B.Tech. (Artificial Intelligence and Data Science)

2018 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

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BANNARI AMMAN INSTITUTE OF TECHNOLOGY, SATHYAMANGALAM

REGULATIONS 2018

(CHOICE BASED CREDIT SYSTEM)

(Common to all B.E./B.Tech. Degree Programmes)

Regulation 2018 has been prepared in accordance with the guidelines given by the University Grants Commission, All India Council for Technical Education and affiliating University incorporating the features of the Choice Based Credit System (CBCS). The Regulation 2018 is applicable to the candidates admitted to the Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) Degree Programmes of the Institution in the academic year 2018-2019 for Regular admission (Academic year 2019-2020 for Lateral Entry) and subsequently.

The regulations hereunder are subjected to amendments as may be decided by the Academic Council of the Institution from time to time. Any or all such amendments will be effective from such date and to such batches of students (including those already in the middle of the programme) as may be decided by the Academic Council.

1. ADMISSION

Candidate, seeking admission to the B.E./B.Tech. Programme, shall satisfy the conditions of admission prescribed by the Directorate of Technical Education and Anna University, Chennai as given below.

1.1 Regular Admission

Candidates, for admission to the first semester of the eight semesters B.E./B.Tech. Degree Programmes, shall be required to have passed:

- Higher Secondary Examination (10 +2) of curriculum (Regular Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics, and Chemistry as three of the four subjects of the study prescribed under Part-III or any other examinations of any Board or University or authority accepted by the Syndicate of the University / Directorate of Technical Education (DoTE), Chennai as equivalent thereto.

(or)

- Should have passed Higher Secondary Examination of Vocational Stream (Engineering/Technology), prescribed by the Government of Tamil Nadu.

1.2 Lateral Entry Admission

1.2.1 The candidates who possess Diploma in Engineering / Technology awarded by the State Board of Technical Education and Training, Tamil Nadu or its equivalent are eligible to apply for Lateral Entry admission to the third semester of B.E. / B.Tech. Programmes in the branch of study as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time.

(or)

1.2.2 The candidates who possess the Bachelor Degree in Science (B.Sc.) (10+2+3 stream) with Mathematics as a subject in B.Sc. is eligible to apply for Lateral Entry admission to the third semester of B.E./B.Tech. Programmes, as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time. Such candidates shall undergo two additional Engineering subject(s) one each in third and fourth semesters, as bridge courses.

2. PROGRAMMES OFFERED

A candidate may be offered admission to any one of the programmes offered by the Institution for the candidates specified in Clause 1.1 and as per the eligibility criteria of DoTE for the candidates under Clause 1.2 from the list given below:

B. E. Programmes

i. Aeronautical Engineering
ii. Agricultural Engineering
iii. Automobile Engineering
iv. Civil Engineering
v. Computer Science and Engineering
vi. Electronics and Communication Engineering
vii. Electrical and Electronics Engineering
viii. Electronics and Instrumentation Engineering
ix. Mechanical Engineering
x. Mechatronics

B. Tech. Programmes

i. Biotechnology
ii. Fashion Technology
iii. Food Technology
iv. Information Technology
v. Textile Technology

3. STRUCTURE OF THE PROGRAMME

3.1 Every programme shall have a distinct curriculum with syllabi consisting of theory, laboratory, project, soft-skills and personality development courses, as prescribed by the respective Boards of Studies, broadly categorized under:

(i) **Basic Science** courses including Mathematics, Physics, Chemistry and further specialization in these subjects

(ii) **Basic Engineering** courses including Engineering Graphics, Engineering Practices, Basics of Electrical, Electronics, Civil, Mechanical Engineering, Engineering Mechanics and Computer Programming.

(iii) **Humanities and Social Science** courses including Language Courses, Management Courses, Soft Skills and Professional Ethics.

(iv) **Professional Courses** include Discipline Core Courses, Professional Electives, and Open Electives.

(v) **Employability Enhancement Courses (EEC)** includes Project Work and /or Internship, Seminar, Industrial /Practical Training, Value Added and Certificate Courses.

The medium of instruction is English for all the Courses, Examinations, Seminar Presentation, Projects and any other courses that a student registers for.

3.2 Each course is normally assigned a certain number of credits based on the following

Contact period per week	Credits
1 Lecture / 1 Tutorial period	1
2 laboratory Periods (Laboratory / Seminar / Project Work / etc.)	1

3.3 All the B.E. / B.Tech. Students will study Communicative English I during the First Semester. In the Second Semester, they will be divided into two streams based on their English language proficiency assessed in the Continuous Assessment during semester I, in which the upper segment will be provided an option to enroll and study Communicative English II / German / Japanese / French / Chinese / Hindi while the lower segment will study Communicative English II.

3.4 Every student shall be required to opt for **Nine** electives from the list of electives. Students can opt for the electives (Core / Professional) from his / her own discipline courses, during V to VIII Semesters, if he/she satisfies the prerequisite for that particular course.

3.5 However, out of nine electives, every student shall be required to opt for, a minimum of one and subject to a maximum of three courses as open elective from the list of electives of the branch / branches other than his / her branch of specialisation, if he/she satisfies the prerequisite for that particular course.

3.6 Students can also opt for **one-credit courses** of 15 to 20 hour duration, which will be offered by the experts from the industry on specialised topics. Students can opt for such **one-credit courses** during the semesters I to VII as and when these courses are offered. A student will also be permitted to register the **one-credit courses** offered by other Departments, provided the student has fulfilled the necessary pre-requisites or the courses that may not require any pre-requisites. Under no circumstances, the same one credit course shall be repeated in subsequent semesters in any Department / Centre for the same batch of the students and a maximum batch size for a given course shall not exceed 40. In case of disciplines with multiple divisions (intake more than 60) different course(s) shall be offered to other batch(es) of students.

On successful completion of one credit courses, Credits will be indicated in the Grade Sheet, but will not be considered for computing the Cumulative Grade Point Average (CGPA). However, if a student wishes to avail the exemption from any one of the Electives (other than open elective) of the Semester VIII, he / she can do so by exercising his / her option in writing to the respective Head of the Department during the beginning of the VIII Semester, following the equivalence norm, that one **regular elective** (in the **VIII Semester**) is equivalent to **three one-credit courses** completed by the student during the previous semesters, IV to VII. Details of the one credit courses offered by the department shall be forwarded to the Office of the Controller of Examinations. However one credit courses completed during I to III semesters shall be maintained in the Grade sheet as “Additional credits earned” (not considered for the computation of SGPA/CGPA).

3.7 A student can register for Self-Study Elective(s) over and above the electives from any branch of Engineering / Technology at the rate of one per semester starting from V semester onwards provided he/she maintains a Cumulative Grade Point Average (CGPA) of 8.50 or above till the previous semesters with no current arrears. Credits will be indicated for such courses in the grade sheets (additional credits) but will not be considered for computing the CGPA.

3.8 A Student may be permitted to credit only one online course with the approval of the Departmental Consultative Committee constituted by the Head of the Department, subject to a maximum of three credits. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by the CoE. A student can get exemption for a maximum of 3 credits during the entire programme (in lieu of Core elective or Open elective). The Head of the Department may identify a faculty member as coordinator for the course, who is responsible for the evaluation process. The course shall be evaluated through the End Semester Examination only. The evaluation methodology may be decided by the course faculty coordinator.

3.9 **Industrial Training / Internship**

The students may undergo Industrial training / Internship optionally for a period as specified in the table during summer / winter vacation and the credits earned will be indicated in the Mark Sheet. If the student earns three credits in Industrial Training / Internship, the student may drop one Professional Elective. In such cases, Industrial Training / Internship need to be undergone continuously from one organization only. However, if the number of credits earned is 1 or 2, these credits shall not be considered for classification of the degree. The students may also undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) during summer / winter vacation, in lieu of Industrial training.

Duration of Training / Internship	Credits
2 Weeks	1
1 Month	2
2 Months	3

3.10 **Socially Relevant Projects**

A Student may be permitted to carry out a socially relevant project during semester II to semester VI in consultation with the Faculty Guide and submit the project report, in the prescribed format, at the end of the Semester for the valuation.

On successful completion of socially relevant project work, one credit will be indicated in the grade sheet (Additional credits), but these credits will not be considered for computing the CGPA.

4. VALUE ADDED COURSES

A Student can opt for the Value Added Courses offered by the various Department / Centres from Semester II to VII. Head of the Department / Centre shall submit the list of such courses, duly approved / ratified by the Academic Council, to the Controller of Examinations to administer the examination process. A separate Certificate will be issued on successful completion of the course by the Office of the Controller of Examinations.

5. DURATION OF THE PROGRAMME

5.1 A regular student (admitted after 10+2) or equivalent is normally expected to satisfactorily fulfil the requirements for award of the degree B.E. / B.Tech. within four academic years (8 semesters) from the date of admission but in any case not more than 7 years (14 Semesters); lateral entry students shall fulfil such requirements within three academic years (6 semesters) from the date of admission but in any case not more than six years (12 Semesters) leading to the award of Degree of Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) of Anna University, Chennai.

5.2 The total period for completion of the programme from the commencement of the semester, to which the student was admitted, shall not exceed the maximum period (Clause 5.1), regardless to the break-of-study (vide Clause 15) or period of prevention in order.

5.3 Each semester shall consist of minimum 90 working days. Head of the Department shall ensure that every faculty member teaches the subject / course as prescribed in the approved curriculum and syllabi.

5.4 Special Theory / Practical Sessions may be conducted for students who require additional inputs over and above the number of periods normally specified (Remedial Classes), as decided by the Head of the Department, within the specified duration of the Semester / Programme.

6. COURSE ENROLLMENT AND REGISTRATION

6.1 Each student, on admission shall be assigned to a Faculty Advisor (vide Clause 8) who shall advise / counsel the student about the details of the academic programme and the choice of course(s) considering the student's academic background and career objectives.

6.2 Every student shall enroll for the courses of the succeeding semester, in the current semester. However, the student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the semester concerned.

6.3 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the End Semester Examinations.

6.3.1 Each student, on admission to the programme, shall register for **all the courses prescribed in the curriculum** in the **first Semester of study (III Semester** for students admitted under **lateral entry stream).**

6.3.2 The enrollment for all the courses of the Semester II will commence 10 working days prior to the last working day of Semester I. The student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the Semester II. In case, if a student fails to register in course(s), he/ she may be permitted to register the same, as specified in the Clause 6.5, in the subsequent semesters or when it is offered.

6.3.3 The enrollment for the courses of the Semesters III to VIII will commence 10 working days prior to the last working day of the preceding semester. The student shall enroll for the courses with the guidance of the student's Faculty Advisor. If a student wishes, the student may drop or add courses (vide Clause 6.4) within **five** working days after the commencement of the

semester concerned and complete the registration process duly authorized by the Faculty Advisor.

6.4 Flexibility to Add or Drop courses

6.4.1 A student has to earn the total number of credits specified in the Curriculum of the respective Programme of study in order to be eligible to obtain the degree. However, if a student wishes, the student is permitted to earn more than the total number of credits prescribed in the curriculum by opting for one- credit courses, self study electives or additional courses.

6.4.2 From the III to VIII semesters (from IV to VIII Semesters in case of lateral entry students), the student has the option of registering for additional courses or dropping existing courses. The total number of credits that a student can add or drop is limited to 8, subject to a maximum of 2 courses in a given Semester. In such cases, the attendance requirement as stated in Clause 7 is mandatory.

6.4.3 The student shall register Project work I in semester VII and Project work II in semester VIII only.

6.5 Reappearance Registration

6.5.1 If a student fails in a theory course, the student shall do reappearance registration (Examination) for that course in the subsequent semesters or when it is offered next.

6.5.2 On registration, a student may attend the classes for the reappearance registration courses, if the student wishes, and the attendance requirement (vide Clause 7) is not compulsory for such courses.

6.5.3 However, if a student wishes to improve his/ her continuous assessment, in the second attempt during reappearance, he/she shall satisfy the Clause 6.5.5 and appear for continuous assessment as given for that particular course.

6.5.4 If the theory course, in which the student has failed, is either a professional elective or an open elective, the student may register for the same or any other professional elective or open elective course, respectively in the subsequent semesters. However, the change of elective courses is permitted only once.

6.5.5 In this case (Clause 6.5.4), the student shall attend the classes, satisfy the attendance requirements (vide Clause 7), earn Continuous Assessment marks and appear for the End Semester Examination.

6.5.6 The student who fails in any continuous assessment courses (Laboratory/ Project work / Seminar or any other HSS/EEC courses) shall register for the same in the subsequent semesters or when offered next, and **repeat** the course as per Clause 6.5.5.

6.5.7 If a student is prevented from writing the end semester examination of a course or several courses due to lack of attendance, the student has to register for that / those course(s) again, when offered next, attend the classes and fulfill the requirements as per Clause 6.5.5 & 6.5.6. If the course, in which the student has 'lack of attendance', is a Core Elective or an Open Elective, the student may register for the same or any other Core Elective or Open Elective course(s) respectively in the subsequent semesters and appear in the examination as per Clause 6.5.5.

6.5.8 If a student fails to secure a pass in any theory courses (including elective) he/she is given a maximum of three arrear attempts to complete the courses. If the student still fails to secure a pass, he/she shall register for the same when offered next and repeat the course.

7. REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

A student who has fulfilled the following conditions (vide Clause 7.1 and 7.2) shall be deemed to have satisfied the attendance requirements for appearing for End Semester Examination of a particular course.

7.1 Every student is expected to attend all the periods and earn 100% attendance. However, a student shall secure not less than 80% attendance course wise taking into account the number of periods required for that course as specified in the curriculum.

7.2 If a student, secures attendance between 70% and 79% in any course(s) in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) or participation in Institution/ University/ State/ National/

International level extra and co-curricular activities, with prior permission from the Head of the Department, shall be permitted to appear for the current semester examinations subject to the condition that the student shall submit the medical certificate / participation certificate attested by the Head of the Department (along with Condonation form). Such certificates along with the condonation forms shall be forwarded to the Controller of Examinations for verification and permission to attend the examinations. However during the entire programme of study, a student can avail such Condonation in any two semesters only (regardless the number of courses).

7.3 A student shall normally be permitted to appear for End Semester Examination of the course(s) if the student has satisfied the attendance requirements (vide Clause 7.1 – 7.2) and has registered for examination in those courses of that semester by paying the prescribed fee.

7.4 Students who do not satisfy Clause 7.1 and 7.2 and who secure less than 70% attendance in a course will not be permitted to write the End-Semester Examination of that course. The student has to register and repeat this course in the subsequent semesters or when it is offered next (vide Clause 6.5).

7.5 If a student has shortage of attendance in all the registered courses, he/she would not be permitted to move to the higher semester and has to repeat the current semester in the subsequent year.

