B.Tech. (Information Technology)

2018 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai

Approved by AICTE - Accredited by NBA New Delhi and NAAC with 'A' Grade)

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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 coursesare 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 semestersin any Department / Centre for the same batch of the students and a maximum batchsize 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 anyone 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 Departmentduring 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” (notconsidered 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 currentarrears. 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 beissued 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 theEnd Semester Examinations.

6.3.1 Each student, on admission to the programme, shall register for **all thecourses 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 astudent 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 isoffered.

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 addor 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 itis 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 courseas 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 eachsemester.
- 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 coursewith one of the members as the Course Coordinator, nominated by the Headof 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 theteaching-learning process. It is the responsibility of the student representativesto 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 endof 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 reportand 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 stipulatedtime.
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 Appearancewithin 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 Departmentstating 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 atthe 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 (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	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 (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	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*

		Marks
VIII	**INDUSTRIAL TRAINING/ INTERNSHIP (CONTINUOUS ASSESSMENT ONLY)**	
	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 Ior Test II or both on account of medical reasons (hospitalization / accident / specific illness), or (ii) participation in the College / University / State / National / Internationallevel 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.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Apply Computational Theory blended with Mathematics and Engineering to model, design, implement, test and maintain software systems

PEO2 Communicate effectively with team members, engage in applying technologies and lead teams in industry

PEO3 Excel in Professional development, Higher studies and Entrepreneurship related to IT

PEO4 Engage in lifelong learning, career enhancement and adapt to changing professional and societal needs

PROGRAM OUTCOMES

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 analyse 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 onsiderations.

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 modelling 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 theseto 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 OBJECTIVES (PSOs)

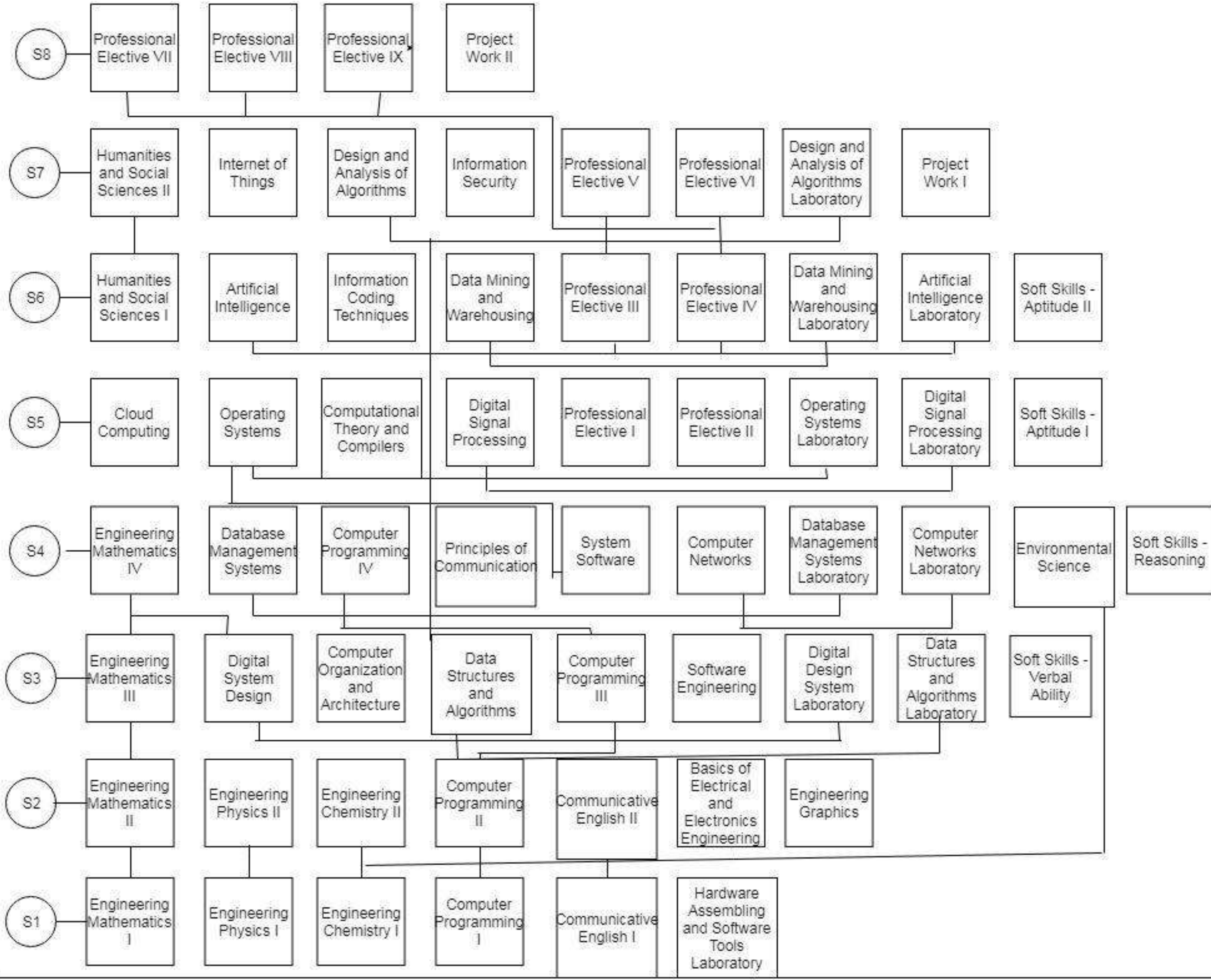
PSO 1 Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

PSO 2 Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

MAPPING OF PEO WITH POs and PSOs

POs / PSOs	a	b	c	d	e	f	g	h	i	j	k	l	PSO1	PSO2
PEO1	x	x	x	x	x	x				x			x	x
PEO2		x	x	x		x		x		x	x	x	x	x
PEO3			x		x	x	x		x		x	x	x	x
PEO4	x	x			x	x		x		x	x	x	x	x

2018 REGULATION DEPARTMENT OF INFORMATION TECHNOLOGY CONNECTIVITY CHART



DEPARTMENT of IT Minimum Credits to be Earned : 161										
I SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18IT101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
18IT102	ENGINEERING PHYSICS I	2	0	2	3	4	50	50	100	BS
18IT103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
18IT104	COMPUTER PROGRAMMING I	2	0	2	3	4	50	50	100	ES
18HS101	COMMUNICATIVE ENGLISH I	1	0	2	2	3	100	0	100	HS
18IT106	HARDWARE ASSEMBLING AND SOFTWARE TOOLS LABORATORY	0	0	4	2	4	100	0	100	ES
Total		**10**	**1**	**12**	**17**	**23**	-	-	-	-
II SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18IT201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
18IT202	ENGINEERING PHYSICS II	2	0	2	3	4	50	50	100	BS
18IT203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
18IT204	COMPUTER PROGRAMMING II	2	0	2	3	4	50	50	100	ES
	LANGUAGE ELECTIVE	-	-	-	2	-	100	0	100	HS
18IT206	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	2	0	2	3	4	50	50	100	ES
18IT207	ENGINEERING GRAPHICS	1	0	4	3	5	100	0	100	ES
Total		**12**	**1**	**12**	**21**	**25**	**-**	**-**	**-**	-

