ENGLISH COMMUNICATION SKILLS LAB

B. Tech AI&ML V Sem

L	T	P	C
0	0	3	1.5

INTRODUCTION

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

UNIT-I

Functional English: Starting a conversation, responding appropriately and relevantly, using the right body anguage, Role play in Different Situations.

UNIT-II

Vocabulary Building: Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrasal verbs.

UNIT-III

Group Discussion: Dynamics of group discussion, intervention, summarizing, modulation of voice, body languagea, relevance, fluency and coherence.

UNIT-IV

Interview Skills: Concept and process, pre-interview planning, opening strategies, answering strategies, Interview through tale and video- conferencing.

UNIT-V:

Resume` and Technical Report Writing: Structure and presentation, planning, defining the career objective, projecting one's strengths and skill-sets, summary, formats and styles, Letter-writing.

Reading Comprehension: Reading for facts, guessing meanings from context, scanning, skimming, inferring meaning and critical reading.

COURSE OUTCOMES

Students shall be able to:

1. Explain the rules of formal and informal situational dialogues and develop verbal & non-verbal communication skills.
2. Build academic vocabulary; use a variety of accurate sentence structures and utilize digital literacy tools to develop writing and grammar skills.

3. Express thoughts with clarity and hold discussions with everyone to develop analytical thinking.

4. Develop the skills required for attending different types of interviews.

5. Illustrate the report writing and summarize the main ideas of report; apply key elements of structure and style in drafting loner documents and read an increasing range of text.

(A30017) INDIAN CONSTITUTION

(MANDATORY COURSE)

B. Tech AI&ML V Sem

L	T	P	C
2	0	0	0

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution- Sources and constitutional history, Features- Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions; State Government and its Administration Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions

UNIT-III

A: Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation,

B:Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-IV

Concept and Development of Human Rights: Meaning Scope and Development of Human Rights, United Nations and Human Rights – UNHCR, UDHR 1948, ICCPR 1996 and ICESCR 1966, Human Rights in India: Protection of Human Rights Act, 1993 (NHRC and SHRC), First, Second and Third Generation Human Rights, Judicial Activism and Human Rights.

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

TEXT BOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd. NewDelhi
2. SubashKashyap, Indian Constitution, National BookTrust
3. J.A. Siwach, Dynamics of Indian Government &Politics
4. D.C. Gupta, Indian Government andPolitics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and PoliticsHans

E-Resources:

1. nptel.ac.in/courses/109104074/8

2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes:

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

1. Know the sources, features and principles of Indian Constitution.
2. Learn about Union Government, State government and itsadministration.
3. Get acquainted with Local administration and Pachayati Raj.
4. Be aware of basic concepts and developments of HumanRights.
5. Gain knowledge on roles and functioning of ElectionCommission.

****END****

(A30018) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (MANDATORY COURSE)

B. Tech AI&ML V Sem

L	T	P	C
2	0	0	0

UNIT I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNIT II

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

UNIT III

Legal frame work and TK:

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);

B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

UNIT IV

Traditional knowledge and intellectual property:

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

TEXT BOOKS

1. Traditional Knowledge System in India, by Amit Jha,2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002

E-RESOURCES

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

Course Outcomes

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

1. Understand the concept of Traditional knowledge and its importance.

2. Know the need and importance of protecting traditionalknowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge
5. Compare and contrast the basics of Indian Traditional knowledge with modern scientific perspectivies.

(A36608) Deep Learning

B. Tech.(AI&ML) VI-Semester

L	T	P	C
3	0	0	3

Unit-I

Introduction: History, AI vs ML vs DL, Deep Learning and its Applications, Prerequisites: Linear Algebra and Machine Learning – Revisited: Matrix types, derivative, transformation, inverse, determinants, statistics: mean, median, mode, probability: Bayes theorem, Eigen Decomposition, Singular Value Decomposition; conditional probability, the chain rule of conditional probability, expectation, variance and covariance, common probability distributions, baye's rule, overflow and underflow, Gradient-based optimization, constrained optimization

Unit-II

Basics of Machine Learning: features, weights, Linear Regression, Logistic Regressions, loss function, cost function, Multilayer perceptron, forward propagation; Model Training: Backpropagation, Stochastic Gradient Descent and Optimizers: Momentum, RMSProp, Adam; Deep Learning Experiments: Datasets, training-validation testing set, evaluation measures: accuracy, precision, recall, f-measure.

Unit-III

Model Improvement: Overfitting vs underfitting, Bias vs Variance, hyper parameter tuning: random, coarse to fine; Regularization: L1, L2 regularization, Dropout, Early stopping, Data normalization, Augmentation; Convolutional Neural Networks: convolution, striding, padding, pooling, 1x1 convolution, famous CNN models; CNN Applications: Transfer Learning, Image classification, face detection, object detection, face/instance recognition.

Unit-IV

Recurrent Neural Networks: Time-series data analysis, forward propagation, Backpropagation Through Time (BPTT), word embedding, Vanishing-exploding gradients, LSTM, GRU; RNN Application: Sentiment analysis, text generation, image captioning, machine translation, attention model, speech recognition, video classification; Unsupervised Learning: Sparse Coding, Auto-encoder, Denoising Autoencoder; AE Applications: Data compression, retrieval, classification, document clustering, sentiment analysis.