7.6 In the case of reappearance (Arrear) registration for a course, the attendance requirement as mentioned in Clauses 7.1 - 7.3 is not applicable. However, the student has to register for examination in that course by paying the prescribed fee.

7.7 A student who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of grades.

8. FACULTY ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty member of the Department who shall function as Faculty Advisor

for those students. The Faculty Advisor shall advise and guide the students in registering of courses, reappearance of courses, monitor their attendance and progress and counsel them periodically. The Faculty Advisor also discusses with or informs the parents about the progress / performance of the students concerned.

The responsibilities of the faculty advisor shall be:

- To inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.
- To guide student enrollment and registration of the courses.
- To authorize the final registration of the courses at the beginning of each semester.
- To monitor the academic and general performance of the students including attendance and to counsel them accordingly.

9. COMMITTEES

9.1 Common Course Committee

9.1.1 A theory course handled by more than one faculty including the discipline with multiple divisions (greater than or equal to 2) shall have a "Common Course Committee" comprising of all members of faculty teaching that course with one of the members as the Course Coordinator, nominated by the Head of the Institution (Head of the Department in the case of multiple divisions of a discipline) and student representatives (one per specialization or division) registered for that course in the current semester.

First meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. Two subsequent meetings in a semester may be held at suitable intervals. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all the students.

9.1.2 In addition, Common Course Committee (without the student representatives) shall meet to ensure uniform evaluation through the common question papers during Continuous Assessment and End Semester Examinations.

9.2 Class Committee Meeting

For all the courses taught, prescribed in the curriculum, Class Committee meeting shall be convened thrice in a semester (first meeting within 15 days from the commencement of the semester and other two meetings at equal interval after the first meeting) comprising members of the faculty handling all the courses and two student representatives from the class.

One of the members of the faculty (preferably not handling any courses to that class), nominated by the Head of the Department, shall coordinate the activities of the Committee. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all other students.

10. SYSTEM OF EXAMINATION

10.1 Performance in each course of study shall be evaluated based on (i) Continuous Assessment throughout the semester and (ii) End Semester examination at the end of the semester for the regular courses or as given in the Clause 16. However, the final examination in the case of certificate / value added courses may be conducted, as and when the course is completed, through the office of the Controller of Examinations.

10.2 Each course, both theory and laboratory including project work, shall be evaluated as per the Scheme of Assessment given in Clause 16.

10.3 The End Semester Examinations shall normally be conducted after satisfying the Clause 5.2.

10.4 For the End Semester examinations, both theory and project work, the internal and external examiners (from Academia or Industry) shall be appointed by the Controller of Examinations as per the guidelines given by the Examination cum Evaluation committee of the Institute.

11. PASSING REQUIREMENTS AND PROVISIONS

11.1 The Passing requirement for a student in a course is determined based on the marks obtained both in Continuous Assessment and End Semester Examinations. If the student gets <50% of marks in End Semester Examination, then the student will be awarded only RA (Reappearance) grade.

11.1.1 If a student fails to secure a pass in a particular course, i.e., failing to obtain minimum marks, as stated above, it is mandatory that he/she shall reappear for the examination in that course in the subsequent semester(s) whenever the examinations are conducted for that course, till he / she secures a 'Pass'.

Continuous Assessment (CA) marks obtained by the student in the first appearance shall be retained and considered valid for one subsequent attempt, except Clause 6.5.4, 6.5.5, 6.5.6 and 6.5.7. However, from the third attempt onwards, the student shall be declared to have passed the course if he/she secures a minimum of 6 Grade Points (B Grade) in the course prescribed during the End Semester Examinations.

11.2 If a candidate fails in the seventh semester examinations of Project work I, he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. If he / she fails in the End semester examination of Project work II, he/she shall resubmit the Project Report within 60 days from the date of declaration of the results. The resubmission of the project report and the subsequent viva-voce examination will be considered as reappearance with payment of exam fee. In case a student fails in the resubmission of a project report and subsequent viva-voce examination, the student shall register for the course again, when offered next.

11.3 The passing requirement for the courses which are assessed only through continuous assessment (Laboratory and EEC courses except project work), shall be fixed as minimum 50% and the remaining grades are decided as per clause 12.4. If a candidate fails in EEC courses (Except Project work), he/she has to register and repeat the course within 30 days from the date of declaration of the

results. In case a student fails to register within 30 days, he/she shall register for the course again, when offered next.

11.4 The minimum number of total credits to be earned by a student to qualify for the award of Degree in the various branches of study as prescribed by the respective Boards of Studies is given below:

Branch of Study	Minimum Credits	
	Regular Admission	Lateral Entry
B.E. Programmes		
Aeronautical Engineering	172	135
Agricultural Engineering	172	134
Automobile Engineering	170	133
Civil Engineering	171	133
Computer Science and Engineering	171	133
Electronics and Communication Engineering	172	131
Electrical and Electronics Engineering	170	131
Electronics and Instrumentation Engineering	170	131
Mechanical Engineering	170	131
Mechatronics	170	132
B.Tech. Programmes		
Biotechnology	172	134
Fashion Technology	172	134
Food Technology	170	132
Information Technology	170	132
Textile Technology	171	133

11.5 Student Migration and Credit Transfer: Normalization of the Credits will be carried out in consultation with the Board of Studies of the programme concerned and approved by the Head of Institution, if a student migrates from other Autonomous institutions to Bannari Amman Institution of Technology or rejoins from previous regulation to this regulation.

11.6 A student shall be declared to have qualified for award of B.E/B.Tech. Degree if he/she successfully completes the course requirements (vide Clause 7, 10 and 11) and passed all the prescribed courses of study of the respective programme (listed in Clause 2), within the duration specified in Clause 5.1.

12. ASSESSMENT AND AWARD OF LETTER GRADES

12.1 The assessment shall be based on the performance in the End Semester Examinations and / or Continuous Assessment, carrying marks as specified in Clause 16. Letter Grades (based on Credit Point and Grade Point) are awarded to the students based on the performance in the evaluation process.

12.2 Credit Point is the product of Grade Point and number of credits for a course and Grade Point is a numerical weight allotted to each letter grade on a 10-point scale (as specified in the Clause 12.4), while the Letter Grade is an index of the performance of a student in a said course.

12.3 Condition for Relative Grading

The minimum number of students for applying relative grading system is 30. If the students' strength is less than 30 then absolute grading system will be applied. The relative grading system shall not be applied for laboratory and EEC courses.

12.4 The performance of a student will be reported using Letter Grades in absolute grading, each carrying certain points as detailed below: In relative grading, grades will be decided by the faculty concerned. A student who earns a minimum of 6 grade points in a course is declared to have successfully passed the course.

Range of Total Marks (as specified in Clause 16) / Specific Reason	**Grade Points**	**Letter Grade**
91 to 100	10	O (Outstanding)
81 to 90	9	A + (Excellent)
71 to 80	8	A (Very Good)
61 to 70	7	B + (Good)
50 to 60	6	B (Above average)
0 to 49	0	RA (Reappearance Registration)
Incomplete	0	I
Withdrawal	0	W
Absent	0	AB
Shortage of Attendance	0	SA

'RA' ---Reappearance registration is required for that particular course

'I' --- Continuous evaluation is required for that particular course in the subsequent examinations.

'SA' --- shortage of attendance (Clause 7) and hence prevented from writing end semester examination.

12.5 After completion of the evaluation process, Semester Grade Point Average (SGPA), and the Cumulative Grade Point Average (CGPA) is calculated using the formula:

$$SGPA/CGPA = \frac{\sum_1^n C_i * g_i}{\sum_1^n C_i}$$

Where

C_i : Credit allotted to the course.

g_i : Grade Point secured corresponding to the course.

n : number of courses successfully cleared during the particular semester in the case of SGPA and all the semesters, under consideration, in the case CGPA.

12.6 A student who does not appear for the End Semester Examinations in a course, after registering for the same, shall be deemed to have appeared for that examination for the purpose of classification (Subject to Clause 14 and 15).

12.7 For the non credit courses grades shall be indicated as given in the Clause 16 and shall not be counted for the computation of SGPA/CGPA.

For the Co-curricular activities such as NCC / NSS / NSO / YRC, a satisfactory / not satisfactory grading will appear in the mark sheet. Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year. A satisfactory grade in the above co-curricular activities is compulsory for the award of degree.

12.8 **Revaluation:** A student, who seeks the re-valuation of the answer script, is directed to apply through proper application to the Controller of Examinations in the prescribed format through the Head of the Department. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses. In the case of theory courses with laboratory component, a student can seek revaluation for the theory component only, following the procedure stated above.

12.9 **Supplementary Examinations**: If a student fails to secure a pass in theory course(s) of VIII semester examination, he/she is eligible to appear for a one time Supplementary Examination which shall be conducted at the end of VIII semester, for the subjects of VIII semester alone within 30 days from the date of declaration of the results.

12.10 **Eligibility for the Award of Degree**

A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.
ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the courses prescribed in all the 8 semesters within a maximum period of 7 years reckoned from the commencement of the first semester to which the candidate was admitted.
iii. Successfully completed the NCC / NSS / NSO / YRC / Extra-curricular/ Co-curricular requirements.
iv. No disciplinary action is pending against the student.
v. The award of Degree must have been approved by the Syndicate of the University.

13. CLASSIFICATION OF THE DEGREE AWARDED

For the purpose of the 'Award of Degree', the duration of completion of the programme shall be the total duration taken by a student for completing first time registration of all the required courses and satisfying Clause 11, regardless to the period of Break-of-study as per Clause 15 and satisfy any one of the conditions required as given below.

13.1 **First Class with Distinction**: A student who satisfies the following conditions shall be declared to have passed the examination in **First class with Distinction**:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry students) in the student's First Appearance within five years, which includes authorized break of study of one year. Withdrawal from examination (vide Clause 15) will not be considered as an appearance.
- Should have secured a CGPA of **not less than 8.50**
- Should **NOT** have been prevented from writing end semester examination due to lack of attendance in any of the courses.

13.2 **First Class**: A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry students) within five years, which includes one year of authorized break of study (if availed) or prevention from writing the End Semester Examination due to lack of attendance (if applicable).
- Should have secured a CGPA of **not less than 7.00**

13.3 **Second Class**: All other students (not covered in clauses 13.1 and 13.2) who qualify for the award of the degree shall be declared to have passed the examination in **Second Class.**

14. WITHDRAWAL FROM THE EXAMINATION

14.1 A student may, for valid reasons, be granted permission by the Head of the Department to withdraw from appearing in the examination in any course(s) only once during the entire duration of the degree programme.

14.2 Withdrawal application shall be valid only, if the student is eligible to write the examination as per Clause 7 and, if it is made within TEN working days before the commencement of the end semester examination in that course or courses and also recommended by the Head of the Department.

14.3 Notwithstanding the requirement of mandatory TEN working days' notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

14.4 If a student withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examination(s).

14.5 Withdrawal shall not be considered as an appearance in the examination for the eligibility of a student for First Class with Distinction or First Class.

14.6 Withdrawal is permitted for the end semester examinations in the final semester, only if the period of study of the student concerned does not exceed 5 years as per clause 13.1 & 13.2.

15. AUTHORIZED BREAK OF STUDY FROM A PROGRAMME

15.1 A student is permitted to go on break of study for a fixed period of one year as a single break in the entire course of study.

15.2 A student is normally not permitted to break the period of study temporarily. However, if a student happens to discontinue the programme temporarily during the middle of programme of study, for reasons such as personal accident or hospitalization due to ill health or in need of health care, he/she shall apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester examination, through the Head of the Department stating the reasons for the break-of-study (for one academic semester or 6 months, whichever is earlier). However, a student detained for want of minimum attendance

requirement as per Clause 7 shall not be considered as permitted 'Break of Study' and Clause 15.3 is not applicable for such case.

15.3 The student is permitted to rejoin the programme after the break / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Dean Academics in the prescribed format through the Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

15.4 Authorized break of study will be counted towards the duration specified for passing all the courses (vide Clause 5.1 and 5.2) and for the purpose of classification of Degree (vide Clause 13).

15.5 The total period for completion of the programme reckoned from the commencement of the first semester to which the student is admitted shall not exceed the maximum period specified in Clause 5.1, irrespective of the period of break of study in order that he / she may be eligible, for the award of the degree (vide Clause 13).

15.6 In case of valid reasons (as stated in Clause 15.2) extended break-of-study may be granted by the Head of the Institution for a period not more than one year in addition to the earlier authorized break of study.

15.7 If a student does not report back to the Institute, even after the extended Break of Study, the name of the student shall be deleted permanently from the college enrollment. Such students are not entitled to seek readmission under any circumstances.

16. SCHEME OF ASSESSMENT

Courses offered under B.E. / B.Tech. Programmes are assessed as given below:

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (10)	
	Periodical Test II (10)	
	Innovative Practices (30)	
	End Semester Examination	**50**
	Total Marks	**100**

II	**THEORY COURSES WITH LAB COMPONENT**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (10)	
	Periodical Test II (10)	
	Innovative Practices (30)	
	(Laboratory Assessment & Report)	
	End Semester Examination (QP pattern as per (I))	**50**
	Total Marks	**100**

III	**LABORATORY COURSES**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Conduct of Experiment	
	i. Preparation (20)	
	ii. Experiment and Analysis of Results (20)	
	iii. Record (10)	
	Test – Cycle I (25)	
	Test – Cycle II (25)	
	Total Marks	**100**

IV	**PROJECT WORK I**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Literature Survey (5)	
	Identification of topic and Justification (5)	
	Work plan (10)	
	Review II	
	Approach & Results (15)	
	Conclusion (15)	

	End Semester Examination	**50**
	Report[@] (20)	
	Presentation (20)	
	Viva voce (10)	
	Total Marks	**100**

V	**PROJECT WORK II**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Progress (10)	
	Review II	
	Approach & Results (10)	
	Review III	
	Conclusion & Final Presentation (10)	
	Report (15)	
	Publication of Paper in Conferences / Journals (5)	
	End Semester Examination	
	Presentation (30)	**50**
	Viva voce (20)	
	Total Marks	**100**

VI	**LANGUAGE ELECTIVE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test 1	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Test 2	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Oral Exam	**50**
	Total Marks	**100**

VII	**ONE-CREDIT COURSE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test I	**50**
	Quiz/ Assignment	**50**
	Total Marks	**100**

[#] *Reports / Record Note / Integrated Lab Manual to be retained for 1 year for Academic Audit, by respective Department*

VIII	**INDUSTRIAL TRAINING/ INTERNSHIP (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Assessment by Industry	**30**
	Viva-voce	**20**
	Presentation	**30**
	Case Study / Report	**20**
	Total Marks	**100**

IX	**SOFT SKILLS (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory)	

X	**VALUE ADDED / CERTIFICATE COURSES (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Evaluation / Test	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory)	

XI	**ENGINEERING GRAPHICS**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Exercise (Minimum 10 Exercises/Modelling)	**60**
	Model Examination	**40**
	Total Marks	**100**

Optional Test: *A student becomes eligible to appear for an optional test conducted after the Periodical Test II, only under the following circumstances: (i) absent for Test I or Test II or both on account of medical reasons (hospitalization / accident / specific illness), or (ii) participation in the College / University / State / National / International level Sports events with prior permission from the Head of the Institution and (iii) on satisfying the conditions (i) or (ii), the student should have registered for the Optional Test, through the concerned member of faculty who handles the course or through the respective Head of the Department, submitted to the Controller of Examinations. Such Optional Tests are not conducted for the courses under the categories III, IV, V, VI, VII, VIII, IX, X and XI listed above.*

17. FIELD / INDUSTRIAL VISIT / INTERNSHIP

In order to provide the experiential learning to the students, Head of the Department shall take efforts to arrange at least two industrial visits / field visits. The students may also undergo in-plant training / internship during summer / winter vacation between III and VII semesters.