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18IT301	ENGINEERING MATHEMATICS III	3	1	0	4	4	40	60	100	BS
18IT302	DIGITAL SYSTEM DESIGN	3	1	0	4	4	40	60	100	PC
18IT303	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3	3	40	60	100	PC
18IT304	DATA STRUCTURES AND ALGORITHMS	3	0	0	3	3	40	60	100	PC
18IT305	OBJECT ORIENTED PROGRAMMING WITH CPP and JAVA	2	0	2	3	4	50	50	100	PC
18IT306	SOFTWARE ENGINEERING	3	0	0	3	3	40	60	100	PC
18IT307	DIGITAL SYSTEM DESIGN LABORATORY	0	0	2	1	2	100	0	100	PC
18IT308	DATA STRUCTURES AND ALGORITHMS LABORATORY	0	0	2	1	2	100	0	100	PC
18GE301	SOFT SKILLS - VERBAL ABILITY	0	0	2	-	2	100	0	100	EEC
Total		**17**	**2**	**8**	**22**	**27**	**-**	**-**	**-**	**-**

IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18IT401	ENGINEERING MATHEMATICS IV	3	1	0	4	4	40	60	100	BS
18IT402	DATABASE MANAGEMENT SYSTEMS	3	1	0	4	4	40	60	100	PC
18IT403	WEB TECHNOLOGY	2	0	2	3	4	50	50	100	PC
18IT404	PRINCIPLES OF COMMUNICATION	3	0	0	3	3	40	60	100	ES
18IT405	SYSTEM SOFTWARE	3	1	0	4	4	40	60	100	PC
18IT406	COMPUTER NETWORKS	3	0	0	3	3	40	60	100	PC
18IT407	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	2	1	2	100	0	100	PC
18IT408	COMPUTER NETWORKS LABORATORY	0	0	2	1	2	100	0	100	PC
18HS001	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
18GE401	SOFT SKILLS – BUSINESS ENGLISH	0	0	2	-	2	100	0	100	EEC
Total		**19**	**3**	**8**	**23**	**30**	-	**-**	-	**-**

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21IT501	CLOUD COMPUTING	3	1	0	4	4	40	60	100	PC
21IT502	OPERATING SYSTEMS	3	1	0	4	4	40	60	100	PC
21IT503	COMPUTATIONAL THEORY AND COMPILERS	3	1	0	4	4	40	60	100	PC
21IT504	DIGITAL SIGNAL PROCESSING	3	0	2	4	5	50	50	100	ES
	PROFESSIONAL ELECTIVE I	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE II	-	-	-	3	-	-	-	100	PE
21IT507	CLOUD COMPUTING LABORATORY	0	0	2	1	2	100	0	100	PC
21IT508	OPERATING SYSTEMS LABORATORY	0	0	2	1	2	100	0	100	PC
18GE501	SOFT SKILLS - APTITUDE I	0	0	2	-	2	100	0	100	EEC
Total		**12**	**3**	**8**	**24**	**23**	**-**	**-**	**-**	-

VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21IT601	ARTIFICIAL INTELLIGENCE	3	1	0	4	4	40	60	100	PC
21IT602	DESIGN AND ANALYSIS OF ALGORITHMS	3	1	0	4	4	40	60	100	PC
21IT603	INFORMATION CODING TECHNIQUES	3	1	0	4	4	40	60	100	PC
	PROFESSIONAL ELECTIVE III	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IV	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE V	-	-	-	3	-	-	-	100	PE
21IT607	ARTIFICIAL INTELLIGENCE LABORATORY	0	0	2	1	2	100	0	100	PC
21IT608	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY	0	0	2	1	2	100	0	100	PC
18GE601	SOFT SKILLS - APTITUDE II	0	0	2	-	2	100	0	100	EEC
Total		**18**	**3**	**6**	**23**	**27**	**-**	**-**	**-**	-

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21HS002	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
21IT702	DATA MINING AND WAREHOUSING	3	1	0	4	4	40	60	100	PC
	PROFESSIONAL ELECTIVE VI	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE VIII	-	-	-	3	-	-	-	100	PE
	PROFESSIONAL ELECTIVE IX	-	-	-	3	-	-	-	100	PE
21IT707	DATA MINING AND WAREHOUSING LABORATORY	0	0	2	1	2	100	0	100	PC
21IT708	PROJECT WORK I	0	0	6	3	6	50	50	100	EEC
Total		**17**	**1**	**8**	**22**	**26**	**-**	**-**	**-**	**-**

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21IT801	PROJECT WORK II	0	0	18	9	18	50	50	100	EEC
Total		**0**	**0**	**18**	**9**	**18**	**-**	**-**	**-**	**-**

ELECTIVES										
LANGUAGE ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
18HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
18HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
18HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
18HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HSS
PHYSICS ELECTIVES										
18GE0P1	NANOMATERIALS SCIENCE	3	0	0	3	3	40	60	100	BS
18GE0P2	SEMICONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	40	60	100	BS
18GE0P3	APPLIED LASER SCIENCE	3	0	0	3	3	40	60	100	BS
CHEMISTRY ELECTIVES										
18GE0C1	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	BS
18GE0C2	ENERGY STORING DEVICES	3	0	0	3	3	40	60	100	BS
18GE0C3	POLYMER SCIENCE	3	0	0	3	3	40	60	100	BS
VERTICAL 1 - DATA SCIENCE										
21IT001/ 21ITH01/ 21ITM01	EXPLORATORY DATA ANALYSIS	2	0	2	3	4	50	50	100	PE
21IT002/ 21ITH02/ 21ITM02	RECOMMENDER SYSTEMS	3	0	0	3	3	40	60	100	PE
21IT003/ 21ITH03/ 21ITM03	BIG DATA ANALYTICS	3	0	0	3	3	40	60	100	PE
21IT004/ 21ITH04/ 21ITM04	NEURAL NETWORKS AND DEEP LEARNING	2	0	2	3	4	50	50	100	PE