Unit-V

Generative Learning: Variational Auto-encoders, Generative Adversarial Neural Networks; GL Applications: Image generation, font generation, anime face/celebrity face generation, video generation; Reinforcement Learning: Markov decision Processing, Deep Q Learning, Model optimization for Deployment: Pruning, sparse decomposition, quantization and binarization, Transferred or Compact Convolutional Filters.

Textbook

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, Deep Learning (1 ed.), MIT Press, 2017. ISBN 978-0262035613. St

Reference Textbook

1. Charu C. Aggarwal, Neural Networks and Deep Learning (1 ed.), Springer International Publishing AG, part of Springer Nature, 2018. ISBN 978-3319944623.

Course Outcome

Students are able to

1. Apply the linear algebra applications in machine learning and deep learning applications
2. Understanding the Model selection and training protocols, loss functions and error optimization
3. Investigate Deep CNN and transfer learning approach for classification, and object detection.
4.
5. and time series analysis.
6. Applying adversarial neural networks and understanding the reinforcement learning

END

(A36612) Natural Language Processing
(Common to CSM & AIM)

B. Tech. AI&ML VI-Sem

L	T	P	C
3	0	0	3

UNIT- I

Overview: Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval.

Language Modeling: Introduction, Various Grammar-based Language Models, Statistical Language Model.

UNIT- II

Information Retrieval: Introduction, Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, Evaluation

Lexical Resources: Introduction, WordNet, Frame Net, Stemmers, POS Tagger, Research Corpora

UNIT- III

Word Level Analysis: Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part of Speech Tagging, TF, IDF.

Syntactic Analysis: Introduction, Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.

UNIT -IV

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure

UNIT- V

Natural Language Generation: Introduction, Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG.

Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages

Text Book

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

References

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition,2008.

2. James Allen, Bejamin/cummings, "Natural Language Understanding", 2nd edition,1995

END

(A30514) COMPUTER NETWORKS

(common to CSM & AIM)

B.Tech AI&ML VI SEM

L	T	P	C
3	0	0	3

UNIT -I

Introduction: Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

UNIT –II

Data link layer: Design issues, framing, Error detection and correction. **Elementary data link protocols**: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.

Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.

Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

UNIT –III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT –IV

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT -V

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

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.

Course Outcomes:

The student shall be able

1. Describe the functions of each layer in OSI and TCP/IP model and explain the types of transmission media with real time applications
2. Describe the functions of data link layer and explain the protocols
3. Classify the routing protocols and analyze how to assign the IP addresses for the given network
4. Describe the Transport layer services.
5. Explain the functions of Application layer Protocols.

****END****

(A36610) Internet Technologies

(PROFESSIONAL ELECTIVE-II)

L	T	P	C
3	0	0	3

B. Tech.(AI&ML) VI-Semester

UNIT -I

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, reading data from web form controls like text boxes, radio buttons, lists etc.,Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies. File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

UNIT –II

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

UNIT –III

Introduction to Servlets: Common Gateway Interface (CGI), 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.

UNIT –IV

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.

UNIT –V

Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions. event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.

Text Books:

1. Web Technologies, Uttam K Roy, Oxford UniversityPress

2. The Complete Reference PHP — Steven Holzner, TataMcGraw-Hill

Reference Books:

1. Web Programming, building internet applications, Chris Bates, 2ndEdition, Wiley Dreamtech

2. Java Server Pages, Hans Bergsten, SPDO'Reilly,

3. Java Script, D. Flanagan, 6th Edition, O'Reilly Media.

4. Beginning Web Programming-Jon Duckett WROX.

5. Programming world wide web, R.W. Sebesta, 4th Edition,Pearson.

6. Internet and World Wide Web — How to program, Dietel and Nieto,Pearson

Course Outcomes Students shall be able to

1. write client-side scripting ,perform validation of forms using AJAX
2. write server-side scripting with PHP language
3. Describe XML parse and use XML Data with Java
4. Create Server-side programming with Java Servlets and JSP
5. Develop Client-side Scripting with Java script and form validation Course Outcomes

(A37307) RANDOMIZED ALGORITHMS
(Professional Elective – II)

B. Tech.(AI&ML) VI-Semester **L T P C**

3 0 0 3

Course Objective: To introduce the power of randomization in the design and analysis of algorithms.