18. PERSONALITY AND CHARACTER DEVELOPMENT

Every student shall be required to undergo a minimum of 40 hours of Personality Development Programmes viz, NSS / NCC / YRC / YOGA / Sports and Games / Technical and Non-technical Club activities during the first year. The attendance of the personality and character development courses / events shall be maintained on the regular basis by the concerned First Year Co-ordinators and made available in the Office of the Controller of Examinations before the commencement of Semester examinations of Semester I or Semester II.

19. DISCIPLINE

A student is expected to follow the rules and regulations laid down by the Institute and the affiliating University, as published from time to time. Any violations, if any, shall be treated as per the procedures stated thereof.

If a student indulges in malpractice in any of the End Semester / Continuous Assessments, he / she shall be liable for punitive action as prescribed by the Institution / University from time to time.

20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The Institution reserves the right to revise/amend/change the Regulations, Curriculum, Syllabi, Scheme of Examinations and date of implementation and to introduce Additional Electives, Open Electives, One Credit Courses and Value Added Courses through the Academic Council.

VISION

To build a conducive academic and research environment to produce competent Professionals to the dynamic needs of the emerging trends in the field of Artificial Intelligence and Data Science.

MISSION

i. To establish a unique learning environment and to enable the students to face the challenges in Artificial Intelligence and Data Science.

ii. To critique the role of information and analytics for a professional career, research activities and consultancy.

iii. To produce competent engineers with professional ethics and life skills.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Competent engineering professionals to use Artificial Intelligence and Data Science to solve engineering problems.

PEO2: Capable of pursuing higher studies and research, with wider opportunities in teaching and innovation.

PEO3: Improve communication skills, follow professional ethics and involve in team work in their profession.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to design and develop Artificial Intelligence algorithms, tools and techniques for solving real world problems.

PSO2: Ability to identify and use appropriate analytical tools and techniques on massive datasets to extract information.

MAPPING OF PEOs AND POs

POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2
PEO 1	X	X	X	X	X	X	X							X
PEO 2	X	X	X	X	X	X					X	X	X	
PEO 3								X	X	X	X		X	X

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Minimum Credits to be Earned : 172

I SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
20AI101	ENGINEERING MATHEMATICS I	3	1	0	4	4	50	50	100	BS
20AI102	ENGINEERING PHYSICS I	2	0	2	3	4	50	50	100	BS
20AI103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
20AI104	PROGRAMMING FOR PROBLEM SOLVING IN C	2	0	2	3	4	50	50	100	ES
20AI105	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
20HS101	COMMUNICATIVE ENGLISH I	1	0	2	2	3	100	0	100	HSS
Total		**12**	**1**	**10**	**18**	**23**	**-**	**-**	**-**	**-**

II SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
20AI201	ENGINEERING MATHEMATICS II	3	1	0	4	4	50	50	100	BS
20AI202	ENGINEERING PHYSICS II	2	0	2	3	4	50	50	100	BS
20AI203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
20AI204	APPLICATION BASED PROGRAMMING IN PYTHON	3	0	2	4	4	50	50	100	ES
20AI205	DIGITAL SYSTEM DESIGN	3	0	2	4	4	50	50	100	ES
	LANGUAGE ELECTIVE	1	0	2	2	3	100	0	100	HSS
Total		**13**	**1**	**10**	**20**	**23**	-	-	-	**-**

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
20AI301	STATISTICS AND PROBABILITY	3	1	0	4	4	50	50	100	BS
20AI302	DATA STRUCTURES USING C++	3	0	0	3	4	50	50	100	PC
20AI303	PRINCIPLES OF OPERATING SYSTEM	3	0	0	3	3	50	50	100	PC
20AI304	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3	3	50	50	100	PC
20AI305	DATABASE MANAGEMENT SYSTEM	3	0	0	3	3	50	50	100	PC
20AI306	JAVA PROGRAMMING	2	0	2	3	3	50	50	100	PC
20AI307	DATA STRUCTURES LABORATORY	0	0	4	2	2	100	0	100	PC
20AI308	DATABASE MANAGEMENT SYSTEM LABORATORY	0	0	4	2	2	100	0	100	PC
18GE301	SOFT SKILLS - VERBAL ABILITY	2	0	0	0	2	100	0	100	EEC
Total		**17**	**2**	**12**	**23**	**26**	**-**	**-**	**-**	**-**

IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
20AI401	APPLIED LINEAR ALGEBRA	3	1	0	4	4	50	50	100	BS
20AI402	DESIGN AND ANALYSIS OF ALGORITHM	3	1	0	4	4	50	50	100	PC
20AI403	DATA MINING AND WAREHOUSING	2	0	2	3	4	50	50	100	PC
20AI404	COMPUTER NETWORKS	3	0	0	3	3	50	50	100	PC
20AI405	ARTIFICIAL INTELLIGENCE	3	0	0	3	3	50	50	100	ES
20AI406	STATISTICAL MACHINE LEARNING	3	0	0	3	3	50	50	100	PC
20AI407	ARTIFICIAL INTELLIGENCE LABORATORY	0	0	4	2	4	100	0	100	PC
20AI408	STATISTICAL MACHINE LEARNING LABORATORY	0	0	4	2	4	100	0	100	ES
18GE401	SOFT SKILLS – REASONING	0	0	2	0	2	100	0	100	EEC
Total		**17**	**2**	**12**	**24**	**31**	-	-	-	-

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
20AI501	SOFTWARE ENGINEERING AND TESTING METHODOLOGIES	3	0	0	3	3	50	50	100	PC
20AI502	DEEP LEARNING	3	1	0	4	4	50	50	100	PC
20AI503	ANALYTICS IN CLOUD COMPUTING	3	0	0	3	3	50	50	100	PC
20AI504	PROGRAMMING FOR DATA SCIENCE	3	0	0	3	3	50	50	100	PC
	PROFESSIONAL ELECTIVE I	3	0	0	3	3	50	50	100	PE
	PROFESSIONAL ELECTIVE II	3	0	0	3	3	50	50	100	PE
20AI507	PROGRAMMING FOR DATA SCIENCE LABORATORY	0	0	4	2	4	100	0	100	PC
20AI508	ANALYTICS IN CLOUD COMPUTING LABORATORY	0	0	4	2	4	100	0	100	PC
18GE501	SOFT SKILLS - APTITUDE I	0	0	2	0	2	100	0	100	EEC
Total		**18**	**0**	**10**	**23**	**29**	**-**	**-**	**-**	**-**
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
20AI601	DATA SECURITY	3	1	0	4	3	50	50	100	PC
20AI602	COMPUTER VISION	3	0	0	3	3	50	50	100	PC
20AI603	DATA VISUALIZATION	3	0	2	4	3	50	50	100	PC
20AI604	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	50	50	100	EEC
	PROFESSIONAL ELECTIVE III	3	0	0	3	3	50	50	100	PE
	PROFESSIONAL ELECTIVE IV	3	0	0	3	3	50	50	100	PE
20AI607	NATURAL LANGUAGE PROCESSING LABORATORY	0	0	4	2	4	100	0	100	EEC
20AI608	COMPUTER VISION LABORATORY	0	0	4	2	4	100	0	100	PC
18GE601	SOFT SKILLS - APTITUDE II	0	0	2	0	2	100	0	100	EEC
Total		**18**	**0**	**12**	**24**	**28**	-	-	-	-

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HS002	PROFESSIONAL ETHICS IN ENGINEERING	2	0	0	2	2	50	50	100	HSS
20AI702	IOT ANALYTICS	3	0	0	3	3	50	50	100	PC
20AI703	SOCIAL MEDIA ANALYSIS	3	0	0	3	3	50	50	100	EEC
20AI704	AI FOR ROBOTICS	3	1	0	4	3	50	50	100	PC
	PROFESSIONAL ELECTIVE V	3	0	0	3	3	50	50	100	PE
	PROFESSIONAL ELECTIVE VI	3	0	0	3	3	50	50	100	PE
20AI707	IOT ANALYTICS LABORATORY	0	0	4	2	4	100	0	100	EEC
20AI708	PROJECT WORK I	0	0	6	2	6	50	50	100	EEC
Total		**17**	**1**	**10**	**22**	**27**	-	-	-	-
VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
	PROFESSIONAL ELECTIVE VII	3	0	0	3	3	50	50	100	PE
	PROFESSIONAL ELECTIVE VIII	3	0	0	3	3	50	50	100	PE
	PROFESSIONAL ELECTIVE IX	3	0	0	3	3	50	50	100	PE
20AI804	PROJECT WORK II	0	0	18	9	18	50	50	100	EEC
Total		**9**	**0**	**18**	**18**	**27**				

ELECTIVES										
LANGUAGE ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /week**	**CA**	**ES**	**Total**	**Category**
18HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
18HSC01	CHINESE	1	0	2	2	3	100	0	100	HSS
18HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
18HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
18HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
18HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS

20AI101 ENGINEERING MATHEMATICS I

3 1 0 4

Course Objectives

- Understand the concepts of vectors and Eigenvectors for different matrices to describe the stability of the linear systems in engineering fields.
- Exemplify the concepts of differentiation and integration to identify the area of 2D and 3D surfaces in engineering problems.
- Explain the concepts of analytic functions in complex domain to predict the nature of different engineering systems.

Course Outcomes (COs)

1. Represent the different forms of coordinate system in complex plane and characteristics of linear systems by Eigenvalues and Eigenvectors.
2. Analyse various types of functions and their differentiation techniques involved in engineering fields.
3. Implement different methods of integration used in engineering problems.
4. Execute the suitable integration technique to calculate the area and volume of different surfaces.
5. Apply the concept of analytic function to estimate the integral in complex plane.

UNIT I **9 Hours**

COMPLEX NUMBERS, VECTORS AND MATRICES

Complex plane, polar coordinates and polar form of complex numbers, powers and roots, fundamental theorem of algebra. Vector algebra in 2-D and 3-D space, dot product and cross product. Matrices: Eigen values and Eigen vectors, Properties of eigen values and eigen vectors.

UNIT II **9 Hours**

CALCULUS

Limits and Continuity of Functions: Limits of functions, types of limits, evaluation of limits, continuity of functions, properties of continuous functions. Derivatives: Derivatives, differentiability, rules and properties, differentiation of transcendental functions, higher order derivatives, implicit differentiation, and differentiation of hyperbolic functions. Integration: Anti-derivatives, Riemann Sum, indefinite and definite integration, Mean Value Theorem for definite integral, Fundamental Theorem of Calculus.

UNIT III **9 Hours**

INTEGRATION METHODS

Basic integration formulae for algebraic and transcendental functions. Integration by special devices: integration by parts, rationalizing substitution or trigonometric substitution, partial fractions, reduction formulas, improper integrals, convergence tests.

UNIT IV **9 Hours**

APPLICATIONS OF DERIVATIVES AND INTEGRATIONS

Extreme values, points of inflection and curve sketching, Rolles Theorem, Mean Value Theorem, optimization, indeterminate forms, L Hopitals Rule. Area between curves, volume of a general solid by slicing and cylindrical shell methods, volume of a solid of revolution, length of plane curves, area of a surface of revolution.

UNIT V **9 Hours**

COMPLEX ANALYSIS

Analytic Functions- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method. Cauchys Integral Formula - Classification of Singularities - Cauchys Residue Theorem.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 60 Hours

Reference(s)

1. Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2. Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.
3. Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
4. Anton H, Calculus with Analytic Geometry, 5th edition, John Wiley & Sons, 1995.
5. Ayres F Jr and Mendelson E, Schaum s Outline of Theory and Problems of Calculus, 4th edition, McGraw Hill, 1999.
6. S.C. Gupta, Fundamentals of Statistics, 7th Edition, Himalaya Publishing House Pvt. Ltd. 2018.