21IT005 / 21ITH05/ 21ITM05	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
21IT006 / 21ITH06/ 21ITM06	COMPUTER VISION	3	0	0	3	3	40	60	100	PE
VERTICAL II - FULL STACK DEVELOPMENT										
21IT007	PRINCIPLES OF PROGRAMMING LANGUAGES	3	0	0	3	3	40	60	100	PE
21IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
21IT009	WEB FRAMEWORKS	3	0	0	3	3	40	60	100	PE
21IT010	APP DEVELOPMENT	2	0	2	3	4	50	50	100	PE
21IT011	SOFTWARE TESTING AND AUTOMATION	3	0	0	3	3	40	60	100	PE
21IT012	DEVOPS	3	0	0	3	3	40	60	100	PE
VERTICAL III - CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES										
21IT013	VIRTUALIZATION IN CLOUD COMPUTING	3	0	0	3	3	40	60	100	PE
21IT014	CLOUD SERVICES AND DATA MANAGEMENT	3	0	0	3	3	40	60	100	PE
21IT015	CLOUD STORAGE TECHNOLOGIES	3	0	0	3	3	40	60	100	PE
21IT016	CLOUD AUTOMATION TOOLS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
21IT017	SOFTWARE DEFINED NETWORKS	2	0	2	3	4	50	50	100	PE
21IT018	SECURITY AND PRIVACY IN CLOUD	3	0	0	3	3	40	60	100	PE
VERTICAL IV - CYBER SECURITY AND DATA PRIVACY										
21IT019	CYBER SECURITY	3	0	0	3	3	40	60	100	PE
21IT020	MODERN CRYPTOGRAPHY	3	0	0	3	3	40	60	100	PE
21IT021	CYBER FORENSICS	3	0	0	3	3	40	60	100	PE
21IT022	ETHICAL HACKING	3	0	0	3	3	40	60	100	PE
211T023	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
21IT024	MALWARE ANALYSIS	3	0	0	3	3	40	60	100	PE
VERTICAL V - CREATIVE MEDIA										
21IT025	MULTIMEDIA AND ANIMATION	2	0	2	3	4	50	50	100	PE
21IT008	UI AND UX DESIGN	3	0	0	3	3	40	60	100	PE
21IT026	AUGMENTED REALITY/VIRTUAL REALITY	2	0	2	3	4	50	50	100	PE
21IT027	GAME DEVELOPMENT	2	0	2	3	4	50	50	100	PE

21IT028	VIDEO CREATION AND EDITING	2	0	2	3	4	50	50	100	PE
21IT029	DIGITAL MARKETING	3	0	0	3	3	40	60	100	PE
VERTICAL VI- EDGE COMPUTING AND AUTONOMOUS SYSTEMS										
21IT030	PROGRAMMING ON EDGE DEVICES	3	0	0	3	3	40	60	100	PE
21IT031	ROBOTIC PROCESS AUTOMATION	3	0	0	3	3	40	60	100	PE
21IT032	AI ON EDGE COMPUTING	3	0	0	3	3	40	60	100	PE
21IT005	NATURAL LANGUAGE PROCESSING	3	0	0	3	3	40	60	100	PE
21IT033	IOT ANALYTICS	3	0	0	3	3	40	60	100	PE
21IT034	AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES	2	0	2	3	4	50	50	100	PE
VERTICAL VII- DIVERSIFIED COURSES										
21IT035	XML AND WEB SERVICES	3	0	0	3	3	40	60	100	PE
21IT036	MINING AND SOCIAL MEDIA WEB ANALYTICS	3	0	0	3	3	40	60	100	PE
21IT037	OPERATION AND SUPPLY CHAIN ANALYTICS	3	0	0	3	3	40	60	100	PE
21IT038	SOCIAL NETWORK SECURITY	3	0	0	3	3	40	60	100	PE
21IT039	HUMAN COMPUTER INTERACATION	3	0	0	3	3	40	60	100	PE
21IT040	E-COMMERCE	3	0	0	3	3	40	60	100	PE
ONE CREDIT COURSES										
18IT0XA	ANGULAR JS	-	-	-	1	-	100	0	100	EEC
18IT0XB	NODEJS	-	-	-	1	-	100	0	100	EEC
18IT0XC	LARAVEL: A PHP FRAMEWORK	-	-	-	1	-	100	0	100	EEC
18IT0XD	TABLEAU FOR BUSINESS INTELLIGENCE	-	-	-	1	-	100	0	100	EEC
18IT0XE	BLOCKCHAIN	-	-	-	1	-	100	0	100	EEC
18IT0XF	FULL STACK DEVELOPMENT-MEAN STACK	-	-	-	1	-	100	0	100	EEC
18IT0XG	ROBOTIC PROCESS AUTOMATION	-	-	-	1	-	100	0	100	EEC
18IT0XH	AGILE PROJECT METHODOLOGY SCRUM	-	-	-	1	-	100	0	100	EEC
18IT0XI	UiPATH	-	-	-	1	-	100	0	100	EEC
18IT0XJ	JOOMLA WEB DEVELOPMENT	-	-	-	1	-	100	0	100	EEC

18IT0XK	DRUPAL WEB DEVELOPMENT	-	-	-	1	-	100	0	100	EEC
18IT0XL	LANGUAGE INTEGRATED QUERY (LINQ)	-	-	-	1	-	100	0	100	EEC
ADDITIONAL ONE CREDIT COURSE										
18GE0XA	ETYMOLOGY	1	0	0	1	-	100	0	100	EEC
18GE0XB	GENERAL PSYCHOLOGY	1	0	0	1	-	100	0	100	EEC
18GE0XC	NEURO BEHAVIORAL SCIENCE	1	0	0	1	-	100	0	100	EEC
18GE0XD	VISUAL MEDIA AND FILM MAKING	1	0	0	1	-	100	0	100	EEC
18GE0XE	YOGA FOR HUMAN EXCELLENCE	1	0	0	1	-	100	0	100	EEC
18GE0XF	VEDIC MATHEMATICS	1	0	0	1	-	100	0	100	EEC
18GE0XG	HEALTH AND FITNESS	1	0	0	1	-	100	0	100	EEC
18GE0XH	CONCEPT, METHODOLOGY AND APPLICATIONS OF VERMICOMPOSTING	1	0	0	1	-	100	0	100	EEC
18GE0XI	BLOG WRITING	1	0	0	1	-	100	0	100	EEC
18GE0XJ	INTERPERSONAL SKILLS	1	0	0	1	-	100	0	100	EEC
18GE0XK	COMMUNITY SERVICE AND LEADERSHIP DEVELOPMENT	1	0	0	1	-	100	0	100	EEC
18GE0XL	NATIONAL CADET CORPS	1	0	0	1	-	100	0	100	EEC
18GE0XM	NEW AGE INNOVATION AND ENTREPRENEURSHIP	1	0	0	1	-	100	0	100	EEC
18GE0XN	DISRUPTIVE INNOVATION BASED STARTUP ACTIVITIES	1	0	0	1	-	100	0	100	EEC
18GE0XO	SOCIAL PSYCHOLOGY	1	0	0	1	-	100	0	100	EEC

SUMMARY OF CREDIT DISTRIBUTION

S.No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDIT	CREDITS in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	10	10	4	4					28	16.47	15%	20%
2	ES	5	9		3	4	4			25	14.71	15%	20%
3	HSS	2	2				2	2		8	4.70	5%	10%
4	PC			18	16	13	10	13		70	41.18	30%	40%
5	PE					6	6	6	9	24	15.88	15%	20%
6	EEC							3	9	12	7.06	7%	10%
Total		**17**	**21**	**22**	**23**	**23**	**22**	**24**	**18**	**170**	**100**	**-**	**-**