Course Outcomes:

1. Appreciate the fundamentals of randomized algorithm design.
2. Understand the fundamentals of Markov chains and the Monte Carlo method.
3. Apply high probability analysis to selected randomized algorithms.
4. Understand the Comparison of Fingerprinting Techniques and Pattern Matching

UNIT - I

Introduction, A Min – Cut algorithm, Las Vegas and Monte Carlo, Binary Planar Partitions, A Probabilistic Recurrence. Game – Theoretic Techniques: Game Tree Evaluation, The Minimax Principle

UNIT - II

Moments and Deviations: Occupancy Problems, The Markov and Chebyshev Inequalities, Randomized Selection. Markov Chains and Random Walks: A 2-SAT example, Markov Chains, Random Walks on Graphs, Graph Connectivity

UNIT - III

Algebraic Techniques: Fingerprinting and Freivald's Technique, Verifying Polynomial Identities, Perfect Matching in Graphs, Verifying Equality of Strings, A Comparison of Fingerprinting Techniques, PatternMatching

UNIT - IV

Data Structures: The Fundamental Data-structuring Problem, Random Treaps, Skip Lists, Hashtables, Hashing with O(1) Search Time. Graph Algorithms: All Pairs Shortest Paths, The Min- Cut Problem, Minimum Spanning Trees

UNIT - V

Geometric Algorithms: Randomized Incremental Construction, Convex Hulls in the Plane, Duality, Half- Space Intersections, Dalaunay Triangulations, Trapezoidal Decompositions. Parallel and Distributed Algorithms: The PRAM Model, Sorting on a PRAM, Maximal Independent Sets, Perfect Matchings

TEXT BOOKS:

1. Randomized Algorithms: Rajeev Motwani, Prabhakar Raghavan.
2. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms andData Analysis by Eli Upfal and Michael Mitzenmacher.

REFERENCE BOOK:

1. Rajeev Motwani, Prabhakar Raghavan, Randomized Algorithms, Cam bridge University Press.

(A36623) Reinforcement Learning

L	T	P	C
3	0	0	3

(Professional Elective – II)

B. Tech.(AI&ML) VI-Semester

UNIT-I

Introduction to RL: Course logistics and overview, Introduction to Reinforcement Learning (RL), Origin and history of RL research, RL and its connections with otherML branches. Linear algebra overview, Probability overview, Sequential Decision Making, Modelling the world, Components of a reinforcement learning agent,Taxonomy of reinforcement learning agents. Introduction to Instance based learning.

UNIT-II

Markov Decision Processes and Bandit Algorithms, Policy Gradient Methods & Introduction to Full RL, Reinforcement Learning Problems, MDP Formulation,Bellman Equations & Optimality Proofs, Markov Processes, Markov Reward Processes, Markov Decision Processes, Bellman Equation, Bandit Algorithms (UCB,PAC, Median Elimination, Policy Gradient), Contextual Bandits.

UNIT-III

Dynamic Programming and Temporal Difference Methods, DQN, Fitted Q & Policy Gradient Approaches, Introduction to Dynamic Programming, Policy Evaluation(Prediction), Policy Improvement, Policy Iteration, Hierarchical Reinforcement Learning, Value Iteration, Generalized Policy Iteration, Hierarchical RL: MAXQ,Asynchronous Dynamic Programming, Efficiency of Dynamic Programming, Temporal Difference Prediction, Why TD Prediction Methods, On-Policy and Off-PolicyLearning, Q-learning, Reinforcement Learning in Continuous Spaces, SARSA.

UNIT-IV

Value Function, Bellman Equation, Value Iteration, and Policy Gradient Methods, Value Function, Bellman Equations, Optimal Value Functions, Bellman OptimalityEquation, Optimality and Approximation, Value Iteration, Introduction to Policy-based Reinforcement Learning: Policy Gradient, Monte Carlo Policy Gradients,Generalized Advantage Estimation (GAE), Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control withoutExploring Starts, Incremental Implementation, Policy optimization methods (Trust Region Policy Optimization (TRPO) and Proximal Policy, Optimization (PPO).

UNIT-V

Deep Reinforcement Learning - Masters Atari Games-Markov Decision Processes-Policy Versus ValueLearning, Pole-Cart with Policy Gradients-Q-Learning and Deep RecurrentvQ-Networks.Applications in Object Recognition and Computer Vision

TEXTBOOKS

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction (2 ed.), MIT Press, 2017. ISBN 978-0262039246.
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective (1 ed.), MIT Press, 2012. ISBN 978-0262018029.

REFERENCE BOOKS

3. Dimitri Bertsikas and John G. Tsitsiklis, Neuro Dynamic Programming, Athena Scientific (1 ed.), Athena Scientific, 1996. ISBN 978-1886529106.
4. Mohit Sewak, Deep Reinforcement learning: Frontiers of Artificial Intelligence (1 ed.), Springer, 2019. ISBN 978-9811382840.
5. Sugiyama, Masashi, Statistical reinforcement learning: modern machine learning approaches (1 ed.), Chapman and Hall/CRC, 2015. ISBN 978-1439856895

(A30013) BUSINESS MANAGEMENT & FINANCIAL ANALYSIS

	L	T	P	C
B. Tech AI&ML VI Sem	**4**	**0**	**0**	**4**

UNIT – I Introduction of Management Concepts: Concept, Origin, Growth, Nature, Characteristics, Scope and Principles of Management. Functions of Management: Planning, Organizing, Staffing, Directing, Coordinating, Reporting and Budgeting. Scientific Management- FW Taylor Contributions to Management Modern Management- Henry Fayol Contributions to Management Human Relations Approach to Management: Theories of Motivation and Leadership

UNIT – I Functional areas of Management: Production Management: Systems of Production, PPC functions & Plant Layout. Financial Management: Objectives, Goals, & Functions of Financial Management. Marketing Management: Recent Trends in Marketing & Marketing Mix. Human Resources Management: Nature, Objectives, Scope & Functions of HR Management

UNIT – III Introduction to Managerial Economics & Business Environment: Definition, Nature, Scope and Functions Managerial Economics, Difference between Micro & Macro Economics Internal & External Scanning of Business Environment, Importance of National Income, Inflation, Deflation, Stagflation, Business Cycle & Product Life Cycle Concepts. Concept & Law of Demand, Factors Influencing and Limitations. Concept of Elasticity of Demand, Types of Elasticity, Methods of Measuring Elasticity. Introduction to Demand Forecasting, Objectives, Scope, Types and Methods.