20AI102 ENGINEERING PHYSICS I

2 0 2 3

Course Objectives

- Illustrate the Newtons laws of motion and wave motion with applications
- Understand the basic properties of electricity, magnetism and optics
- Differentiate the special theory of relativity and quantum physics from classical physics

Course Outcomes (COs)

- Illustrate the Newtons three laws of motion and apply the same to solve the real world problems involving elevator, atwood machine and acceleration of objects
- Exemplify the physical characteristics of simple harmonic motion, wave motion and find the solutions for wave equations
- Infer the fundamental laws, properties of electricity and magnetism and apply the same to electric and magnetic elements

- Apply the principles of physical and geometrical optics in the mirrors, lenses, microscopes and diffraction gratings
- Outline the importance of special theory of relativity, quantum physics and analyse the wave and particle nature of matter

UNIT I **6 Hours**

MECHANICS

Newtons laws of motion: Concept of force and its nature-Newtons first law and inertial frames- definition of mass -Newtons second law-gravitational force and weight -Newtons third law. Applications of Newtons laws: particle in equilibrium, particle under net force-weighing a mass in an elevator, the atwood machine and acceleration of two objects connected by a cord

UNIT II **6 Hours**

OSCILLATIONS AND WAVES

Fundamentals of simple harmonic motion -energy of simple harmonic oscillator -spring mass system -time period of simple pendulum, compound pendulum and torsional pendulum - Damped oscillations. Travelling wave motion -sinusoidal waves on strings -speed of a wave -reflection and transmission -rate of energy transfer in wave motion

UNIT III **6 Hours**

ELECTRICITY AND MAGNETISM

Point charges-electric fields -Gauss law and its applications -electric potential -capacitance -energy stored in a capacitor. Concept and source of magnetic fields -Amperes theorem -determination of magnetic field due to different current distributions -Faradays law -self-induction and mutual induction -energy stored in an inductor

UNIT IV **6 Hours**

LIGHT AND OPTICS

Nature of light -laws of reflection and refraction -refractive index and Snells law -dispersion of light -total internal reflection -image formation: concave mirrors -convex mirrors -thin lenses -compound microscope -human eye. Conditions of interference -Youngs double slit experiment - intensity distribution of interference -phase change due to reflection -diffraction-narrow slit diffraction -single slit and two slit -intensity distribution -diffraction grating -applications

UNIT V **6 Hours**

MODERN PHYSICS

Special theory of relativity -simultaneity and time dilation -twin paradox -length contraction -relativistic mass variation -space time graph.Black body radiation and Planck hypothesis -allowed energy levels -thermal radiation from different objects -photoelectric and Compton effect. Matter waves -de-Broglie hypothesis -wave nature of particles -Davission-Germer experiment

EXPERIMENT 15 Hours

Determination of resultant of system of concurrent coplanar forces-Parallelogram law of forces

EXPERIMENT 25 Hours
Determination of moment of inertia-Torsional pendulum

EXPERIMENT 35 Hours
Determination of wavelength of mercury spectral lines-spectrometer

EXPERIMENT 44 Hours
Determination of refractive index of solid and liquid-travelling microscope

EXPERIMENT 53 Hours
Determination of wavelength of laser-diffraction grating

EXPERIMENT 64 Hours
Determination of frequency of a tuning fork-Meldes apparatus

EXPERIMENT 74 Hours
Thickness of a thin wire using interference of light-Air wedge method
Total: 60 Hours

Reference(s)

1. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2011
2. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011
3. H C Verma, Concepts of Physics (Vol I & II), BharathiBhawan Publishers & Distributors, New Delhi, 2017
4. H D Young and R A Freedman, Sears and Zemanskys University Physics with Modern Physics, Pearson education, 2016
5. R K Gaur and S L Gupta, Engineering Physics, DhanpatRai Publications, 2012

20AI103 ENGINEERING CHEMISTRY I

2 0 2 3

Course Objectives

- Identify the properties and applications of optical materials for smart screen
- Summarize the conducting materials and explain its applications to smart screens
- Classify the materials for data storage in electronic devices
- Outline the applications of organic materials in data storage
- Choose the suitable materials for the fabrications of microprocessors in electronic devices

Course Outcomes (COs)

1. Compare the inorganic and organic materials used for smart screen fabrication
2. Demonstrate the fabrication of smart screen using conducting material
3. Analyse the type of materials for data storage in electronic devices
4. Identify various organic nanoscale materials in data storage
5. Select suitable materials for fabrication of microprocessor

UNIT I **6 Hours**

OPTICAL MATERIAL FOR SMART SCREEN

Types: Inorganic: Rare earth metals [yttrium, lanthanum, cerium, praseodymium, neodymium, europium, terbium and dysprosium] - organic : Organic dielectric material [Polystyrene, PMMA] - organic light emitting diodes [polythiopene]

UNIT II **6 Hours**

CONDUCTING MATERIALS FOR SMART SCREEN

Conductive components: Indium tin oxide [properties and applications] - touch screen [resistive and capacitive]. Chemical components in glass - alumino silicate - gorilla glass

UNIT III **5 Hours**

MATERIALS FOR DATA STORAGE

Classification - magnetic storage [Iron oxide, cobalt alloy, chromium oxide and barium ferrite] - optical storage [photochromic materials] - solid storage

5 Hours

UNIT IV

ORGANIC NANOSCALE MATERIAL FOR DATA STORAGE

Data Storage - classification [media, access, information and volatility] - flexible data storage [transistor Structure] - flexible floating gate - flexible charge trap- flexible ferroelectric- flexible resistive memory with organic material

7 Hours

UNIT V

MATERIALS FOR MICROPROCESSOR FABRICATION

Micro electrical components: Fabrication (CVD method) and use of metal oxide materials. Integrated circuit manufacturing - preparation of silicon wafer - masking - photo-resistant materials - classification. Doping: Atomic diffusion, ion implantation, making successive layers. Microcapacitors: Types - electrochemical capacitors, electrolytic capacitors and supercapacitors. Soldering materials: copper, tin and silver

FURTHER READING

Applications of advanced data storage materials in electronic devices. Conducting materials for smart screen Applications of smart material for microprocessor fabrication

EXPERIMENT 15 Hours

Estimation of copper content in a sample solution prepared from copper doped optical light emitting diodes

EXPERIMENT 25 Hours

Determination of conductivity of aluminium chloride, aluminium silicate and tin oxide compounds using conductivity meter

EXPERIMENT 35 Hours

Estimation of barium content in a sample solution prepared from iron alloy used in magnetic storage material

EXPERIMENT 44 Hours

Estimation of iron content in sample solution prepared from ferro electric materials using spectrophotometer

EXPERIMENT 56 Hours

Electroless plating of copper on polymeric material used in IC fabrication

EXPERIMENT 66 Hours

Electroless plating of nickel on polymeric material used in IC fabrication

Total: 60 Hours

Reference(s)

1. Smart Materials Taxonomy, Victor Goldade, Serge Shil"ko, Aleksander Neverov, CRC publication, 2015
2. https://www.dmccoltd.com/english/museum/touchscreens/technologies/projected.asp
3. Advanced Magnetic and Optical Materials, edited by Ashutosh Tiwari, Parameswar K. Iyer, Vijay Kumar, Hendrik Swart, wiley publication, 2016
4. Recent Advances of Flexible Data Storage Devices Based on Organic Nanoscaled Materials- Li Zhou, Jingyu Mao, Yi Ren, Su-Ting Han, V A. L. Roy and Ye Zhou, Small 1703126, 2018
5. Padma L Nayak, Polymer Science, 1st Edition, Kalyani Publishers, New Delhi, 2005
6. G.M. Crean, R. Stuck, J.A. Woollam . Semiconductor Materials Analysis and Fabrication Process Control Elsevierpublication, 2012

20AI104 PROGRAMMING FOR PROBLEM SOLVING

2 0 2 3

Course Objectives

- Understand the basics of C primitives, operators and expressions.
- Gain knowledge about the different primitive and user defined data types.
- Impart knowledge about the structural programming concepts.

Course Outcomes (COs)

1. Explain the basic C programming concepts
2. Implement C programs using control statements
3. Implement the concepts of Arrays and strings in C
4. Implement the concepts of functions and pointers in C
5. Analyze the concepts of structures, unions and files in C

UNIT I **6 Hours**

INTRODUCTORY CONCEPTS

C Primitives: Introduction to C- planning and writing a C program- Character Set - Keywords and Identifiers - Data Types - Variables and Constants - Compiling and executing the C program Operators and Expressions: Arithmetic - Relational - Logical - Increment and decrement - Conditional - Bitwise - Comma - Sizeof() - Assignment - Shift operator - Precedence and order of evaluation TypeConversion-Input and Output Operations: Formatted I/O functions - getchar and putchar function - gets and puts functions

UNIT II **6 Hours**

CONTROL STATEMENTS

Decision Making and Branching: simple if statement - if else statement - nesting of if else Statement - Switch Statement. Decision Making and Looping: while statement - do while statement - for statement - Nested for statement Jump Statements: goto - break - continue - return statement

UNIT III **6 Hours**

ARRAYS AND STRINGS

Arrays: Introduction, one dimensional array, declaration - Initialization of one dimensional array, two-dimensional arrays, initializing two dimensional arrays, multi-dimensional arrays. Strings: Declaring and initializing string variables- Reading strings from terminal - writing string to screen - String handling functions.

UNIT IV **6 Hours**

FUNCTIONS AND POINTERS

User Defined Functions: Elements of user defined functions - Definition of functions - return values and their types - function calls - function declaration - categories of function - call by value and call by reference -recursion - Pre-processor directives and macros. Pointers: Understanding Pointers - accessing the address of the variable - declaring pointer variables - Initialization of pointer variables - Accessing a variable through its pointer

UNIT V **6 Hours**

STRUCTURES AND FILES

Storage Class Specifiers: Auto - registers - static - extern - typedef Structures and Unions: Introduction - defining a structure - declaring structure variables - accessing structure members - structure initialization - Unions - Enumerated data type

File Management in C: Defining and opening a file - closing a file - Input/output operations on files - Command line arguments

EXPERIMENT 14 Hours

Write a C program to perform arithmetic operations on integers and floating point numbers.

EXPERIMENT 24 Hours

Write a C program to implement ternary operator and relational operators.

EXPERIMENT 32 Hours

Write a C program to read the values of A, B, C through the keyboard. Add them and after addition check if it is in the range of 100 to 200 or not. Print separate message for each.

EXPERIMENT 42 Hours

Write a C program to display the roots of a quadratic equation with their types using switch case.

EXPERIMENT 52 Hours

Write a C program to generate the following triangle.
1
1 2 3
1 2 3 4 5
1 2 3 4 5 6 7

EXPERIMENT 64 Hours

Write a C program to get a matrix of order 3x3 and display a matrix of order of 4x4, with the fourth row and column as the sum of rows and columns respectively.

EXPERIMENT 72 Hours

Write a c program to remove the occurrence of "the" word from entered string.

EXPERIMENT 82 Hours

Write a C program to find the factorial of given number.

EXPERIMENT 94 Hours

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Studentdetails: rollno, name, branch, year, section, cgpa. **********
NAME:
ROLL NO:
BRANCH:
YEAR:
SECTION:
CGPA:

EXPERIMENT 104 Hours

Create two files test1.txt and test2.txt and write a C program to read the file text1.txt character by character on the screen and paste it at the end of test2.txt

Total: 60 Hours

Reference(s)

1. Herbert Schildt, C -The complete Reference, Tata McGraw-Hill, 2013
2. Byron Gottfried, Programming with C, Schaum"s Outlines, Tata Mcgraw-Hill, 2013
3. E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4. Kernighan B W and Ritchie O M, The C programming Language. Prentice-Hall of India, 2009
5. Kelley A and I. Pohl, A Book on C: Programming in C, Pearson Education, 1998
6. Ashok.N.Kamthane,Programming in C,Pearson education,2013

20AI105 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

2 0 2 3

Course Objectives

- To understand the basic concepts of electric circuits and magnetic circuits.
- To illustrate the construction and operation of various electrical machines and semiconductor devices.
- To learn the fundamentals of communication systems.

Course Outcomes (COs)

1. Understand the basic concepts of electric and magnetic circuits.
2. Summarize the types of DC machines.
3. Classify the static and dynamic AC machines and explain their operation.
4. Interpret the operation of AC and DC drives
5. Illustrate the characteristics of semiconductor devices and communication systems.

UNIT I **7 Hours**

ELECTRIC CIRCUITS

Definition of Voltage, Current, Electromotive force, Resistance, Power & Energy, Ohms law and Kirchoffs Law & its applications - Series and Parallel circuits - Voltage division and Current division techniques - Generation of alternating emf - RMS value, average value, peak factor and form factor- Definition of real, reactive and apparent power.

UNIT II **5 Hours**

DC MACHINES

Introduction of magnetic circuits - Law of Electromagnetic induction, Flemings Right & Left hand rule- Types of induced emf - Definition of Self and Mutual Inductance - DC Motor- Contruction - Working Principle- Applications.

UNIT III **6 Hours**

AC MACHINES

Single Phase Transformer - Alternator - Three phase induction motor - Single phase induction motor - Construction - Working Principle - Applications.

UNIT IV **5 Hours**

ELECTRICAL DRIVES

Speed control of dc shunt motor and series motor - Armature voltage control - Flux control - Construction and operation of DC servo motor - Construction and operation of DC servo motor stepper motor.

UNIT V **7 Hours**

ELECTRON DEVICES AND COMMUNICATION

Characteristics of PN Junction diode and Zener diode - Half wave and Full wave Rectifiers - Bipolar Junction Transistor - Operation of NPN and PNP transistors - Logic gates - Introduction to communication systems.

FOR FURTHER READING

Voltage Regulator - Stepper motor - Energy meter - SMPS, Satellite and Optical communication.

EXPERIMENT 1 4 Hours

Analyze the VI characteristics of a fixed resistor and a lamp by varying its temperature.

EXPERIMENT 2 4 Hours

Apply the voltage division and current division techniques for series and parallel connections of lamp loads.

EXPERIMENT 3 4 Hours

Understand the concept of electromagnetic induction using copper coil.

EXPERIMENT 4 4 Hours

Understand the construction and working principle of DC machines.

EXPERIMENT 5 6 Hours

Determine the VI Characteristics of PN Junction diode and plot the input and output wave shapes of a half wave rectifier.

EXPERIMENT 64 Hours

Realize the working of transistor as an electronic switch through experiments.

EXPERIMENT 74 Hours

Lighting applications using logic gates principle.

Total: 60 Hours

Reference(s)

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Smarjith Ghosh, Fundamentals of Electrical and Electronics Engineering, Prentice Hall (India) Pvt. Ltd., 2010.
3. A. Sudhakar, Shyammohan S Palli, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill, 2010
4. R. S. Sedha, A Textbook of Applied Electronics, S.Chand& Company Ltd, 2013

20HS101 COMMUNICATIVE ENGLISH I

1 0 2 2

Course Objectives

- Read and understand the main points on familiar matters regularly encountered in work, school or leisure.
- Listen and respond in most common situations where English is spoken.
- Write simple connected texts on topics which are familiar or of personal interest.
- Describe experiences and events, hopes and ambitions and briefly give reasons and explanations for opinions and plans.

Course Outcomes (COs)

1. Use appropriate grammar & vocabulary that is expected at the BEC Preliminary exam level.
2. Understand the general meaning of non-routine letters within own work area, and short reports of a predictable nature.
3. Write straightforward, routine letters of a factual nature, and make notes on routine matters, such as taking/placing orders.
4. Follow simple presentations/demonstrations.
5. Deal with predictable requests from a visitor, state routine requirements, and offer advice within own job area on simple matters.

UNIT I Grammar **9 Hours**

Tenses – Future continuous, Past continuous, Past perfect, Past simple, Past tense responses, Present perfect continuous, Present perfect/past simple – Reported speech – Adverbs – intensifiers – Comparatives and superlatives – Conditionals 2nd and 3rd – Connecting words expressing cause and effect, contrast – Phrasal verbs – Prepositions of place – Simple passive - Wh-questions in the past – Question tags – Will and going to, for prediction – Gender Sensitive Vocabulary.

UNIT II Reading **9 Hours**

Understanding short real-world notices, messages – Detailed comprehension of factual material; skimming and scanning skills - Interpreting visual information – Reading for detailed factual information – Reading for gist and specific information - Grammatical accuracy and understanding of text structure - Reading and information transfer.

UNIT III Writing **9 Hours**

Internal communication including note, message, memo or email - arranging / rearranging appointments, asking for permission, giving instructions - Business correspondence including letter, email – apologising and offering compensation, making or altering reservations, dealing with requests, giving information about a product –Hierarchy in Business Correspondence.