BS - Basic Sciences
ES - Engineering Sciences
HSS - Humanities and Social Sciences
PC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course

CA - Continuous Assessment
ES - End Semester Examination

18IT101 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

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	2												
3	2	2												
4	1	2												
5	1	2												

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. Cauchy s Integral Formula - Classification of Singularities - Cauchy s 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, Schaums Outline of Theory and Problems of Calculus, 4th edition, McGraw Hill, 1999

18IT102 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)

1. Illustrate the Newton three laws of motion and apply the same to solve the real world problems involving elevator atwood machine and acceleration of objects
2. Exemplify the physical characteristics of simple Harmonic motion, wave motion and find the solutions for wave equations
3. Infer the fundamental laws, properties of electricity and magnetism and apply the same to electric and magnetic elements
4. Apply the principles of physical and geometrical optics in the mirrors, lenses, microscopes and diffraction gratings
5. Outline the importance of special theory of relativity, quantum physics and analyse the wave and particle nature of matter

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2								2					
3	2	1												
4	2	1							2					
5	2	1							2					

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. Applicationsof 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**

ELECYRICITY AND MAGNETISM

Point charges - electric fields - Gausss 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 todifferent current distribution 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 ofparticles - Davission-Germer experiment

FURTHER STUDY

Nano materials, Advanced materials

1 **5 Hours**

EXPERIMENT 1

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

2 **5 Hours**

EXPERIMENT 2

Determination of moment of inertia-Torsional pendulum

3 **5 Hours**

EXPERIMENT 3

Determination of wavelength of mercury spectral lines-spectrometer

4 **4 Hours**

EXPERIMENT 4

Determination of refractive index of solid and liquid-travelling microscope

5 **3 Hours**

EXPERIMENT 5

Determination of wavelength of laser-diffraction grating

6 **4 Hours**

EXPERIMENT 6

Determination of frequency of a tuning fork-MeldeÃƒÂ¢??s apparatus

7 **4 Hours**

EXPERIMENT 7

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), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017
4. H D Young and R A Freedman, Sears and ZemanskyÃ¢??sUniversity Physics with Modern Physics, Pearson education, 2016
5. R K Gaur and S L Gupta, Engineering Physics, DhanpatRai Publications, 2012

18IT103 ENGINEERING CHEMISTRY I **2 0 2 3**

Course Objectives

- Identify the properties and applications of optical materials for smart screen
- Summarize the terminologies of electrochemistry and explain the applications of electrochemical instruments
- 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 micro processors 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. Analyze 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 microprocesser

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2					1							
2	2	2												
3	2	2					1							
4	2	2												
5	2	2												

UNIT I **6 Hours**

OPTICAL MATERIALS 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.

UNIT IV **6 Hours**

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.

UNIT V **7 Hours**

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

Application of advanced data storage materials in electronic devices. Conducting Materials for smart screen.

Applications of smart materials for microprocessor fabrication.

1 **4 Hours**

EXPERIMENT 1

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

2 **5 Hours**

EXPERIMENT 2

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

3 **5 Hours**

EXPERIMENT 3

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

4 **4 Hours**

EXPERIMENT 4

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

5 **6 Hours**

EXPERIMENT 5

Electroless plating of copper on polymeric material used in IC fabrication

6 **6 Hours**

EXPERIMENT 6

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 2018, 1703126
5. G.M. Crean, R. Stuck, J.A. Woollam . Semiconductor Materials Analysis and Fabrication Process Control Elsevier, 2012
6. S. Vairam, Engineering Chemistry, IInd Edition, John Wiley & sons, New Delhi 2014.

18IT104 PYTHON PROGRAMMING 2 0 2 3

Course Objectives

- Understand the history and basics of python
- Gain knowledge about the different data types and control flow statements
- Impart knowledge about the functions, files, list, set tuples and dictionaries

Course Outcomes (COs)

1. Implement simple python programs using input output operations
2. Develop python programs using expressions and statements
3. Implement python programs using control flow statements and strings
4. Apply the concepts of functions and files in python programming
5. Design applications using list, sets, tuples and dictionaries in python

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3		3										
2	2	3		3										
3	2	3		3										
4	2	3		3										
5	2	3		3									2	

UNIT I **6 Hours**

INTRODUCTION

What is Python - History of Python - Features of Python - Simple Program in Python - Commenting in Python - Quotations in Python - Lines and Indentation - Multi-Line Statements - Input Operations - Output Operations.

UNIT II **4 Hours**

DATA, EXPRESSIONS AND STATEMENTS

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III **8 Hours**

CONTROL FLOW STATEMENTS AND STRINGS

if statement - if-else statement - if-elif-else statement - Nested if - While loop - for loop - else statement used with loops - break statement - continue - pass statement - Strings: string slices - immutability - string functions and methods - In-built string methods - string formatting operations - string module.

6 Hours

UNIT IV

FUNCTIONS AND FILES

Functions: return values - parameters - local and global scope - function composition - recursion; Files: Reading and Writing-Format Operators-Filenames and paths.

UNIT V **6 Hours**

LIST, SET AND TUPLES

Lists as arrays - Lists: list operations - list slices - list methods - list loop - mutability - aliasing - cloning lists - list parameters; Set; Tuples: tuple assignment, tuple as return value;

FOR FURTHER READING

Dictionaries: operations and methods.

1 **2 Hours**

EXPERIMENT 1

Program to implement basic operators.

2 **2 Hours**

EXPERIMENT 2

Program for Operator Precedence.

3 **2 Hours**

EXPERIMENT 3

Program to implement the concept of function.

4 **3 Hours**

EXPERIMENT 4

Develop the program for selection statements.

5 **3 Hours**

EXPERIMENT 5

Program to implement looping statements.

6 **3 Hours**

EXPERIMENT 6

Program to implement break and continue statements.

7 **3 Hours**

EXPERIMENT 7

Develop a program to implement the concept of Recursion.

8 **3 Hours**

EXPERIMENT 8

Program to implement string functions.

9 **3 Hours**

EXPERIMENT 9

Implement the concept of list.

10 **3 Hours**

EXPERIMENT 10

Develop a program to implement tuples.

11 **3 Hours**

EXPERIMENT 11

Program to implement set, dictionaries.

Total: 60 Hours

Reference(s)

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/OÃƒÂ¢??Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python - Revised and updated for Python 3.2", Network Theory Ltd., 2014.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2015.
4. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2017

18IT106 HARDWARE ASSEMBLING AND SOFTWARE TOOLS LABORATORY

0 0 4 2

Course Objectives

- Understand the basic hardware components
- Gain knowledge about installation of operating systems
- Impart knowledge about hardware assembling and troubleshooting

Course Outcomes (COs)

1. Identify the basic hardware components
2. Install and configure Windows and Linux operating systems
3. Install and configure software packages and drivers
4. Assemble and troubleshoot hardware devices
5. Install and work with office automation software

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
1	3	2												
2					3									
3		2			3									
4	3				1									
5	2	2			3									

6 Hours

1

EXPERIMENT 1

a) Study of desktop computer, motherboard and its interfacing components.
b) Install and configure computer drivers and system components.