UNIT –IV Theory of Production, Cost, Price & Markets: Production Function, Assumptions, Limitations & Types Cost Concepts, Cost-Output Relationship, Break Even Analysis Assumptions, Limitations & Applications (Simple Problems). Theory of Pricing, Objectives, Situations & Types. Introductions Markets, Demand-Supply Schedule for Equilibrium Price, Nature & Types of Competition.

UNIT – V Introduction to Financial Statement Analysis: Types & Objectives of Business Enterprises, Conventional & Non-Conventional Sources of Financing Business Enterprise. Identification of Financial Statement Formats-Manufacturing A/c, Trading A/c, Profit & Loss A/c, Balance Sheet. Techniques of Analyzing Financial Statements: Analysis & Interpretation through Liquidity, Leverage, Coverage, Activity, Turnover, Profitability Ratios-Simple Problems on Liquidity, Leverage and Activity Ratios

Course Outcomes:

At the end of the course, the student will,

1. Float different forms of business enterprises and generate capital from various sources.

2. Analyze financial stability of an enterprise in view of cut-throat competition from rivals.

3. Tune Enterprise in accordance with changes in surround economic environment.

4. Forecast demand, production, cost, capital, price under different market situations for variousproducts of business enterprise in general.

5. Employ various functions of management in different functional areas of enterprise.

6. Review, Monitor & Control Managerial & Financial performance of an enterprise under currentEconomic constraints.

Text Books:

1.Varshney, Maheswari (2003), Managerial Economics, Sultan Chand, New Delhi, India.

2. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004.

Reference Books:

1. Kotler Philip & Keller Kevin Lane: Marketing Mangement 12/e, PHI, 2005

2. Koontz &Weihrich: Essentials of Management, 6/e, TMH, 2005 Thomas N. Duening& John M. Ivancevich Management—Principles and Guidelines, Biztantra, 2003.

3. Ambrish Gupta (2004), Financial Accounting for Management, Pearson Education, New Delhi, India.

4. Domnick Salvatore (2011), Managerial Economics in a Global Economy, 7th edition, Oxford University Press, United States of America.

5. Narayanaswamy (2005), Financial Accounting, A Managerial Perspective, Prentice Hall of India private Ltd, New Delhi, India.

6. Aryasri (2005), Managerial Economics and Financial Analysis, 2nd edition, Tata McGraw Hill, New Delhi, India

****END****

(A36609) Deep Learning Lab

B. Tech.(AI&ML) VI-Semester

L	T	P	C
0	0	3	1.5

Week 1: Consider a neural network that takes two inputs, has one hidden layer with two nodes, and an output layer with one node. Let's start by randomly initializing the weights and the biases in the network. print the weights and biases.

Week 2: Consider the week 1 network and compute the following

- The weighted sum.
- Assuming a sigmoid activation function, let's compute the activation of the first node.
- compute the activation of the second node
- compute the weighted sum of these inputs to the node in the output layer
- compute the output of the network as the activation of the node in the output layer

Week 3: Initialize a network with the following specification

- Takes 5 inputs
- has three hidden layers
- has 3 nodes in the first layer, 2 nodes in the second layer, and 3 nodes in the third layer
- has 1 node in the output layer

Print the network and its nodes

Week 4: Consider the Week 3 network and do the following

- Change the activation of the network from sigmoid to tanh and observe the performance of the network
- Compute the activation of every node in first hidden node
- Compute the activation of every node in second hidden node
- Compute the activation of every node in third hidden node

Week 5: Consider the Week 3 network and do the following

- Change the activation of the network from tanh to relu and observe the performance of the network
- Compute the activation of every node in first hidden node
- Compute the activation of every node in second hidden node
- Compute the activation of every node in third hidden node

Week 6:

Construct convolution neural network and perform the classification using MNIST dataset using K10 cross validation.

Week 7:

consider the network and dataset from week 6 visualize the hidden layers features. Compute the confusion matrix.

Week 8:

Construct CNN model with 7 layers and compute the performance of the model using Cats and Dogs dataset with K5 cross validation.

Week 9:

Construct AlexNet on MNIST dataset compute the performance evaluation matrices.

Week 10:

Construct VGG16 network, transfer the pre trained weights from Imagenet for classification of the cats and dogs.

Week 11:

Construct RNN network for MNIST dataset. Evaluate all performance metrices

Week 12:

Construct LSTM network for dogs and cats dataset, Evaluate all performance metrices.

Text book

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, Deep Learning (1 ed.), MIT Press, 2017. ISBN 978-0262035613.