UNIT IV Listening **9 Hours**

Listening for specific information – Listening for numbers and letters – Note completion – Listening for gist – listening to monologues (presentations, lectures, announcements and briefings) – listening to interacting speakers (telephone conversations, face-to-face conversations, interviews and discussions).

UNIT V Speaking **9 Hours**

Exchanging personal and factual information – expressing and finding out about attitudes and opinions – organise a larger unit of discourse – Turn-taking, negotiating, collaborating, exchanging information, expressing and justifying opinions, agreeing and/or disagreeing, suggesting, speculating, comparing and contrasting, and decision-making.

Total: 45 Hours

Reference(s)

1. Alexander Garrett, Cambridge BEC Preliminary Students Book with Answers, Cambridge University Press, 2016.
2. Lan Wood, Anne Williams and Anna Cowper. Pass Cambridge BEC Preliminary, Second Edition, New Delhi, 2014.
3. Norman Whitby. Cambridge Business Benchmark. Pre-Intermediate to Intermediate, Students Book. South Asian Edition, 2018.

20AI201 ENGINEERING MATHEMATICS II

3 1 0 4

Course Objectives

- Understand the concepts of partial derivatives and multiple integrals to define the area, volume and extreme values of various surfaces in engineering fields.
- Classify the sequences and series in linear systems is convergent or divergent.
- Formulate the real time engineering problem into mathematical model using ordinary differential equation and solve it by appropriate method.

Course Outcomes (COs)

1. Illustrate the various parameters in partial differentiation and characterize the maxima and minima functions for signals and systems.
2. Apply multiple integral concepts to calculate the area and volume by appropriate vector integral theorems.
3. Analyse the convergence and divergence of sequences and series by various tests.
4. Construct first order differential equations from real time phenomena and solve it by suitable method.
5. Execute the appropriate method to solve the second order differential equations.

UNIT I **9 Hours**

PARTIAL DIFFERENTIATION

Functions of several variables, plotting of 2-variable functions, introduction to cylindrical and spherical coordinates, chain rule, total differential, gradient, directional derivatives, normal lines and tangent planes, extreme of functions of two variables, applications.

UNIT II **9 Hours**

MULTIPLE INTEGRALS

Double integrals, regions of integrations, triple integrals, applications (Cartesian coordinates only- Greens theorem and Gauss Divergence theorem).

UNIT III **9 Hours**

SEQUENCES AND SERIES

Sequences and series, convergence and divergence of series, absolute convergence, conditional convergence, test for convergence and divergence. Power series for functions, interval of convergence, Taylor and Maclaurin series, Taylors Theorem with remainder.

UNIT IV **9 Hours**

FIRST ORDER DIFFERENTIAL EQUATIONS

Separable differential equations, homogeneous differential equations, exact differential equations, integrating factor, Bernoullis equation, applications

UNIT V **9 Hours**

SECOND ORDER DIFFERENTIAL EQUATIONS

Second order homogeneous and non-homogeneous equations with constant coefficients, variation of parameters, method of undetermined coefficients, series solutions of differential equations, applications.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 60 Hours

Reference(s)

1. Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2. Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
3. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
4. Peter V. O Neil , Advanced Engineering Mathematics, Seventh Edition , Cengage Learning India Private Limited, 2012.
5. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India, 2014.

20AI202 ENGINEERING PHYSICS II

2 0 2 3

Course Objectives

- understand the applications of laser and fibre optics in the field of engineering
- impart knowledge in crystallography and semiconductors
- differentiate the different types of magnetic materials and their applications

Course Outcomes (COs)

1. Understand the principle, characteristics, different types of lasers and apply the same for optical data storage and retrieval techniques
2. Illustrate the propagation of light through different optical fibers, applications of optical fibers in communication and sensors
3. Identify the seven crystal systems, crystal planes and the stacking sequences in metallic crystal structures
4. Analyse the characteristics of semiconducting materials interms of crystal lattice, charge carriers and energy band diagrams

5. Outline the properties of magnetic materials, domain theory of ferromagnetism and the applications for recording and readout process

UNIT I **7 Hours**

LASER

Principle - interaction of radiation with matter - characteristics of laser radiation - pumping mechanisms - types: CO2 laser -homo junction GaAs laser -applications: optical data storage and retrieval techniques - holography: principle -types - comparison of holography with photography - construction - reconstruction of hologram -applications

UNIT II **7 Hours**

FIBER OPTICS

Principle- conditions to achieve total internal reflection- structure- acceptance angle and numerical aperture (qualitative treatment only)- types- modes of propagation- refractive index profile- block diagram of fiber optic communication system- fiber optic sensors- intensity modulated sensor-endoscopy - merits of fiber cables over conventional communication systems

UNIT III **5 Hours**

CRYSTAL PHYSICS

Crystalline and amorphous materials - lattice -lattice point -basis - unit cell - crystal systems - Bravais lattices -planes in crystals- Miller indices -procedure for finding Miller indices- important features of Miller indices-unit cell characteristics of SC, BCC, FCC and HCP structures

UNIT IV **6 Hours**

SEMICONDUCTING MATERIALS

Characteristics -elemental and compound semiconductors- energy band description and current conduction in intrinsic semiconductors- energy band description of n-type and p-type semiconductors- conductivity of extrinsic semiconductors - variation of Fermi level with temperature and impurity concentration- temperature dependence on carrier concentration - Hall effect-applications - solar cells - photodiodes

UNIT V **5 Hours**

MAGNETIC MATERIALS

Fundamental definitions -Bohr magneton- classification of dia, para and ferromagnetic materials - domain theory - hysteresis curve - soft and hard magnetic materials -energy product and its importance - anti-ferromagnetic materials - ferrites -giant magneto resistance (GMR) effect -application: Principles of Magnetic Recording- Magnetic Digital Recording- Magneto-Optic Recording

EXPERIMENT 12 Hours

Exposure to Engineering Physics Laboratory and precautionary measures

EXPERIMENT 24 Hours

Determine the wavelength of given laser source by applying the principle of diffraction

EXPERIMENT 3 4 Hours

Determination of acceptance angle and numerical aperture of a given fiber

EXPERIMENT 4 4 Hours

Evaluation of bandgap of given material using bandgap kit.

EXPERIMENT 5 4 Hours

Determine the V-I characteristics of a solar cell

EXPERIMENT 6 4 Hours

Using Hall effect, determine the nature of given material

EXPERIMENT 7 4 Hours

Find the refractive index of a transparent solid with the aid of travelling microscope

EXPERIMENT 8 4 Hours

Determination of energy loss per cycle of a ferromagnetic material using hysteresis curve

Total: 60 Hours

Reference(s)

1. Balasubramaniam, R. Callisters Materials Science and Engineering Wiley India Pvt.Ltd, 2014
2. Kasap, S.O. Principles of Electronic Materials and Devices McGraw-Hill Education,2017
3. Wahab, M.A. Solid State Physics: Structure and Properties of Materials Alpha Science International Ltd., 2017
4. Donald A. Neamen. Semiconductor Physics and Devices, McGraw-Hill, 2011
5. K. Thiyagarajan and A. K. Ghatak, LASERS: Fundamentals and Applications, Springer, USA, 2015
6. B.D. Cullity, Introduction to Magnetic Materials, Addison-Wesley

20AI203 ENGINEERING CHEMISTRY II

2 0 2 3

Course Objectives

- Classify the traditional and advanced materials used to manage heat developed in electronic devices
- Summarize the terminologies of electrochemistry and explain the applications of energy storage devices for computers
- Indicate the types, properties and applications of nanochips and carbon nanotubes used in electronic devices
- Outline sources of e-wastes and its effects on environment and its management

Course Outcomes (COs)

1. Compare the metals and alloys used as thermal management materials in electronic devices
2. Interpret the advanced thermal management materials for microelectronics and optoelectronics
3. Analyze the importance of primary, secondary batteries and fuel cells used in energy storage devices in computers
4. Identify suitable nanomaterial used for diverse applications in electronic devices
5. Select a suitable technology to manage e-wastes from various electronic devices

UNIT I **6 Hours**

THERMAL MANAGEMENT MATERIALS

Heat generation - purpose - classification of electronic packaging - types of thermal management materials - traditional thermal management materials : Metals [Cu, Al, W and Mo] - compounds [Al2O3, BeO, AlN, SiC and Kovar alloy]

UNIT II **7 Hours**

ADVANCED THERMAL MANAGEMENT MATERIALS

Alloys: W-Cu, Mo-Cu, Cu/MoCu/Cu, AlSiC, Cu/SiC and W85-Cu. Fiber-reinforced material - sandwich structure of composite - thermal management materials for microelectronics and optoelectronics: Carbon nanotubes and aluminium/diamond composites

UNIT III **7 Hours**

ENERGY STORAGE DEVICES FOR COMPUTERS

Cell - cell potential - determination of potential. Batteries - types: Primary battery [Zinc-carbon]. Secondary battery: lead-sulphur. Modern battery: lithium polymer battery and fuel cells

UNIT IV **5 Hours**

NANOMATERIALS

Nano chips - types of material - properties - applications. Carbon nanotubes - fullerene, graphene : Types and applications

UNIT V **5 Hours**

E- WASTE MANAGEMENTS

Sources - toxicity due hazardous substances - impact to environment. E-waste management- Hazardous materials recycling (Gallium and Arsenic)

EXPERIMENT 18 Hours

General introduction and Determination of thermal stability of aluminium oxide using thermo gravimetric analysis

EXPERIMENT 24 Hours

Determination of thermal stability of copper alloys using thermo gravimetric analysis

EXPERIMENT 36 Hours

Determination of single electrode potential of zinc and copper electrodes

EXPERIMENT 46 Hours

Preparation of cadmium nanoparticles and its characterization

EXPERIMENT 56 Hours

Estimation of chromium and lead content in sample solution prepared from e-waste [PCB] using spectrophotometer

Total: 60 Hours

Reference(s)

1. Ravi Kandasamy, Arun S. Mujumdar. Thermal Management of Electronic Components. Lap Lambert Academic Publishing GmbH KG, 2010.
2. Guosheng Jiang, Liyong Diao, Ken Kuang. Advanced Thermal Management Materials. Springer Science & Business Media, 2012.
3. Nihal Kularatna. Energy Storage Devices for Electronic Systems: Rechargeable Batteries and Supercapacitors. Academic Press, 2014.
4. Odne Stokke Burheim. Engineering Energy Storage. Academic Press, 2017.
5. M. S. Dresselhaus, G. Dresselhaus, P. C. Eklund. Science of Fullerenes and Carbon Nanotubes: Their Properties and Applications. Elsevier, 1996.
6. Kazuyoshi Tanaka, S. Iijima. Carbon Nanotubes and Graphene. Edition 2, Newnes, 2014.

20AI204 APPLICATION BASED PROGRAMMING IN PYTHON

3 0 2 4

Course Objectives

- Develop a basic understanding Python programming language
- Solve problems requiring the writing of well-documented programs in the Python language, including use of the logical constructs of that language
- Demonstrate significant experience in data structures with the Python program

Course Outcomes (COs)

1. Explain the basic concepts of Python programming
2. Implement Python programs using control statement and functions
3. Develop Python programs for the data structures String, List and Set
4. Implement Python programs for tuples and dictionaries data structures
5. Develop Python programs for files, modules and packages

UNIT I9 Hours

THEORY COMPONENT CONTENTS BASICS OF PYTHON PROGRAMMING

Introduction-Python – Object Oriented Programming –Classes , Object and Instances- Constructor, class attributes and destructors –decorator pattern – real time uses of class in live projects- inheritance, overlapping and overloading operators- adding and retrieving dynamic attributes of classes-programming using Oops Support.

9 Hours

UNIT II

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON

Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, Break, continue, pass; Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion

9 Hours

UNIT III

DATA STRUCTURES: STRINGS, LISTS, SET

Strings: string slices, immutability, string methods and operations; Lists: creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions ; list processing : list comprehension, searching and sorting, Sets: creating sets, set operations.

8 Hours

UNIT IV

DATA STRUCTURES: TUPLES, DICTIONARIES, ARRAYS

Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries, Arrays : operations and methods

10 Hours

UNIT V

FILES, MODULES, PACKAGES

Files and exception: text files, reading and writing files, format operator, exception handling, modules, packages

EXPERIMENT 12 Hours

Programs using expressions and input and output statements.

EXPERIMENT 22 Hours

Programs using operators and built in functions.

EXPERIMENT 32 Hours

Programs using conditional statements.

EXPERIMENT 42 Hours

Programs performing all string operations.

EXPERIMENT 52 Hours

Programs using functions

EXPERIMENT 62 Hours

Programs to find square root, GCD, exponentiation, sum an array of numbers

EXPERIMENT 72 Hours
Programs to perform linear search, binary search

EXPERIMENT 82 Hours
Programs to perform operations on list

EXPERIMENT 92 Hours
Programs using dictionary and set

EXPERIMENT 102 Hours
Programs to work with Tuples.

EXPERIMENT 112 Hours
Programs to sort elements (Selection, Insertion, Merge, Quick)

EXPERIMENT 122 Hours
Program to perform word count in file.

EXPERIMENT 132 Hours
Program to perform file operations

EXPERIMENT 142 Hours
Program to count the number of characters, words and lines in a text file

EXPERIMENT 152 Hours
Programs using modules and packages

Total: 75 Hours

Reference(s)

1. Ashok Namdev Kamthane,Amit Ashok Kamthane, Programming and Problem Solving with Python , Mc-Graw Hill Education,2018.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff Reilly Publishers, 2016
3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press , 2013.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.

20AI205 DIGITAL SYSTEM DESIGN

3 0 2 4

Course Objectives

- Understand the fundamentals of digital logic
- Understand the implementation of logic circuits.
- Analyse and design various combinational and sequential circuits.

Course Outcomes (COs)

1. Understand the boolean algebra and logic gates.
2. Design and analyze combinational circuits.
3. Implement synchronous sequential logic
4. Understand the procedures in Asynchronous sequential logic
5. Implement the design with MSI devices

UNIT I **9 Hours**

BOOLEAN ALGEBRA AND LOGIC GATES

Number systems and conversions - Boolean algebra - Minterm - Maxterm - SOP and POS forms - NAND and NOR implementation - Simplification of Boolean functions: K Map - Don"t care conditions - Five variable K map - Quine Maccluskey method - Logic gates.

UNIT II **9 Hours**

COMBINATIONAL LOGIC

Combinational circuits - Analysis procedures - Design procedures - Adders - Subtractors - Binary adder - Carry Look Ahead Adder - BCD Adder - Magnitude comparator - Code Converters - Multiplexers and Demultiplexers- Function realization using multiplexers - Decoders and encoders.

UNIT III **10 Hours**

SYNCHRONOUS SEQUENTIAL LOGIC

Sequential circuits - Flip flops - Flip Flop Conversion - Analysis procedures - Design procedures - Moore and Mealy models - State reduction and state assignment - Shift Registers - Counters.