3 Hours

2

EXPERIMENT 2

Disk formatting, partitioning and Disk operating system commands

6 Hours

3

EXPERIMENT 3

a) Install, upgrade and configure Windows/Linux operating systems.
b) Installation of Dual OS using Virtual Machine

6 Hours

4

EXPERIMENT 4

a) Installation Antivirus and configure the antivirus.
b) Installation of printer and scanner software.

6 Hours

5

EXPERIMENT 5

a)Assembly and Disassembly of hardware.
b)Troubleshooting and Managing Systems

6 **6 Hours**

EXPERIMENT 6

a)Recovering the root file system after corruption.
b)Create a FAT32 formatted partition on a disk in Windows 7, and convert the partition to NTFS

7 **3 Hours**

EXPERIMENT 7

Remote desktop connections and file sharing.

8 **3 Hours**

EXPERIMENT 8

Establish network connections, Configure IP address and Domain name system.

9 **3 Hours**

EXPERIMENT 9

Install two different kinds of network cards and connect two computers to campus LAN and download a file from a computer on the LAN

10 **6 Hours**

EXPERIMENT 10

a)Create an advertisement page in Word
b)Create a Mail Merge Letter and a macro for inserting a picture and formatting the text in Word

11 **3 Hours**

EXPERIMENT 11

Create a report in Excel containing the pay details of the Employee

12 **3 Hours**

EXPERIMENT 12

Create a simple bar chart to high light the sales of a company for 5 different periods

13 **3 Hours**

EXPERIMENT 13

Create a macro which creates a line chart using the data in the worksheet

14 **3 Hours**

EXPERIMENT 14

Make a presentation on Wild Life and apply the following:
a. Add audio and video effects
b. Apply various Color Schemes
c. Apply various animation schemes.
d. Apply Slide Show computer on the LAN

Total: 60 Hours

18IT201 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

Programme Outcomes (POs)

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	1												
4	2	1												
5	2	1												

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 tangentplanes, extreme of functions of two variables, applications.

UNIT II **9 Hours**

MULTIPLE INTEGRALS OF VECTOR CALCULUS

Double integrals, regions of integrations, triple integrals, applications (Cartesian coordinates only- Green 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, Taylor Theorem with remainder.

UNIT IV **9 Hours**

FIRST ORDER DIFFERENTIAL EQUATIONS FUNCTIONS

Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

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

UNIT VI FOR FURTHER READING

Applications to Data mining, Graphics and Machine learning.

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

18IT202 ENGINEERING PHYSICS II **2 0 2 3**

Course Objectives

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

Programme Outcomes (POs)

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Understand the principle, characteristics, and 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 fibersin communication and sensors
3. Identify the seven crystal systems, crystal planes and the stacking sequences in metallic crystal structures
4. Analyze the characteristics of semiconducting materials in terms 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

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2	1							2					
3	2	1												
4	2	1							2					
5	2	1							2					

UNIT I **7 Hours**

1 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 descriptionand 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

1 **2 Hours**

EXPERIMENT 1

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 2

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

3 **4 Hours**

EXPERIMENT 3

Determination of acceptance angle and numerical aperture of a given fiber

4 **4 Hours**

EXPERIMENT 4

Evaluation of bandgap of given material using bandgap kit

5 **4 Hours**

EXPERIMENT 5

Determine the V-I characteristics of a solar cell

6 **4 Hours**

EXPERIMENT 6

Using Hall effect, determine the nature of given material

7 **4 Hours**

EXPERIMENT 7

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

8 **4 Hours**

EXPERIMENT 8

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

Total: 60 Hours

Reference(s)

1. Balasubramaniam, R. "Callister's 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, Mc Graw-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

18IT203 ENGINEERING CHEMISTRY II 2 0 2 3

Course Objectives

- Classify the traditional and advanced materials used to manage heat developed in electronic devices
- Summaries 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

Programme Outcomes (POs)

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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.

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

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2					1							
2	2	3					1							
3	2	2					1							
4	2	2					2							
5	2	2					2							

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**

NANO MATERIALS

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

UNIT V **5 Hours**

E-WASTE MANAGEMENT

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

FOR FURTHER READING

virtual lab experience

1 **2 Hours**

EXPERIMENT 1

General instruction for lab

2 **6 Hours**

EXPERIMENT 2

Determination of thermal stability of aluminium oxide using thermo gravimetric analysis

3 **4 Hours**

EXPERIMENT 3

Determination of thermal stability of copper alloys using thermo gravimetric analysis

4 **6 Hours**

EXPERIMENT 4

Determination of single electrode potential of zinc and copper electrodes

5 **6 Hours**

EXPERIMENT 5

Preparation of cadmium nanoparticies and its characterization

6 **6 Hours**

EXPERIMENT 6

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
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.

18IT204 C PROGRAMMING 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.

Programme Outcomes (POs)

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 analyse 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.
m. Ability to Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Implement C programs using operators, type conversion and input-output functions.
2. Apply decision making and looping statements in writing C programs.
3. Develop C programs using the concepts of Arrays and strings.
4. Apply the concepts of functions and pointers in writing C programs.
5. Design applications using structures, unions and files in C.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1		2									
2	3	1		2	2									
3	1	2	2		2									
4	1	2		2	2									
5	1	2	2		2								2	

UNIT I **6 Hours**

INTRODUCTORY CONCEPTS

Problem Solving Techniques - C Primitives: Introduction to C- Planning and writing a C program- - Compiling and executing the C program - Operators and Expressions - Type Conversion Formatted I/O functions.

UNIT II **4 Hours**

CONTROL STATEMENTS

Decision Making and Branching - Statement - Decision Making and Looping Jump Statements

UNIT III **6 Hours**

ARRAYS AND STRINGS

Arrays- one dimensional array - two-dimensional arrays - multi dimensional arrays. Strings - String handling functions.

UNIT IV **6 Hours**

FUNCTIONS AND POINTERS

User Defined Functions: - categories of function - call by value and call by reference - recursion. Pointers - Accessing a variable through its pointer

UNIT V **8 Hours**

STRUCTURES AND FILES

Storage Class Specifiers - Structures and Unions: Introduction - File Management in C - Defining and opening a file - closing a file - Input/output operations on files.

FOR FURTHER READING

Problem solving - Logical thinking - logic - symbolic logic - truth tables - Math puzzles - magic triangles - magic squares

1 **3 Hours**

EXPERIMENT 1

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

2 **3 Hours**

EXPERIMENT 2

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

3 **3 Hours**

EXPERIMENT 3

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.

4 **3 Hours**

EXPERIMENT 4

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

5 **3 Hours**

EXPERIMENT 5

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

6 **3 Hours**

EXPERIMENT 6

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.