Reference Textbook.

1. Charu C. Aggarwal, Neural Networks and Deep Learning (1 ed.), Springer International Publishing AG, part of Springer Nature, 2018. ISBN 978-3319944623.

Course Outcomes

The student will be able to.

1. Design the Feed Forward Neural and apply back propagation technique.

2. Modify the existing fully connected network with various activation functions.

3. Develop the conventional convolution neural network and visualize the hidden layer weights.

4. Design transfer learning models and transfer the pre-trained weights trained on another cohort.

5. Develop the RNN and LSTM models for computer vision problems.

****END****

(A37306) NATURAL LANGUAGE PROCESSING LAB

B. Tech.(AI&ML) VI-Semester ` **L T P C**

0 0 3 1.5

Course Objectives:

1. Become familiar with basic principles of AI toward problem solving, knowledge representation,and learning.
2. Knowledge on basic Language processing features, design an innovative application using NLP components

Course Outcomes:

1. Apply basic principles of AI in solutions that require problem solving, knowledge representation, and learning.
2. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
3. Understand and carry out proper experimental methodology for training and evaluatingempirical NLP systems
4. Able to design, implement, and analyze NLP algorithms

List of Experiments (AI)

1) Write a program in prolog to implement simple facts and Queries
2) Write a program in prolog to implement simple arithmetic
3) Write a program in prolog to solve Monkey banana problem
4) Write a program in prolog to solve Tower of Hanoi
5) Write a program in prolog to solve 8 Puzzle problems
6) Write a program in prolog to solve 4-Queens problem
7) Write a program in prolog to solve Traveling salesman problem
8) Write a program in prolog for Water jug problem

List of Experiments (NLP)

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. WORD TOKENIZER
7. SENTENCE TOKENIZER
8. PARAGRAPH TOKENIZER
9. CORPORA
10. .PROBABILISTIC PARSING
11. PROBABILISTIC CONTEXT FREE GRAMMER
12. LEARNING GRAMMAR
13. CONDITIONAL FREQUENCY DISTRIBUTIONS
14. LEXICAL ANALYSER
15. WORDNET
16. CONTEXT FREE GRAMMAR
17. LARGE CONTEXT FREE GRAMMAR AND PARSING
18. NAMED ENTITY RECOGNITION
19. NAMED ENTITY RECOGNITION

TEXT BOOKS:

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

2010.Pearson Education, Inc. ISBN: 978-0-13-604259-4

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

REFERENCE BOOK:

1. Breck Baldwin, —Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015.

(A30014) ENVIRONMENTAL SCIENCES
(MANDATORY COURSE)

B. Tech.(AI&ML) VI-Semester

L	T	P	C
2	0	0	0

UNIT-I

Environmental Studies:

Introduction, Definition, scope and importance, Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems. Bio geo chemical cycle, Classification of Eco system.

UNIT-II

Natural Resources: Classification of Resources, Land resources, Land as resource, Common property resources, Land degradation, Soil erosion and desertification, Effects of modern agriculture, fertilizer – pesticide problems, Forest resources, Use and over-exploitation.

Mining and dams – their effects on forest and tribal people, Water resources, Use and over- utilization of surface and groundwater, Floods, droughts, Water logging and salinity, Dams –benefits and costs, Conflicts over Water, Energy resources.

UNIT-III

Bio-diversity and its conservation, Value of bio-diversity -consumptive and productive use, social, ethical, aesthetic and option values, Bio-geographical classification of India – India as a mega diversity habitat, Threats to bio-diversity –Hot-spots, habitat loss, poaching of wild life, loss of species, seeds, etc. Conservation of bio-diversity – Insitu and Ex-situ conservation.

UNIT-IV

Environmental Pollution –Local and Global Issues, Nature of thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion. Environmental case studies.

UNIT-V

Environmental Problems in India, Drinking water, sanitation and public health, Effects of the activities on the quality of environment, Water scarcity and groundwater depletion, Controversies on major dams – resettlement and rehabilitation of people: problems and concerns, Rain water harvesting, cloud seeding and watershed management. Economy and Environment, The economy

and environment interaction, Economics of development, preservation and conservation, Sustainability: theory and practices, Limits to growth, Equitableuse of resources for sustainable life styles, Environmental Impact Assessment.

Text Books

1. Environmental Science - Y. Anjaneyulu, B S Publications.1st Edition
2. Environmental studies-Deekshadave, Cengage learning India Pvt. Ltd.,
3. Environmental sciences and Engineering - P. Venugopal Rao, PHI learning Pvt. Ltd.,
4. Environmental Science and Technology by M. Anji Reddy, B S Publications.

Reference Books

1. Clark, R.S., Marine Pollution, Clanderson Press, Oxford, 2002.
2. Cunningham, W.P., et al. Environmental Encyclopedia, Jaico Publishing House, Mumbai, 2003.

Course Outcomes:

students shall be able to

1. Acquire the knowledge on environment

2. Acquire the knowledge of various Natural Resources

3. Develop skills in understanding of various environmental problems

4. Develop skills to protect the Environment

5. To understand various environmental issues in India

END

(A30556) CYBER SECURITY

(Common to all branches-Mandatory Course)

L	T	P	C
2	0	0	0

B. Tech (AI&ML) VI Sem

Unit-I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIATriad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Unit-II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Unit-III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit-IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Unit-V

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial, etc.