UNIT IV **10 Hours**

ASYNCHRONOUS SEQUENTIAL LOGIC

Design of Asynchronous sequential circuits - Analysis procedure: Transition Table - Flow Table - Race Condition- stability, Design Procedure: Primitive Flow Table- Reduction- Transition Table- Race Free State Assignment- Hazards.

UNIT V **7 Hours**

DESIGN WITH MSI DEVICES

Programmable Logic Devices (PLD) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA, PAL.

FOR FURTHER READING

Design of a simple CPU - ASM charts - Hardware Description Language - RTL Design

EXPERIMENT 12 Hours

Implement Boolean Laws using Logic Gates

EXPERIMENT 24 Hours

Implement arithmetic circuits (Adder, Subtractor)

EXPERIMENT 32 Hours

Construct Code convertors (BCD, Gray, Excess -3)

EXPERIMENT 44 Hours

Construct Parity generator and parity checker

EXPERIMENT 52 Hours

Construct Magnitude comparator

EXPERIMENT 64 Hours

Demonstrate Multiplexer and Demultiplexers

EXPERIMENT 72 Hours

Function realization using multiplexers

EXPERIMENT 84 Hours

Demonstrate Encoder and Decoder

EXPERIMENT 92 Hours

Construct synchronous and Ripple counter

EXPERIMENT 104 Hours

Implement shift register (SISO, SIPO, PISO, PIPO)

Total: 75 Hours

Reference(s)

1. M.Morris Mano and Michael D Ciletti, Digital Design with an introduction to the VHDL, Pearson Education, 5th Edition, 2013
2. A Anand Kumar, Fundamentals of Digital Circuits, 3rd Edition,2014
3. Charles H.Roth, Jr., Fundamentals of Logic Design, 4th Edition, Jaico Publishing House, 2000
4. Mandal, Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
5. Donald D.Givone, Digital Principles and Design, Tata McGraw-Hill, 2003.
6. John M.Yarbrough, Digital Logic, Application & Design, Thomson, 2002.

20AI301 – STATISTICS AND PROBABILITY

3 0 0 3

Course Objectives

- Understand the basic concepts of Statistics and apply testing of hypothesis.
- Analyze the data from the real world problems by various statistical techniques.
- Understand the basic concepts of probability and the distributions with characteristics of one and two dimensional random variables
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Course Outcomes (COs)

1. Interpret the data from the application problems and infer the decision by various statistical techniques.
2. Analyze the real life phenomena and compute the solution by ANOVA techniques.
3. Analyze the statistical quality of solutions by various charts.
4. Demonstrate and apply the basic probability axioms and probability distribution concepts in their core areas of random phenomena
5. Exemplify the concepts two dimensional random variables and apply it to core areas.

UNIT I **9 Hours**

Statistical Hypothesis

Introduction - Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, and F test for mean, variance – Chi-square test: Contingency table (test for independent) – Goodness of fit.

UNIT II **9 Hours**

Design of Experiments

Basic definition- Principles of experimental design – Analysis of variance(ANOVA) - One way and two way classifications: Completely Randomized Design – Randomized Block Design – Latin Square Design

UNIT III **9 Hours**

Statistical Quality Control

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

UNIT IV **9 Hours**

Probability theory

Probability – definitions - axioms of probability - Combinatorial Probability - Conditional Probability - Bayes Theorem. Random variables: Discrete and continuous random variables - Probability distributions: Binomial distribution - Poisson distribution – Normal distribution

UNIT V **9 Hours**

Two dimensional Random variables

Joint distributions – Marginal and conditional distributions – Covariance – Correlation: Properties - Regression

FOR FURTHER READING

Implement computer algorithms to statistical techniques and analyse the processing time.

Total: 45 Hours

Reference(s)

1. A.Goon,M.Gupta and B.Das Gupta ,Fundamentals of Statistics, World Press Private Ltd.,1968
2. A.M.Mood,F.A.Graybill and D.C. Boes,Introduction to the Theory of Statistics,3rd Edition, Tata Mc Graw Hill Education,1973.
3. T Veerarajan, Probability, Statistics and Random Processes, Tata Mc Graw Hill Education, 4th Edition, 2017
4. S.M.Ross, Introduction to Probability Models,11th Edition, Academic Press, New York,2014.
5. B.S.Grewal, Higher Engineering Mathematics,43rd Edition, Khanna Publication,Delhi,2014.

20AI302 DATA STRUCTURES USING C++

3 0 0 4

Course Objectives

- Understand the concepts of Object Oriented Programming.
- Implement ADTs such as arrays, lists, stacks, queues, trees, graphs, search trees in C++ to solve real world problems.
- Analyze various searching and sorting techniques.

Course Outcomes (COs)

1. Identify the features of object oriented concepts in C++
2. Exemplify the operations and applications of Stack ADT, Queue ADT and List ADT
3. Classify the types of tree data structures and explain the tree traversal methods
4. Outline the features and applications of graph data structure
5. Design algorithms for searching and sorting techniques

9 Hours

UNIT I

Introduction

Need for Object Oriented Programming - Characteristics of Object Oriented Programming - Classes and Objects – Member Functions - Constructors and Destructors - Operator Overloading - Inheritance - Function Overloading.

9 Hours

UNIT II

Stacks and Queues

Classification of Data Structures -Abstract Data Types(ADTs) - Array Implementation - Linked List Implementation - Types of Linked List - Applications of List - Stack ADT - Operations – Applications of Stack - Queue ADT - Operations - Circular Queue - Priority Queue - Dequeue - Applications of Queue.

9 Hours

UNIT III

Trees

Tree ADT - Tree Traversals - Binary Tree ADT - Expression Trees - Applications of Trees - Binary Search Tree ADT - AVL Trees – Heap Tree- B-Tree - B+ Tree - Heap - Applications of Heap.

9 Hours

UNIT IV

Graphs

Definition - Representation of Graph - Types of Graph - Breadth-First Traversal - Depth-First Traversal - Topological Sort - Shortest Path Algorithms: Unweighted Shortest Paths - Dijkstra's Algorithm - Minimum Spanning Tree: Prim's Algorithm - Kruskal's Algorithm**.**

9 Hours

UNIT V

Searching, Sorting and Hashing Techniques

Searching: Linear Search - Binary Search -Sorting : Bubble Sort - Selection Sort - Insertion Sort - Shell Sort - Radix Sort - Merge Sort – Hashing: Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

FOR FURTHER READING

Set - Extensible Arrays – Associative Arrays – Reactive Data Structures – Distributed Data Structures – Custom Data Structures

Total: 45 Hours

Reference(s)

1. E.Balagurusamy, "Object Oriented Programming with C++", Seventh Edition, McGraw Hill Education, 2017.
2. Robert Lafore, "Object Oriented Programming in C++", Galgotia Publication, 2010.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition, Pearson Education, 2014.
4. Michael T. Goodrich, Roberto Tamassia and David M. Mount, Data structures and Algorithms in C++, Second Edition, Wiley India, 2011.
5. Sartaj Sahni, ata Structures, Algorithms, And Applications in C++, Second Edition, Silicon Press, 2004.
6. John Hubbard, Data Structures with C++, First Edition, McGraw Hill Education, 2017.
7. Adam Drozdek, Data Structures and Algorithms in C++, Fourth Edition, Cengage Learning, 2012.

20AI303 PRINCIPLES OF OPERATING SYSTEM

3 0 0 3

COURSE OBJECTIVE(S)

- To understand the concepts of the basic functionalities of an Operating Systems
- To analyze and evaluate the process of Operating Systems
- To provide knowledge on the structure and operations of memory management

COURSE OUTCOME(S)

1. Classify operating system components and system calls based on functionality
2. Analyze and evaluate CPU scheduling algorithms
3. Interpret the solutions for critical section problems and deadlock prevention
4. Analyze the memory management techniques in terms of fragmentation
5. Identify the various file organization and access methods

UNIT I **9 Hours**

OVERVIEW OF OPERATING SYSTEM

Introduction - operating system structure - Operating System Operations- Process Management - Memory Management - Storage Management- I/O systems-Protection and Security- Operating System Services- System Calls - Types of System Calls- System Programs - Operating system services and kernelFeatures.

UNIT II **9 Hours**

PROCESS MANAGEMENT

Processes - Process Concept - Process Scheduling- Operations on Processes- Inter-process Communication. Threads: Overview- Multithreading Models- Threading Issues. CPU Scheduling – BasicConcepts- Scheduling Criteria- Scheduling Algorithms- Overview of Multiprocessor Scheduling and Real time scheduling.

UNIT III **9 Hours**

SYNCHRONIZATION AND DEADLOCK

Process Synchronization: Introduction - The Critical Section Problem - Synchronization Hardware - Semaphores -Deadlocks: System Model - Deadlock Characterization - Methods for Handling Deadlock - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.

UNIT IV **8 Hours**

MEMORY MANAGEMENT

Main Memory: Background- Swapping- Contiguous Memory Allocation- Segmentation- Paging- Structure of the Page Table. Virtual Memory: Background- Demand Paging- Page Replacement - Resident set management, cleaning policy, fetch policy - Allocation of Frames- Thrashing.

UNIT V **10 Hours**

STORAGE MANAGEMENT

Overview of Mass Storage Structure - Disk Structure and attachment - Disk Scheduling – DiskManagement - Swap-Space Management. File -System Interface: File Concept - Access Methods – File System Implementation: File-System Structure - Directory Implementation - Allocation Methods - Free- Space Management.

Reference(s)

1. William Stallings, "Operating Systems Internals and Design Principles", Pearson Education, Eighth Edition, 2015.
2. John J Donovan, "System Programming", McGraw Hill Publication, Reprint, 2014.
3. William Stallings, "Operating System", Pearson Education, Sixth Edition, 2012
4. Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition Prentice Hall of India Pvt. Ltd, 2010

20AI304 COMPUTER ARCHITECTURE **3 0 0 3**

Course Objectives

- Understand the basic structure and operation of a digital computer
- Familiarize with the implementation of fixed point and floating-point arithmetic operations
- Explore the processing of instruction and control unit design
- Acquire the knowledge of Parallel processing and memory hierarchy system

Course Outcomes (COs)

1. Apply the knowledge of performance metrics to find the performance of systems
2. Determine the technique to execute multiple instruction in single core and multi-core processor
3. Analyze how parallel processing and memory system can have significant impact on performance of a digital computer
4. Identify the different types of parallelism that can be exploited in a computer architecture

5. Understand the process of controlling and coordinating computer memory.

UNIT I **9 Hours**

COMPUTER STRUCTURE

Evolution of Computers - Functional units and its operational concepts – Performance and Metrics for Performance Measurement. - Memory operations, locations and addresses - Instruction and instruction sequencing - Addressing modes - Assembly language.

UNIT II **10 Hours**

ARITHMETIC OPERATIONS

Hardware for Addition and Subtraction -Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers - Signed operand multiplication and fast multiplication-Integer division - Floating point numbers and operations.

UNIT III **9 Hours**

BASIC PROCESSING AND CONTROL UNIT

ALU Operation-Execution of a complete instruction Control Unit-Hardwired Control - Microprogrammed Control - Data path and control consideration -Pipelining and its Hazards.

UNIT IV **9 Hours**

PARALLELISM

Instruction level parallelism - Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Dynamic Scheduling- Thread Level Parallelism - Introduction, Shared-Memory Multicore Systems, Performance Metrics for Shared-Memory Multicore Systems-Flynn's classification multithreading- Data Level Parallelism- Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, GPU Memory Hierarchy.

UNIT V **8 Hours**

MEMORY MANGEMENT AND I/O SYSTEMS

Introduction- Advanced Optimizations of Cache Performance- Memory Technology and Optimizations- Virtual Memory and Virtual Machines- The Design of Memory Hierarchy - Introduction to Pin Instrumentation and Cache grind.

Total: 45 Hours

FOR FURTHER READING

Case Study: Memory Hierarchies in Intel Core i7 and ARM Cortex-A8, Dynamic Scheduling in Intel Core i7 and ARM Cortex-A8, Intel Skylake and IBM Power8 and Nvidia Maxwell .

Reference(s)

1. David A Patterson and John L Hennessey, Computer organization and design, fifth edition, Morgan Kauffman, 2014.
2. J.L. Hennessy and D.A. Patterson. Computer Architecture: A Quantitative Approach. 5th Edition, Morgan Kauffmann Publishers, 2012.
3. Carl Hamacher, Zvonko G Varanesic and Safat G Zaky, Computer Organisation, sixth edition, Mc Graw-Hill Inc, 2012.
4. William Stallings, Computer Organization and Architecture, seventh Edition, Pearson Education, 2006.
5. John P Hayes, Computer architecture and Organisation, third edition, Tata McGraw-Hill, 1998.
6. Morris Mano, Computer System Architecture, third edition, Prentice-Hall of India, 2000.

20AI305 DATABASE MANAGEMENT SYSTEMS3 0 0 3

Course Objectives

- Understand the data models, conceptualize and depict a database system using E-R diagram.
- Gain knowledge on the design principles of a relational database system and SQL.
- Impart knowledge in transaction processing, concurrency control and recovery techniques.

Course Outcomes (COs)

1. Differentiate database systems from file system by understanding the features of database system and design a ER model for a database system.
2. Develop solutions to a broad range of query and data update problems using relational algebra, relational calculus and SQL.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Compare database storage and access techniques for file organization, indexing methods and Query Processing.
5. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes

UNIT I **8 Hours**
INTRODUCTION

Introduction: Database system application, purpose of database system View of Data -Database Languages-Data Storage and Querying-Database Architecture - Database design and ER model: Overview of the design process-The ER Model - Constraints - Removing redundant attributes in Entity Sets-ER Diagram - Reduction to Relational Schemas - ER Design Issues. Case Studies on Designing Database Models

UNIT II **9 Hours**
RELATIONAL MODEL AND DATABASE DESIGN

Introduction to Relational Model - Formal Relational Query Languages - Introduction to SQL: Data definition-Basic structure of SQL Queries-Additional Basic operations -Set operations-Aggregate functions Nested sub queries-Intermediate SQL: Joins-Views-Integrity Constraints. Functional Dependencies - Normal Forms Based on primary Keys-General Definition of Second and Third Normal Form - Boyce Codd Normal Form - Multi valued dependencies and Fourth Normal Form. Case Study Implementation on Handling Data

UNIT III **8 Hours**

DATA STORAGE AND QUERY PROCESSING

Overview of Physical Storage Media - Magnetic disk Flash storage -RAID-File and Record Organization - Indexing and Hashing :Ordered Indices - B+Tree Index File-Static Hashing -Dynamic Hashing-Query Processing: Overview-measures of Query Cost. Importing / Exporting Large Amount of Data into a database.