7 **3 Hours**

EXPERIMENT 7

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

8 **3 Hours**

EXPERIMENT 8

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

9 **3 Hours**

EXPERIMENT 9

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

10 **3 Hours**

EXPERIMENT 10

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,
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

18IT206 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

2 0 2 3

Course Objectives

- To understand the concept, layout of electrical supply system from SMPS to various computer accessories.
- To understand the operation memory devices and display system used in computers.
- To identify the types of connectors, cables and electric drives for computer systems.

Programme Outcomes (POs)

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 analyse 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.

Course Outcomes (COs)

1. Recognize the operation of power supply system and protection circuit used in computers.
2. Explain different types of memory devices and display system of computers.
3. Differentiate cables and connectors used for personal computers.
4. Classify the various Electric Drives used in Personal computers.
5. Attribute the different types of electronic devices used in computers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2	1		1											
3	1		2											
4	1	2	2											
5	1	2	2											

UNIT I **6 Hours**

POWER SUPPLY AND PROTECTION CIRCUIT

Power supply, rating of power supply and power supply back-up system: CPU, sensors and display systems. Protection: Types of fuses and fuse holders in CPU, Earthing and neutral connection in CPU. - Layout of power supply system from SMPS to various computer accessories and peripherals - Single input multiple output system SMPS - ATx power supply system.

UNIT II **6 Hours**

MEMORY DEVICES AND DISPLAY SYSTEMS

Primary memory: RAM: DRAM, SRAM - ROM: PROM, EPROM, Cache memory - Secondary memory's, Displays Devices: LCD and LED monitors - Plasma monitors - HDTV

UNIT III **6 Hours**

CABLES AND CONNECTORS

Cables: VT, Power, USB, Fiber optics, Multicore, SATA - Sensors: Optical fiber, Thermal, heat sinks. Types of connectors - Ethernet, fiber optic, rectangular, circular, audio, D-Shape, VSB, pluggable.

UNIT IV **6 Hours**

ELECTRICAL MOTORS AND DRIVES

Torque speed characteristics of Stepper motor and Servo motor. Drive system components, CD drive, Hard disk drive and cooling fan drive - Wiring layout of drive systems.

UNIT V **6 Hours**

ELECTRONIC DEVICES

PN junction diode, BJT, FET, IC555 timer, Basic Amplifier and Oscillator circuits.

FOR FURTHER READING

Memory elements - Transducers - Power amplifiers.

1 **6 Hours**

EXPERIMENT 1

Design of power supply system for mobile charger.

2 **6 Hours**

EXPERIMENT 2

Display numbers and words using LED dot matrix.

3 **6 Hours**

EXPERIMENT 3

Identify and trouble shoot Ethernet and optical fiber cable.

4 **6 Hours**

EXPERIMENT 4

Develop a control system for servo motor/stepper motor drive.

5 **6 Hours**

EXPERIMENT 5

Develop a wiring layout form SMPS to various computer peripherals.

Total: 60 Hours

Reference(s)

1. B. Govindarajalu Ibm Pc And Clones: Hardware, Troubleshooting And Maintenance, Tata McGraw Hill Limited.
2. K. L. JAMES, Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance, PHI Learning Private Limited.
3. Robert Bruce Thompson, Barbara Fritchman Thompson, PC Hardware in a Nutshell: A Desktop Quick Reference, Oreilly Media Ltd.

4. Muzaffer A. Siddiqi, Dynamic RAM: Technology Advancements, CRC Press.
5. Sanjay K. Bose, Hardware and Software of Personal Computers, New Age International (P) Limited Publishers.
6. M. Morris Mano, Digital Logic and Computer Design, Pearson India Publishers.

18IT207 ENGINEERING GRAPHICS 1 0 4 3

Course Objectives

- Provide knowledge on projection of points and lines.
- Impart skill in drawing projection of simple solids.
- Familiarize creation of orthographic views from isometric projections of simple solids and vice versa.
- Build the proficiency to create two dimensional sketches using software.
- Provide the skill to build three dimensional models and its orthographic views using software.

Programme Outcomes (POs)

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 analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Illustrate the projection of points and lines in different quadrants.
2. Construct orthographic projections of simple solids.
3. Create the orthographic and isometric projections of simple solids.
4. Sketch the two dimensional views of engineering components using software.
5. Construct three dimensional models of engineering components and its orthographic views using software.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	2							2					
3	1	2												
4	1	2												
5	1	2												

UNIT I **10 Hours**

PROJECTION OF POINTS

Practices on lettering, numbering and dimensioning of drawings. Principles of projection, Projection of points in four quadrants, first angle projection of straight lines - parallel, perpendicular and inclined to anyone plane.

UNIT II **12 Hours**

PROJECTION OF SOLIDS

Orthographic projection of simple solids - parallel, perpendicular and inclined to one plane using change of position method.

UNIT III **14 Hours**

ISOMETRIC AND PERSPECTIVE PROJECTION

Conversion of isometric to orthographic projection and vice versa. Perspective projection of simplesolids.

UNIT IV **10 Hours**

CREATION OF 2D SKETCHES USING SOFTWARE

Sketch Entities -line, circle, arc, rectangle, slots, polygon, text, snap, and grid. Sketch Tools-fillet,chamfer, offset, convert entities, trim, extend, mirror, move, copy, rotate, scale, stretch, sketch pattern. Geometrical constraints, Dimensioning - smart, horizontal, vertical, ordinate.

UNIT V **14 Hours**

PART MODELING AND DRAFTING USING SOFTWARE

Part Modeling - extrude, cut, revolve, creation of planes, fillet, chamfer, shell, rib, pattern, mirror, loft, draft and swept. Drafting - Converting 3D models to orthographic views with dimensions.

Total: 75 Hours

Reference(s)

1. K Venugpoal, Engineering Drawing and Graphics, Third edition, New Age International,2005
2. BasantAgrawal, Mechanical drawing, Tata McGraw-Hill Education, 2008.
3. Engineering Drawing Practice for Schools & Colleges, Bureau of Indian Standards-Sp46,2008.
4. N. D. Bhatt and V. M. Panchal, Engineering Drawing, Charotar Publishing House Pvt.Limited, 2008.
5. K.V. Natarajan, A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 2013.

18IT301 ENGINEERING MATHEMATICS III 3 1 0 4

Course Objectives

- Interpret the introductory concepts of Logic, which will enable them to model and analyze physical phenomena involving continuous changes of variables
- Implement the definitions of relevant vocabulary from graph theory and Combinatorics and be able to perform related calculations
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of polynomial equations and Implement the mathematical ideas for interpolation numerically

Course Outcomes (COs)

1. Interpret the introductory concepts of Logic, which will enable them to model and analyze physical phenomena involving continuous changes of variables
2. Apply graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction
3. Demonstrate the equations into Algebraic, Transcendental or simultaneous and apply the techniques to solve them numerically and implement an appropriate numerical method for interpolation
4. Apply numerical computational techniques to obtain the solutions of first order ordinary differential equations, numerically
5. Develop the identification of Numerical errors arise during computations due to round-off errors and truncation errors.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	2	2												
3	2	1												
4	2	2												
5	1	2												

UNIT I **12 Hours**

LOGIC

Propositional Logic: Truth tables, Tautologies and Contradictions, Rules of inference. Predicate Logic: Predicates-Statement Function - Variables-free and bound variables- Quantifiers-Universe of discourse.