TEXT BOOK:

1.Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Course Outcomes

Students shall be able to

1. Explain cyber-crimes and how they are planned
2. Describe vulnerabilities of mobile and wireless devices
3. Illustrate the crimes in mobile and wireless devices
4. Be able to use cyber security, information assurance, and cyber/computer Forensics software/tools.
5. Identify various crimes

****END****

(A37308) INTERNET OF THINGS (Professional Elective – III)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Course Objectives:

- To introduce the terminology, technology and its applications.
- To introduce the concept of M2M (machine to machine) with necessary protocols.
- To introduce the Python Scripting Language which is used in many IoT devices.
- To introduce the Raspberry PI platform, that is widely used in IoT applications.
- To introduce the implementation of web-based services on IoT devices.

Course Outcomes:

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

UNIT - I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail,Logistics, Agriculture, Industry, health and Lifestyle

UNIT - II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

UNIT - III

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT - IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controllingoutput, reading input from pins.

UNIT - V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, UniversitiesPress, 2015, ISBN: 9788173719547.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,ISBN: 9789350239759.

(A37309) CRYPTOGRAPHY AND NETWORK SECURITY
(Professional Elective - III)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication andavailability
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to IPv4 by IPSec
- Understand Intrusions and intrusion detection
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
- Discuss Web security and Firewalls

Course Outcomes:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

UNIT - I

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 key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipheroperation, Stream ciphers, RC4.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT - III

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-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

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, Singlesign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, WileyIndia, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
   Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

(A30540) BIG DATA ANALYTICS (PE - III)

B.Tech. IV Year I Sem.

Course Objectives:

L	T	P	C
2	0	0	0

- To understand the Big Data Platform and its Use cases
- Apply analytics on Structured and Unstructured Data.
- Acquire the knowledge and working on Big Data platforms

Course Outcomes:Upon the Successful Completion of the Course, the Students would be able to:

- Describe and analyze various Big Data platforms.
- Develop Big Data Solutions using Hadoop Eco System.
- Apply Machine Learning Techniques using R.

UNIT - I

Introduction to Big Data: Types of Digital Data, Introduction to Big Data, Big Data Analytics, Relational Databases & SQL, Data Cleansing and Preparation, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, IBM Big Data Strategy, InfosphereBigInsights and Big Sheets.

UNIT - II

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives

UNIT - III

Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Map Reduce, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features

UNIT - IV

Hadoop Eco System Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions

UNIT - V

Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL, Data Analytics with R,Big Data Analytics with BigR

Text Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.

2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced

Analytics by Bill Franks, John Wiley & Sons.

3. Hadoop: The Definitive Guide by Tom White, O’reily Media.

4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.

(A37310) QUANTUM COMPUTING
(Professional Elective – IV)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Course Objectives:

1. To introduce the fundamentals of quantum computing
2. The problem-solving approach using finite dimensional mathematics

Course Outcomes:

1. Understand basics of quantum computing
2. Understand physical implementation of Qubit
3. Understand Quantum algorithms and their implementation
4. Understand the Impact of Quantum Computing on Cryptography

UNIT - I

Introduction to Essential Linear Algebra: Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory. **Complex Numbers:** Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice,Transcendental Numbers.

UNIT - II

Basic Physics for Quantum Computing: The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement.

Basic Quantum Theory: Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE.

UNIT - III

Quantum Architecture: Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture. **Quantum Hardware:** Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials.

UNIT - IV

Quantum Algorithms: What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm.

UNIT - V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve. **The Impact of Quantum Computing on Cryptography:** Asymmetric Cryptography, Specific Algorithms, Specific Applications.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

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.Basic Concepts. Vol. Basic Tools and Special Topics, World Scientific.
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

(A37311) EXPERT SYSTEMS (Professional Elective – IV)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Course Objectives:

1. Understand the basic techniques of artificial intelligence.
2. Understand the Non-monotonic reasoning and statistical reasoning.

Course Outcomes:

1. Apply the basic techniques of artificial intelligence.
2. Discuss the architecture of an expert system and its tools.
3. Understand the importance of building an expert systems.
4. Understand various problems with an expert systems.

UNIT - I

Introduction to AI programming languages, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game tress, Min-max algorithms, game playing – Alpha-beta pruning.

UNIT - II

Knowledge representation issues predicate logic – logic programming Semantic nets- frames and inheritance, constraint propagation; Representing Knowledge using rules, Rules-based deduction systems.

UNIT - III

Introduction to Expert Systems, Architecture of expert systems, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.

UNIT - IV

Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems.

UNIT - V

Building an Expert System: Expert system development, Selection of the tool, Acquiring Knowledge, Building process.

Problems with Expert Systems: Difficulties, common pitfalls in planning, dealing with domain experts,difficulties during development.

TEXT BOOKS:

1. Elain Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, New Delhi.
2. Waterman D.A., "A Guide to Expert Systems", Addison Wesley Longman.