UNIT IV **9 Hours**

TRANSACTION MANAGEMENT

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

UNIT V **11 Hours**

ADVANCED TOPICS

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL – XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

FOR FURTHER READING

Introduction to Parallel, Distributed and Object Oriented Databases- Introduction to MySQL and PHP

Total: 45 Hours

Reference(s)

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw -Hill, 2015
2. Ramez Elmasri and Shamkant B. Navathe, Fundamental Database Systems, Pearson Education, 2008
3. Raghu Ramakrishnan, Database Management System, Tata McGraw-Hill Publishing Company, 2003
4. C.J.Date,An Introduction to Database system, Pearson Education, 2006
5. Peter Rob and Corlos Coronel, Database System, Design, Implementation and Management , Thompson Learning Course Technology, 2003

20AI306 JAVA PROGRAMMING

2 0 2 3

Course Objectives

- Impart the basics of Java primitives, operators, classes and objects.
- Implement the object oriented thinking in Java
- Develop knowledge of standalone desktop and database applications using Java

Course Outcomes (COs)

1. To understand the elementary programming and object oriented thinking of Java.
2. To develop a java application using three pillars of object oriented programming concepts.
3. To define exceptions and use I/O streams and files in various roles.
4. To develop a java application with generics classes and multithreading concepts.
5. To design desktop based java applications using Java Applet, AWT, Swing and its components.

6 Hours

UNIT I

BASICS OF JAVA

The Evolution of Java- Characteristics of Java-Java Environment-Compilation and Execution-Overview of Object Oriented Programming - -Elementary Programming structures in Java- Datatypes, Variables, Arrays, Operators, Control Statements-Classes-Methods-Objects-this-Constructors and Destructors.

6 Hours

UNIT II

OBJECT ORIENTED PROGRAMMING

Inheritance: Basics - Using Super - Types of Inheritances-Polymorphism- Method overloading and Method overriding-Abstraction- Using Abstract Classesand abstract Methods-Interfaces- Definitions and Implementation-Packages - Access Protection - Importing Packages.

6 Hours

UNIT III

EXCEPTION AND I/O PROGRAMMING

Exception –Exception Hierarchy-Checked and Unchecked Exception- Exception Handling - Try and Catch – Throw and Throws-custom exceptions- Input / Output Basics - Streams - Byte streams and Character streams - Reading and Writing Files-Serialization-String Handling: Special String operations and Methods - String Buffer and String Builder

6 Hours

UNIT IV

GENERIC AND CONCURRENT PROGRAMMING

Generics Types - Generic Classes and Methods - Wild Cards and Type Erasure -Restrictions on Generics-Collection Interfaces -Collection Classes-Multithreaded Programming-Thread Model-Creating Threads-Inter Thread Communication.Lambda Expression and Annotations

6 Hours

UNIT V

EVENT PROGRAMMING

Applet Basics - Applet Architecture - Applet Display Methods - Event Handling Mechanisms - Event Classes - Event Listener - Working with Windows, Graphics, Colours and Fonts - AWT Controls - Introduction to Swing - Swing Components-Layout Managers- JDBC Concepts

FOR FURTHER READING

Java FX vs Swing and AWT,Java FX controls- Java Networking –Java Server faces

1 **3 Hours**

EXPERIMENT 1

Program on Classes and Method

2 **2 Hours**

EXPERIMENT 2

Implementation of Inheritance

3 **3 Hours**

EXPERIMENT 3

Implementation of Interfaces and Packages

4 **3 Hours**

EXPERIMENT 4

Implementation of Exception handling mechanisms

5 **2 Hours**

EXPERIMENT 5

Develop a program to implement String Handling Methods

6 **2 Hours**

EXPERIMENT 6

Implementation of I/O Streams

7 **3 Hours**

EXPERIMENT 7

Implementation of Collections Interfaces and Classes

8 **2 Hours**

EXPERIMENT 8

Implementation of Multithreaded Programming

9 **2 Hours**

EXPERIMENT 9

Implementation of Applet Programs

10 **2 Hours**

EXPERIMENT 10

Write a program to implement Event classes

11 **2 Hours**

EXPERIMENT 11

Implementation of Swing programs and layout managers

12 **3 Hours**

EXPERIMENT 12

Implementation of JDBC concepts

Total: 60 Hours

Reference(s)

1. Herbert Schildt, Java: The Complete Reference, 11th Edition, McGraw Hill Education,2018.
2. Y Daniel Liang, Introduction to Java Programming, 11thEdition, Pearson Publication,2018.
3. Deitel&Deitel, Java How to Program,11th edition, Prentice Hall of India, 2020
4. Cay S Horstmann, Gary Cornell, Core Java Volume - I Fundamentals,11th Edition, Prentice Hall, 2018.
5. Cay S Horstmann, Gary Cornell, Core Java Volume - II Advanced Features,11th Edition, Prentice Hall, 2018.

20AI307 DATA STRUCTURES LABORATORY

0 0 4 2

Course Objectives

- Implement the operations of linear and non-linear data structures
- Build solutions for real world applications using searching, sorting and hashing techniques

Course Outcomes (COs)

1. Implement C++ programs to illustrate linear data structures
2. Implement C++ programs to illustrate non-linear data structures
3. Develop C++ programs to illustrate recursion, searching, sorting and hashing
4. Execute C++ programs using machine learning libraries

2 Hours

EXPERIMENT 1

Implement Towers of Hanoi puzzle using recursion

4 Hours

EXPERIMENT 2

Design a singly linked list data structure that performs the following operations efficiently:

i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list
iv. Arrange the list as sorted order
v. Display the elements of the list

6 Hours

EXPERIMENT 3

Design a doubly linked list data structure that performs the following operations efficiently:

i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list
iv. Arrange the list as sorted order
v. Display the elements of the list

8 Hours

EXPERIMENT 4

i. Design a web browser application using Stack that performs that following operations:

a. 'Create history' function that stores the URLs of web pages visited
b. 'Go back' function removes the recently visited web page from the Stack

ii. Design a music player using Queue with the following functions:

a. 'Play-Next' function should display the next song in the songs list
b. 'Play-Previous' function should display the previously played songs in the list
c. 'Display' function display all the songs added to the queue in order

6 Hours

EXPERIMENT 5

Create a binary search tree of characters and perform preorder, inorder and post order traversals

6 Hours

EXPERIMENT 6

Create an expression tree and traverse the expression tree to generate infix, prefix and post expressions

6 Hours

EXPERIMENT 7

Implement Prim's algorithm and Kruskal's algorithm to find the Minimum Spanning Tree of a Graph

4 Hours

EXPERIMENT 8

Create function templates to search for a key element in a list of elements using Linear search and Binary search

14 Hours

EXPERIMENT 9

Write a C++ program that arranges a list of ATM transactions done by a particular user based on date of transaction using:

a. Insertion sort
b. Selection sort
c. Bubble sort
d. Quick sort
e. Heap sort
f. Merge sort

Analyze the time complexities of each of the above algorithms and identify the best one.

4 Hours

EXPERIMENT 10

Implement the functions of a Dictionary ADT using hashing techniques

Total: 60 Hours

Reference(s)

8. E.Balagurusamy, "Object Oriented Programming with C++", Seventh Edition, McGraw Hill Education, 2017.
9. Robert Lafore, "Object Oriented Programming in C++", Galgotia Publication, 2010.
10. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition, Pearson Education, 2014.
11. Michael T. Goodrich, Roberto Tamassia and David M. Mount, Data structures and Algorithms in C++, Second Edition, Wiley India, 2011.

12. Sartaj Sahni, ata Structures, Algorithms, And Applications in C++, Second Edition, Silicon Press, 2004.
13. John Hubbard, Data Structures with C++, First Edition, McGraw Hill Education, 2017.
14. Adam Drozdek, Data Structures and Algorithms in C++, Fourth Edition, Cengage Learning, 2012.

20AI308 DATABASE MANAGEMENT SYSTEMS LABORATORY

0 0 4 2

Course Objectives

- Understand the DDL, DML, TCL and DCL commands in SQL.
- Understand the design principles of a relational database system and SQL.
- Implement programs using SQL and PL/SQL.

Course Outcomes (COs)

1. Differentiate database systems from file system by understanding the features of database system and design a ER model for a database system.
2. Develop solutions to a broad range of query and data update problems using relational algebra, relational calculus and SQL.
3. Apply the normalization theory in relational databases for removing anomalies.
4. Compare database storage and access techniques for file organization, indexing methods and Query Processing.
5. Analyze the basic issues of transaction processing, concurrency control, deadlock and its recovery schemes

4 Hours

EXPERIMENT 1
Working with SQL commands like DDL, DML, TCL, and DCL

8 Hours

EXPERIMENT 2
Performing Single- row functions and group functions in SQL.

4 Hours

EXPERIMENT 3
Execute simple queries using joins and Integrity constraints.

8 Hours

EXPERIMENT 4
Creation and manipulation of database objects.

4 Hours

EXPERIMENT 5

Implementation of cursor in PL/SQL block.

8 Hours

EXPERIMENT 6
Generate trigger in PL/SQL block.

8 Hours

EXPERIMENT 7
Write PL/SQL block Programs using exception handling.

8 Hours

EXPERIMENT 8
Design a PL/SQL blocks using subprograms namely functions and procedures

8 Hours

EXPERIMENT 9
Database Connectivity with Front End Tools

Total: 60 Hours

18GE301 SOFT SKILLS: VERBAL ABILITY

0 0 2 -

Course Objectives:
- To help students gain adequate proficiency in vocabulary
- To help students become proficient in basic writing skills related to workplace communication
- To read and understand unabridged text

Course Outcomes (COs):
Students will be able to:
- Take up verbal ability part of the placement tests with confidence
- Write with confidence in professional and workplace communication
- Distinguish fact from opinion by reading passages from a text

UNIT I **15 hours**
Synonyms - Antonyms - Word Groups - Verbal Analogies - Etymology - Critical Reasoning - Cloze Test - One Word Substitution - Idioms and Phrases - Text & Paragraph Completion.

UNIT II **15 hours**
Sentence Formation - Paragraph Formation - Change of Voice - Change of Speech - Reading Comprehension - Sentence Equivalence - Jumbled Sentences - Spotting Errors -Homophones – Homonyms - Commonly Mispronounced/Misspelt Words.

Total: 30 hours

References:

1. Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book for Intermediate Learners of English. IV Edition. United Kingdom: Cambridge University Press. 2012.
2. Lewis, Norman. Word Power Made Easy. New York: Pocket Books. 1991.
3. Baron's The Official Guide for New GMAT Review, New Jersey: John Wiley & Sons, Inc. 2015.

20AI401 – APPLIED LINEAR ALGEBRA FOR DATA ANALYSIS

3 0 0 3

Course Objectives

- Understand the basic concepts of Matrices, Eigenvalues, Eigenvectors and their Decomposition techniques to solve the given system.
- Analyze the system of vectors by different vector space and Inner product space techniques.
- Apply the concepts of linear algebra in the field of Artificial Intelligence and Data Science.

Course Outcomes (COs)

1. Represent characteristics of matrices and determinants with their properties.
2. Analyze the characteristics of a linear system with Eigenvalues and Eigenvectors.
3. Implement the various matrix decomposition techniques to solve the given system.
4. Analyze the linear dependence and compute the basis and dimension of vector spaces.
5. Analyze the systems by Inner product space techniques.

UNIT I **9 Hours**

Matrices

Types of matrices - Matrix operations - Determinants – Orthogonal Matrices - Block Matrices – Rank of a matrix – Solution of Linear System: Matrix inversion method – Rank method – Consistency of system.

UNIT II **9 Hours**

Diagonalization

Characteristic equation (including Block matrices) – Cayley-Hamilton theorem – Diagonalization - Algebraic and Geometric Multiplicity – Minimal polynomial (including Block matrices) – Characteristic and minimal polynomial of Block matrices – Iterative Method: Eigenvalues and Eigen vectors by Power method.

UNIT III **9Hours**

Matrix Decompositions

Nature of matrices – Echelon matrices – Row canonical form - Gauss-elimination method – Gauss Jordan method - Single value decomposition – LU decomposition.

UNIT IV **9 Hours**

Vector Spaces

Vector spaces – subspaces – Linear Combinations – Spanning sets – Linear dependence and independence – Basis and Dimension – Rank and nullity.

UNIT V **9 Hours**

Inner Product Spaces

Inner product spaces – Vector norms – Cauchy-Schwarz inequality - Orthogonality – Gram-Schmidt Orthogonalization – QR decomposition.

FOR FURTHER READING

Eigenvalues, Eigenvectors, Matrix Operation using MATLAB/Any Programming language of your choice.

Total: 45 Hours

Reference(s)

1. Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication, 2017
3. Lloyd N. Trefethen, David Bau III, Numerical Linear Algebra,Society for Industrial and Applied Mathematics, 1997.
4. James W. Demmel, Applied Numerical Linear Algebra, The Orient Blackswan, 1st Edition,20117.
5. Seymour Lipschutz, Marc Lipson, Schaum's Outlines Linear Algebra, McGraw Hill publication, 4th Edition, 2009.
6. Gilbert Strang, Introduction to linear algebra, Fifth Edition, ANE Books, 2016.

20AI402 DESIGN AND ANALYSIS OF ALGORITHMS

3 1 0 4

COURSE OBJECTIVE(S)

- Identify the various algorithm design techniques.
- Impart knowledge on runtime analysis of algorithms.
- Empathize the limits of computation.

COURSE OUTCOME(S)

1. Exemplify the algorithm efficiency by means of mathematical notations.
2. Analyze the different sorting algorithms using algorithm design techniques.
3. Analyze the different techniques in the design of Graph algorithms.
4. Analyze the various backtracking and branch and bound algorithms.
5. Differentiate algorithms design techniques of NP complete with NP hard problem.

UNIT I

FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY **9 Hours**

Analysis Framework - Asymptotic notations - Basic Efficiency classes - Mathematical Analysis of Non-recursive Algorithm - Mathematical Analysis of Recursive Algorithm - Example: Fibonacci Numbers - Empirical Analysis of Algorithms

UNIT II

BRUTE FORCE AND DIVIDE & CONQUER STRATEGIES 8 Hours

Brute Force Strategy: Selection Sort and Bubble Sort, Sequential Search and Brute-force string matching - Divide and conquer: Presorting, Balanced Search trees AVL Trees, Heaps and Heap sort.

UNIT III

GREEDY STRATEGIES AND DYNAMIC PROGRAMMING 10 Hours

Greedy Technique: Prim's Algorithm, Kruskals' Algorithm, Dijkstra Algorithm, Huffman trees-The simplex method, The stable marriage problem- Dynamic Programming: All pairs shortest path, optimal binary Search tree, Warshalls' and Floyd Algorithm, multistage graphs, Knapsack problem.