UNIT II **10 Hours**

SET THEORY AND GRAPHS

Sets: Relations, Equivalence relations, Functions. Graphs: Graph, Isomorphism, connected graphs, Trees, Shortest path problem

UNIT III **9 Hours**

NUMERICAL SOLUTION OF LINEAR EQUATIONS AND INTERPOLATION

Algebraic and transcendental equations: Newton - Raphson method - Solution of system of linear equations: Gauss elimination method - Matrix inversion: Gauss- Jordan method - Eigen value of a matrix by power method. Polynomial interpolation and cubic spline interpolation

UNIT IV **10 Hours**

NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Single and multi-variable nonlinear equations, convergence of fixed point iterations. Least squares approximation, Normal equations. Single step methods, Runge-Kutta methods. Multi-step methods. Finite Difference Methods

UNIT V **4 Hours**

ERROR ANALYSIS

Errors, Truncation and round off errors, measurement errors, Chebychev Polynomial and data filtering

Total: 60 Hours

Reference(s)

1. Greenberg Michael D, Advanced Engineering Mathematics, Prentice-Hall International Inc, 1998
2. James Glyn , Advanced Modern Engineering Mathematics, Addison-Wesley, 1993
3. Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993
4. Kenneth H Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, Seventh Edition, Seventh Edition, Mc Graw Hill Education India Private Limited, New Delhi, 2013
5. An Introduction to Error Analysis: The Study of Uncertainties Measurements, John R. Taylors University of Science Books, 1996

18IT302 DIGITAL SYSTEM DESIGN 3 1 0 4

Course Objectives

- Understand the most common digital logic families
- Design combinational and sequential circuits using logic gates

Course Outcomes (COs)

1. Apply arithmetic operations in any number system and simplify the Boolean functions using Boolean algebra and Karnaugh maps.
2. Analyze and Design modular combinational logic circuits containing decoder, multiplexer, demultiplexer and adder
3. Construct the synchronous sequential circuits by using the functionality of registers, flip-flops, and counters
4. Design the asynchronous sequential circuits and analyze the type of hazard in the designed circuits.
5. Model memory array for the given digital circuit problem

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	3	2	2											
3	3	1	1											
4	2	2	2											
5		3												

UNIT I **8 Hours**

FUNDAMENTALS

Logic Gates - Number system and conversions - Boolean algebra and Simplification - Minimization of Boolean functions - Sum of Products and Product of Sums - Karnaugh map (3,4 variable) - Quine McCluskey Method - Prime Implicants and Essential Prime Implicants

UNIT II **9 Hours**

COMBINATIONAL CIRCUITS

Introduction - Design Procedure - Binary Arithmetic circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, BCD Adder, Magnitude Comparator, Code Convertors - Encoders & Decoders - Multiplexers & Demultiplexers - Introduction to HDL - HDL model for combinational circuits.

UNIT III **10 Hours**

SYNCHRONOUS SEQUENTIAL CIRCUITS

Latches: SR , JK - Flip-Flops SR , JK , D, T Conversion from SR to D , JK to T - Design Procedure for Synchronous Sequential Circuits - State Reduction and Assignment Moore and Mealy model - Shift Registers - Synchronous Counters - Up Down counters - HDL for sequential circuits

UNIT IV **9 Hours**

ASYNCHRONOUS SEQUENTIAL CIRCUITS

Design Procedure for Asynchronous Sequential Circuits - Reduction of State and Flow Tables - Race free State Assignment - Hazards: Static and Dynamic Hazards.

UNIT V **9 Hours**

MEMORY AND PROGRAMMABLE LOGIC

Introduction - RAM and ROM - Memory decoding - Error detection and correction - Programmable Logic Array(PLA) - Programmable Array Logic(PAL) - Sequential programmable devices - Application specific integrated circuits

Total: 60 Hours

Reference(s)

1. M Morris Mano, Digital Design, fifth edition, Pearson Education, 2015.
2. Leach D, Malvino A P, Saha G, Digital Principles and Applications, 8e, McGraw Hill Education, 2015
3. Charles H Roth, Fundamentals of Logic Design, fourth Edition, Jaico Publishing House, 2010
4. Donald D Givone, Digital Principles and Design, Tata McGraw-Hill, 2013

18IT303 COMPUTER ORGANIZATION AND 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.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2											
2	1	3	2											
3	1	2	2									1		
4	1	3	2					2				1		
5	1	2	2									1		

UNIT I **9 Hours**

COMPUTER STRUCTURE

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

UNIT II **10 Hours**

ARITHMETIC OPERATIONS

Fixed Point Arithmetic - 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 **10 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 **8 Hours**

PARALLELISM

Parallel processing and its challenges-Instruction level parallelism -Flynn's classification - Hardware multithreading: SISD, MIMD, SIMD, SPMD and Vector multithreading- Multi-core processors: Shared memory multiprocessor and cluster multiprocessor.

UNIT V **8 Hours**

MEMORY MANGEMENT AND I/O SYSTEMS

Memory management module paging and segmentation-Memory hierarchy: Cache memory and Virtual memory - Accessing I/O devices - DMA and interrupts.

FOR FURTHER READING

Communication methods: Buses and Interface - RISC and CISC processors - Stack Processor- Superscalar and vector processor-Disk Memory-Backup Memory.

Total: 45 Hours

Reference(s)

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

18IT304 DATA STRUCTURES AND ALGORITHMS 3 0 0 3

Course Objectives

- To understand the various techniques of sorting and searching
- To design and implement arrays, stacks, queues, and linked lists
- To understand the complex data structures such as trees and graphs

Course Outcomes (COs)

1. Compute the time and space complexity of searching and sorting algorithms with asymptotic notations.
2. Implement all the operations of linear data structures to store and retrieve the given data.
3. Create a hierarchical data structure to represent the given data using tree data structure.
4. Design graph algorithms to compute the shortest path of the given graph and to identify the minimum spanning tree.
5. Implement heap and hash functions for dynamic extension of storage space.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	2	3	2											
3		3	2											
4	2	3	2	3										
5		2	3											

UNIT I **8 Hours**

INTRODUCTION

Development of Algorithms-Notations and analysis-Storage structures for arrays-Sorting Techniques-Selection-Bubble-Insertion-Merge-Heap-Quick and Radix sort-Linear Search-Binary Search.

UNIT II **10 Hours**

LINEAR DATA STRUCTURES

Linked Lists - Linked stacks and queues - Operations on polynomials - Doubly linked lists - Circularly linked lists- Applications of Stack and Queue

UNIT III **10 Hours**

NON LINEAR DATA STRUCTURES

Binary Trees - Binary search trees - Tree traversal - Expression manipulation- AVL Trees- B Tree.