REFERENCE BOOKS:

1. Stuart Russel and other Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice-Hall.
2. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley.
3. Patterson, Artificial Intelligence & Expert System, Prentice Hall India, 1999.
4. Hayes-Roth, Lenat, and Waterman: Building Expert Systems, Addison Wesley.
5. Weiss S.M. and Kulikowski C.A., "A Practical Guide to Designing Expert Systems", Rowman &Allanheld, New Jersey.

(A37312) PATTERN RECOGNITION

(Professional Elective – IV)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Prerequisites

- Students are expected to have knowledge basic linear algebra, basic probability theory and basic programming techniques;
- A course on "Computational Mathematics"
- A course on "Computer Oriented Statistical Methods"

Course Objectives

- This course introduces fundamental concepts, theories, and algorithms for pattern recognition and machine learning.
- Topics include: Pattern Representation, Nearest Neighbor Based Classifier, Bayes Classifier, Hidden Markov Models, Decision Trees, Support Vector Machines, Clustering,and an application of hand-written digit recognition.

Course Outcomes

- Understand the theory, benefits, inadequacies and possible applications of various machine learning and pattern recognition algorithms
- Identify and employ suitable machine learning techniques in classification, patternrecognition, clustering and decision problems.

UNIT - I:

Introduction: What is 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: 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: Markov Models for Classification, 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: 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: Why is Clustering Important, 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.

TEXT BOOK:

1. Pattern Recognition: An Algorithmic Approach: Murty, M. Narasimha, Devi, V. Susheela, Spinger Pub, 1st Ed.

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.

(A37313) AD-HOC & SENSOR NETWORKS (Professional Elective - V)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Prerequisites

1. A course on "Computer Networks"
2. A course on "Mobile Computing"

Course Objectives:

1. To understand the concepts of sensor networks
2. To understand the MAC and transport protocols for ad hoc networks
3. To understand the security of sensor networks
4. To understand the applications of adhoc and sensor networks

Course Outcomes:

1. Ability to understand the state-of-the-art research in the emerging subject of Ad Hoc andWireless Sensor Networks
2. Ability to solve the issues in real-time application development based on ASN.
3. Ability to conduct further research in the domain of ASN

UNIT - I

Introduction to Ad Hoc Networks - Characteristics of MANETs, Applications of MANETs and Challenges of MANETs.

Routing in MANETs - Criteria for classification, Taxonomy of MANET routing algorithms, Topology- based routing algorithms-**Proactive**: DSDV; **Reactive**: DSR, AODV; Hybrid: ZRP; Position-based routing algorithms-**Location Services**-DREAM, Quorum-based; **Forwarding Strategies:** Greedy Packet, Restricted Directional Flooding-DREAM, LAR.

UNIT - II

Data Transmission - Broadcast Storm Problem, **Rebroadcasting Schemes**-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbor Knowledge-based: SBA, Multipoint Relaying, AHBP. **Multicasting: Tree-based:** AMRIS, MAODV; **Mesh-based:** ODMRP, CAMP; **Hybrid:** AMRoute**,** MCEDAR.

UNIT - III

Geocasting: Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR**.**
TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT - IV

Basics of Wireless, Sensors and Lower Layer Issues: Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

UNIT - V

Upper Layer Issues of WSN: Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots.

TEXT BOOKS:

1. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P. Aggarwal,World Scientific Publications, March 2006, ISBN – 981–256–681–3.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman).

(A37314) AUGMENTED REALITY AND VIRTUAL REALITY
(Professional Elective – V)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Course objectives:

1. The objective of this course is to provide a foundation to the fast-growing field of AR and makethe students aware of the various AR devices**.**
2. To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

Course Outcomes:

1. Describe how AR systems work and list the applications of AR.
2. Understand and analyze the hardware requirement of AR.
3. Describe how VR systems work and list the applications of VR.
4. Understand the design and implementation of the hardware that enables VR systems tobe built.

UNIT - I:

Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience**.**

UNIT - II:

AR Devices & Components: AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene. AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems.

UNIT - III:

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the VirtualWorld-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality

UNIT - IV:

Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Case Study: GHOST (General Haptics Open Software Toolkit) software development toolkit.

UNIT - V:

Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information, Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.

TEXT BOOKS:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016), ISBN-10: 9332578494

REFERENCE BOOKS:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.

2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman andAlan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers,San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig,WilliamR Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381.
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0.Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005

(A37315) FEDERATED MACHINE LEARNING (Professional Elective – V)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Prerequisites: The prerequisite knowledge for this course includes machine learning, basic computer systems and basic programming skills.

Course Objectives

1. Understand the key concepts and issues behind Federated Learning
2. Get familiar with key theoretical results of Federated Learning

Course Outcomes

1. Knowledge of the basic concepts, architecture, and applications of FL.
2. Understanding of new research and application trends in FL.
3. Analyze horizontal federated learning
4. Understand the significance of Federated Learning for Vision, Language, and Recommendation

UNIT - I

Introduction: Motivation, Federated Learning as a Solution, The Definition of Federated Learning, Categories of Federated Learning, Current Development in Federated Learning, Research Issues in Federated Learning, Open-Source Projects, Standardization Efforts, The Federated AI Ecosystem Background: Privacy-Preserving Machine Learning, PPML and Secure ML, Threat and Security Models, Privacy Threat Models, Adversary and Security Models, Privacy Preservation Techniques, Secure Multi-Party Computation, Homomorphic Encryption, Differential Privacy.