UNIT IV

BACKTRACKING AND BRANCH & BOUND 9 Hours

Backtracking: Solution space and tree organization, N-queens problem, Sum of subset problem, Graph coloring, Knapsack problem – Branch and Bound: 0/1 Knapsack problem, Traveling salesman problem, Assignment problem, Least Cost branch and bound.

UNIT V

ALGORITHM DESIGN TECHNIQUES TO NP COMPLETE AND NP HARD PROBLEMS 9 Hours

NP Complete problems backtracking: n-Queens Problem, Hamiltonian Circuit problem, Subset-Sum problem, Branch and bound: Assignment problem, Knapsack problem, Traveling salesman problem- Approximation algorithms for NP hard problems: Travelling salesman and knapsack problem

FOR FURTHER READING

Sets and Dictionaries- Algorithm visualization- Exhaustive search- Knapsack problem and memory functions- Decision trees

Theory: 45 Hours
Tutorial:15 hours
Total: 60 Hours

Reference(s)

1. AnanyLevitin, Introduction to the Design and Analysis of Algorithms, Third Edition, PearsonEducation Asia, 2011
2. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009
3. Sara Baase and Allen Van Gelder, Computer Algorithms Introduction to Design and Analysis, Pearson Education Asia, 2010
4. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education Asia, 2003

20AI403 DATA WAREHOUSING AND MINING

2 0 2 4

Course Objectives

- Gather and analyze large sets of data to gain useful business understanding
- Understand the data mining functionalities, technologies and steps in preprocessing the data
- Learn data mining algorithms, methods and tools

Course Outcomes (COs)

1. Design data warehouse by applying principles of dimensional modelling and ETL concepts
2. Analyze various data pre-processing techniques for efficient data mining.
3. Apply association rule mining for finding hidden and interesting patterns in data.
4. Apply statistical procedure, machine learning and neural network based classification algorithms for data prediction
5. Apply clustering algorithms for the application and generalizations for real time problems

UNIT I **9 Hours**

DATA WAREHOUSE FUNDAMENTALS

Introduction, OLTP Systems, Characteristics & Functions of Data Warehouses, Advantages and Applications of Data Warehouse, Top- Down and Bottom-Up Development Methodology, Tools for Data warehouse development, Multidimensional Data Model, Data Warehouse architecture, ETL Overview, ETL Requirements and Steps, ETL Tools.

UNIT II **9 Hours**

DATA MINING AND DATA PREPROCESSING

Types of Data , Data Mining Functionalities , Interestingness of Patterns, Classification of Data Mining Systems , Data Mining Task Primitives , Integration of a Data Mining System with a Data Warehouse,Descriptive Data Summarization,Data Preprocessing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Frequent Itemsets, Closed Itemsets, and Association Rules, Frequent Pattern Mining, The Apriori Algorithm, Generating Association Rules from Frequent Itemsets, Mining Frequent Itemsets without Candidate Generation, Mining Frequent Itemsets Using Vertical Data Format, Mining Closed Frequent Itemsets.

UNIT IV **9 Hours**

CLASSIFICATION

Classification: Basic Concepts, General approach to solve classification problem, Decision Trees Induction, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers**,** Estimating Predictive accuracy of classification methods, Improving accuracy of classification methods, Evaluation criteria for classification methods.

UNIT V **9 Hours**

CLUSTER ANALYSIS

Overview, Features of cluster analysis, Data similarity and dissimilarity measures ,Types of cluster analysis methods, Partitioning Methods: K-Means and K-Medoids, Hierarchical Methods: Agglomerative and Divisive Hierarchical Clustering, Outlier Analysis: Statistical Distribution-Based Outlier Detection, Distance-Based Outlier Detection.

References:

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques,Third Edition, Elsevier, 2012.
2. Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley, 2010.
3. Alex Berson, Stephen J Smith, Data warehousing, Data mining, and OLAP, Tata McGraw Hill edition, 2007.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar,Introduction to Data Mining, Pearson Education, 2007.
5. G. K. Gupta ,Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.

20AI404 COMPUTER NETWORKS

3 0 0 3

Course Objectives

- Understand the principles and standards of networking and communication.
- Cognize the different layer of networks and interpret the functionalities and protocols used in each layer of TCP/IP protocol suite.
- Gain knowledge in the trends and application of networks.

Course Outcomes (COs)

- Examines the data communications and defines their components, the types of data exchanged, their standards.
- Summarise the services providedby the data-link layer, its addressing mechanisms and help the delivery of data frame in the network layer.
- Identify the network services, therouting protocols and apply the suitable addressing for their network.

- Apply the necessary transport protocol based on the flow and error control services needed for their network.
- Demonstrate how application programs use the services of all the layers in their network.

9 Hours

UNIT I

DATA COMMUNICATIONS

Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Data and Signals-Digital and Analog Signals-Multiplexing-Spread Spectrum-Transmission Media-Guided and unguided media-Switching

9 Hours

UNIT II

DATA LINK LAYER

Introduction to Data Link Layer: Link Layer Addressing - Error Detection and Correction: Block Coding, Cyclic Codes, Checksum, Forward Error Correction - Data Link Control: DLC services, Data-Link Layer Protocols, HDLC, Point-to-Point Protocol - Media Access Control: Random Access and Controlled Access - Ethernet: IEEE 802.3 - IEEE 802.11.

9Hours

UNIT III

NETWORK LAYER

Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMPv4, Mobile IP - Routing Algorithms- Unicast Routing Protocols-Multicast Routing protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

9 Hours

UNIT IV

TRANSPORT LAYER

Introduction to Transport Layer: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol, Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking - User Datagram Protocol - Transmission Control Protocol - Congestion Control.

9 Hours

UNIT V

APPLICATION LAYER

Client Server Programming - WWW - FTP - Electronic Mail - Telnet - SSH - DNS - SNMP - DHCP - MQTT - IMAP - TLS/SSL-IP Security.

FOR FURTHER READING

WiMAX-Peer to Peer Networking-Internet Security

Total: 45 Hours

Reference(s)

1. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2013.
2. William Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall, 2014.
3. Andrew S Tanenbaum and David J Wetherall, Computer Networks, Fifth Edition, Pearson Education, 2011.
4. Larry L Peterson and Bruce S Davie, Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
5. James F Kurose and Keith W Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Sixth Edition, Addison-Wesley, 2013.

20AI405 ARTIFICIAL INTELLIGENCE 3 0 0 3

Course Objectives

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications

Course Outcomes (COs)

1. Compare AI with human intelligence and traditional information processing, and discuss its strengths and limitations and its application to complex and human-centered problems
2. Analyze the structures and algorithms selection in Artificial Intelligence techniques related to knowledge representation and reasoning.
3. Analyze the search strategies and its types
4. Apply and evaluate intelligent agents to given real time dataset
5. Understand the structures of Learning concepts and use of PROLOG in AI.

UNIT I **9 Hours**

INTRODUCTION TO AI

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

UNIT II **9 Hours**

INTELLIGENT AGENTS

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

UNIT III **9 Hours**

PROBLEM-SOLVING

Solving Problems by Searching: Problem-Solving Agents, Search problems and solutions, Formulating problems, Search Algorithms, Breadth-first search, Depth-first search, A* search, The effect of heuristic accuracy on performance, Generating heuristics from relaxed problems. Local Search and Optimization Problem, Hill-climbing search, Constraint Satisfaction Problem, Variations on the CSP formalism.

UNIT IV **9 Hours**

KNOWLEDGE AND REASONING

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

UNIT V **9 Hours**

ADVERSARIAL SEARCH AND GAMES

Game theory, classification of games, game playing strategies, prisoner's Dilemma, Game playing techniques, minimax procedure, alpha-beta cut-offs, Complexity of alpha-beta search, Limitations of game search algorithms.

FOR FURTHER READING

Text Classification - Information Retrieval, Natural Language Processing

Total: 45 Hours

Reference(s)

1. S.Russell and P.Norvig,‖Artificial Intelligence:A Modern Approach, Prentice Hall, Fourth Edition, 2021.
2. I. Bratko, —Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011
3. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
4. Deepak Khemani, Artificial Intelligence,, Tata McGraw Hill Education 2013
5. Mishra R B, Artificial Intelligence, PHI Learning Pvt. Ltd., New Delhi, 2013.

20AI406 STATISTICAL MACHINE LEARNING 3 0 0 3

Course Objectives

1. To understand the concepts of Machine Learning.

2. To appreciate supervised learning and their applications.

3. To appreciate the concepts and algorithms of unsupervised learning.

4. To understand the basic concept of reinforcement learning algorithm and its applications.

5. To study about modelling, aggregation and knowledge representation using graphical models.

Course Outcomes (COs)

CO1: Identify applications suitable for different types of Machine Learning with suitable justification.

CO2: Implement supervised Learning algorithms for real time data sets for Intelligent decision making.

CO3: Apply Machine Learning techniques to classification and clustering to unstructured data.

CO4: Apply reinforcement learning techniques for real life problems

CO5: Implement probabilistic discriminate and generative algorithms for an applications of your choice and analyze the results.

UNIT I **9 Hours**

INTRODUCTION TO MACHINE LEARNING

Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning - Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison

UNIT II **9 Hours**

SUPERVISED LEARNING

Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- Regression Trees - Pruning.Ensemble methods- Bagging- Boosting.

UNIT III **9 Hours**

UNSUPERVISED LEARNING

Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis

UNIT IV **9 Hours**

REINFORCEMENT LEARNING

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporaldifference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control

UNIT V **9 Hours**

PROBABILISTIC GRAPHICAL MODELS

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

FOR FURTHER READING

Dimensionality Reduction –Linear Discriminant Analysis –Principal Component Analysis –Factor Analysis –Independent Component Analysis - Locally Linear Embedding –Isomap –Least Squares Optimization –Evolutionary Learning –Genetic algorithms –Genetic Offspring

Total: 45 Hours

Reference(s)

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
2. Stephen Marsland, "Machine Learning –An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
3. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
4. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
5. P. Flach, —Machine Learning: The art and science of algorithms that make sense of data‖, Cambridge University Press, 2012.

20AI407 ARTIFICIAL INTELLIGENT LABORATORY **0 0 4 2**

Course Objectives

- To provide skills for designing and analyzing AI based algorithms.
- To enable students to work on various AI tools.
- To provide skills to work towards solution of real life problems.

Course Outcomes

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

CO1: Analyze and specify software requirements.

CO2: Apply search techniques and knowledge representation schemes.

CO3: Apply various tools and techniques to solve real world problems.

List of Programs:

1. Installation and working on various AI tools viz. Python, R tool, GATE, NLTK, MATLAB, etc.
2. Data pre-processing and annotation and creation of datasets.
3. Implementation of Breadth First and Depth First searching techniques

4.Implementing state space search algorithms •Hill climbing algorithms•A* Algorithm

5.Designing a Chat bot application.

6.Information retrieval using semantic search

7.Knowledge representation and inference –Predicate logic

7.Solving 5-queen's problem

8.Solving travelling salesman problem

Total: 30 Hours

References

1. S.Russell and P.Norvig,‖Artificial Intelligence:A Modern Approach‖,Prentice Hall, Fourth Edition, 2021.
2. I. Bratko, —Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011
3.
4. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
5. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
6. P. Flach, —Machine Learning: The art and science of algorithms that make sense of data‖, Cambridge University Press, 2012.
7. Stephen Marsland, "Artificial Intelligence", Chapman and Hall, CRC Press, Second Edition, 2014.

20AI408 MACHINE LEARNING LABORATORY

0 0 4 2

Course Objectives

1) To understand the concepts of Machine Learning.
2) To implement supervised learning and their applications.
3) To implement the concepts and algorithms of unsupervised learning.
4) To practise modelling, aggregation and knowledge representation using graphical models.

Course Outcomes (COs)

CO1: Implement supervised Learning algorithms for real time data sets for Intelligent decision making.

CO2: Apply Machine Learning techniques to classification and clustering to unstructured data.

CO3: Apply reinforcement learning techniques for real life problems

EXPERIMENT 1 **3 Hours**

Load Real Time data Set and Python Libraries, Installing Libraries through Anaconda Prompt, Perform data pre-processing through Pandas Library.

EXPERIMENT 2 **3 Hours**

Implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets

EXPERIMENT 3 **3 Hours**

Implement decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

EXPERIMENT 4 **3 Hours**

Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

EXPERIMENT 5 **3 Hours**

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

EXPERIMENT 6 **3 Hours**

Implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem

EXPERIMENT 7 **3 Hours**

Assuming a set of documents that need to be classified, use the Semi Supervised Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

EXPERIMENT 8 **3 Hours**

Implement Q Learning with Linear Function Approximation.

EXPERIMENT 9 **3 Hours**

Implement the Policy Gradient concept in Reinforcement learning. Compare the Reinforce with Baseline with Actor Critic with Baseline.

EXPERIMENT 10 **3 Hours**

Consider a time series data set. Plot the data, Identify the components of the Time Series data, Calculate the seasonality and stationarity and Identify the trend patter present in the time series data. Remove the white noise if available in the time series data.

Total: 30 Hours

Reference(s)

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
2. Stephen Marsland, "Machine Learning –An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
3. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
4. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
5. [5] P. Flach, —Machine Learning: The art and science of algorithms that make sense of data‖, Cambridge University Press, 2012.

18GE401 SOFT SKILLS: BUSINESS ENGLISH **0 0 2 -**

Course Objectives:

- To acquire command of both the receptive skills (Listening, Reading) and the productive skills (Writing and Speaking) of English language
- To understand and make effective use of English language in business contexts

Course Outcomes (COs):

Students will be able to:

- Listen, Read, Speak, and Write Business English at the level of independent users
- Appear for the Business English Certificate (BEC) Vantage level examination conducted by the Cambridge Assessment English

UNIT – I **15 Hours**

Listening

Listening for writing short answers - filling gaps in sentences - identifying topic, context and function - identify different functions of language in business situations - identify prompts -identify paraphrases of required information

Reading

Scanning - reading for gist - understanding sentence structure - error identification - identify paraphrases - cohesive words and phrases - understand the importance of analysing the distractors - identify grammatical and semantic relationships

UNIT – II **15 Hours**

Writing

Business Emails - notes - memos to colleagues or friends - Giving instructions - explaining a development - asking for comments - requesting information - agreeing to requests - explaining - apologising - reassuring - complaining - describing - summarising - recommending - persuading

Speaking

Turn-taking - sustaining interaction - initiating - responding - giving personal information - Talking about present circumstances, past experiences and future plans - expressing opinion - speculating - organising a larger unit of discourse - giving information - expressing and justifying opinions - speculating - comparing and contrasting - agreeing and disagreeing

Total: 30 Hours

Reference:

1. Whitehead, Russell and Michael Black. Pass Cambridge BEC Vantage Self - study Practice Tests with Key, Heinle - a part of Cengage Learning, Delhi, 2003.