UNIT - II

Distributed Machine Learning: Introduction to DML, The Definition of DML, DML Platforms, Scalability- Motivated DML, Large-Scale Machine Learning, Scalability-Oriented DML Schemes, Privacy-Motivated DML, Privacy-Preserving Decision Trees, Privacy-Preserving Techniques, Privacy-Preserving DML Schemes, Privacy-Preserving Gradient Descent, Vanilla Federated Learning, Privacy-Preserving Methods.

UNIT - III

Horizontal Federated Learning: The Definition of HFL, Architecture of HFL, The Client- Server Architecture, The Peer-to-Peer Architecture, Global Model Evaluation, The Federated Averaging

Algorithm, Federated Optimization, The FedAvg Algorithm, The Secured FedAvg Algorithm, Improvement of the FedAvg Algorithm, Communication Efficiency, Client Selection Vertical Federated Learning: The Definition of VFL, Architecture of VFL, Algorithms of VFL, Secure Federated Linear Regression, Secure Federated Tree-Boosting.

UNIT - IV

Federated Transfer Learning: Heterogeneous Federated Learning, Federated Transfer Learning, The FTL Framework, Additively Homomorphic Encryption, The FTL Training Process, The FTL Prediction Process, Security Analysis, Secret Sharing-Based FTL Incentive Mechanism Design for Federated Learning: Paying for Contributions, Profit- Sharing Games, Reverse Auctions, A Fairness-Aware Profit Sharing Framework, Modeling Contribution, Modeling Cost, Modeling Regret, Modeling Temporal Regret, The Policy Orchestrator, Computing Payoff Weightage.

UNIT - V

Federated Learning for Vision, Language, and Recommendation: Federated Learning for Computer Vision, Federated CV, Federated Learning for NLP, Federated NLP, Federated Learning for

Recommendation Systems, Recommendation Model, Federated Recommendation System Federated Reinforcement Learning: Introduction to Reinforcement Learning, Policy, Reward, Value Function, Model of the Environment, RL Background Example, Reinforcement Learning Algorithms, Distributed Reinforcement Learning, Asynchronous Distributed Reinforcement Learning, Synchronous Distributed Reinforcement Learning, Federated Reinforcement Learning, Background and Categorization.

TEXT BOOK:

1. Federated Learning, Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and Han Yu -Synthesis Lectures on Artificial Intelligence and Machine Learning 2019.

.

(A37316) COGNITIVE COMPUTING
(Professional Elective – VI)

B.Tech. IV Year II Sem. **L T P C**

3 0 0 3

Prerequisites: Probability theory

Course Objectives:

1. To provide an understanding of the central challenges in realizing aspects of human cognition.
2. To provide a basic exposition to the goals and methods of human cognition.
3. To develop algorithms that use AI and machine learning along with human interactionand feedback to help humans make choices/decisions.
4. To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

Course Outcomes:

1. Understand what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and develop the business implications of cognitive computing.

UNIT - I

Introduction to Cognitive Science: Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition,a dynamical systems approach to cognition.

UNIT - II

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics.

UNIT - III

Cognitive Modeling: modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making.

UNIT - IV

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks.

UNIT - V

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems.

TEXT BOOKS:

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), CambridgeUniversity Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, CambridgeUniversity Press.

REFERENCE BOOKS:

1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles Cognitive Computing and Big DataAnalytics, Wiley
2. Vijay V Raghavan, Venkat N. Gudivada, Venu Govindaraju, Cognitive Computing: Theory andApplications: Volume 35 (Handbook of Statistics), North Holland.

(A36618) ROBOTIC PROCESS AUTOMATION

(Professional Elective – VI)

B.Tech. IV Year II Sem. **L T P C**

3 0 0 3

Course Objectives: Aim of the course is to make learners familiar with the concepts of Robotic Process Automation.

Course Outcomes:

1. Describe RPA, where it can be applied and how it's implemented.
2. Identify and understand Web Control Room and Client Introduction.
3. Understand how to handle various devices and the workload.
4. Understand Bot creators, Web recorders and task editors.

UNIT - I

Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots.

UNIT - II

Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials).

UNIT - III

Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

UNIT - IV

Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command.

UNIT - V

Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer.

TEXT BOOKS:

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.

REFERENCES:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

(A30545) BLOCKCHAIN TECHNOLOGIES (PE - VI)

B.Tech. IV Year II Sem.

Course Objectives:

L	T	P	C
3	0	0	3

- To Introduce block chain technology and Cryptocurrency

Course Outcomes:Upon the Successful Completion of the Course, the Students would be able to:

- Learn about research advances related to one of the most popular technological areastoday.

UNIT - I

Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding.

UNIT - II

Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

UNIT - III

Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

UNIT - IV

Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption,Currency Multiplicity, Demurrage currency

.

UNIT - V

Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

Text Book:

1. Blockchain Blue print for Economy by Melanie Swan.