UNIT IV **9 Hours**

GRAPH ALGORITHMS

Graphs - Representation of graphs - BFS, DFS - Topological sort - Shortest path problems- Dijkstra"s Algorithm- Minimum Spanning Tree- Prim"s and Krushkal"s Algorithm.

UNIT V **8 Hours**

DYNAMIC STORAGE MANAGEMENT

Dynamic storage management -Priority Queue - Binary Heap-Heap sort - Hash functions - separate chaining, open addressing - rehasing - Extendible hashing.

FOR FURTHER READING

Floyd Warshall Algorithm, Splay Trees, Tries, Dynamic Programming, Backtracking.

Total: 45 Hours

Reference(s)

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2015.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, Introduction to Algorithms, Third Edition, MIT Press, 2014.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
4. Gilberg, Data Structures: A Pseudocode Approach with C, Second Edition, Cengage Learning, 2007.

18IT305 OBJECT ORIENTED PROGRAMMING WITH CPP and JAVA

2 0 2 3

Course Objectives

- Design, write, debug, run C++ and Java Programs.
- Develop console based applications using C++.
- Develop Console and windows applications using Java.

Course Outcomes (COs)

1. Design class and objects for real world scenario.
2. Apply Inheritance concept to obtain code reusability.
3. Create applications to manipulate data from files using functions and streams
4. Develop console applications using Java OOPS.
5. Develop GUI application using Java library classes.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2	2		2									
2		2	2		2									
3		2	1		2								2	
4		1	2		2									2
5		1	2		2								1	

UNIT I **6 Hours**

CLASSES AND OBJECTS

Overview of OOPs Principles - Introduction to classes & objects - Instantiating and Using Classes with objects - Data Members - Member Functions - this Pointer - Constructor & Destructor - Control Structures - Arrays and Strings in C++ - Static class member

UNIT II **6 Hours**

INHERITANCE

Derived Class and Base Class - Derived Class Constructors - Overriding Member Functions - Public and Private Inheritance - Types of Inheritance: Single, Multi Level, Multiple, Hierarchical and Hybrid - Virtual Base Classes - Abstract Classes.

UNIT III **6 Hours**

FUNCTIONS AND STREAMS

Pointers - this Pointer - Pointers to Objects and Derived Classes - Function Overloading - Operator Overloading - Virtual Function - Friend Function - Static Function - Streams: Stream Classes - Unformatted I/O Operations - Formatted Console I/O Operations

UNIT IV **6 Hours**

JAVA BASICS

Java Basics - Classes and Objects - Inheritance- Interfaces - Abstract Class - packages - Exception handling- Strings - Type wrappers

UNIT V **6 Hours**

JAVA COLLECTIONS AND IO

Generics - Collections -Java Utility Classes - I/O Classes and Interfaces-Java Database Connectivity-Multithreading- Java swing basics

1 **3 Hours**

EXPERIMENT 1

Introduction to OOP lab (Simple C program) - Classes and Objects

2 **3 Hours**

EXPERIMENT 2

Programs using inheritance and polymorphism

3 **3 Hours**

EXPERIMENT 3

Programs on operator overloading

4 **3 Hours**

EXPERIMENT 4

Programs on dynamic memory management using new, delete operators

5 **3 Hours**

EXPERIMENT 5

Programs on exception handling

6 **3 Hours**

EXPERIMENT 6

Programs on generic programming using template function

7 **3 Hours**

EXPERIMENT 7

Programs on java classes and objects and strings

8 **3 Hours**

EXPERIMENT 8

Programs on inheritance in java

9 **3 Hours**

EXPERIMENT 9

Programs on multi-threading in java

10 **3 Hours**

EXPERIMENT 10

Programs on java swing

Total: 60 Hours

Reference(s)

1. E Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing, New Delhi, 2011
2. Robert Lafore, Object Oriented Programming in C++, Galgotia Publication, 2010.
3. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, McGraw-Hill Education,2018
4. D.T. Editorial Services ,Java 8 Programming Black Book , second edition, Dreamtech Press,2015

18IT306 SOFTWARE ENGINEERING 3 0 0 3

Course Objectives

- Understand the phases in a software project
- Analyze synthesize and design software systems for any given specification
- Apply basic software quality assurance practices to ensure that software designs development and maintenance meet or exceed applicable standards
- Learn various testing and maintenance measures

Course Outcomes (COs)

1. Design solutions using common life cycle models for a given software problem
2. Apply the Requirement engineering process with emphasis on elicitation analysis and modeling for any given software requirement
3. Identify appropriate design strategies and analyze the requirement specifications for any software system
4. Characterize various software testing techniques analyze the given software requirements to determine appropriate testing techniques in commercial software environments
5. Interpret the process of software project management and estimate the suitable cost

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3									1		
2	2	1	2		1									
3	2	1	3											
4	1	2	3	2								1		
5	1	2	3								2	1		

UNIT I **8 Hours**

SOFTWARE PROCESS AND AGILE DEVELOPMENT

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models - Introduction to Agility-Agile process-Extreme programming.

UNIT II **10 Hours**

REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document - Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management

UNIT III **10 Hours**

SOFTWARE DESIGN

Design process - Design Concepts-Design Model - Design Heuristic - Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface

Design: Interface analysis, Interface Design - Component level Design: Designing Class based components, traditional Components

UNIT IV **8 Hours**

SOFTWARE TESTING TECHNIQUES

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing - Unit Testing - Integration Testing - Validation Testing - System Testing and Debugging

UNIT V **9 Hours**

PROJECT MANAGEMENT

Software Project Management: Estimation - LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model - Project Scheduling, Earned Value Analysis Planning - Project Plan, Planning Process, RFP Risk Management -Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

FOR FURTHER READING

Domain driven design - architectural design and its benefits

Total: 45 Hours

Reference(s)

1. Roger S Pressman, Software Engineering: A Practitioner Approach, Tata McGraw Hill, Eighth Edition, 2015.
2. I Sommerville, Software Engineering,9th edition, Addison Wesley, 2011
3. James S Peters, WitoldPedrycz, Software Engineering An Engineering Approach, Wiley India Edition, 2011
4. Richard Fairley, Software Engineering Concepts, Tata McGraw Hill, 2008
5. http://nptel.ac.in/

18IT307 DIGITAL SYSTEM DESIGN LABORATORY 0 0 2 1

Course Objectives

- Design, analyze and test simple combinational logic using basic gates
- Analyze and design basic sequential logic circuits for various applications

Course Outcomes (COs)

1. Implement the circuit for conversion of number system from binary to gray,gray to excess 3 and vice versa
2. Design and Implement combinational logic circuits containing decoder, multiplexer, de-multiplexer and adder
3. Analyze, design, build and debug complex and sequential circuit for the given specification
4. Construct the synchronous sequential circuits by using the functionality of registers, flip-flops, and counters.
5. Implementation of simple combinational and sequential circuit using HDL

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	2	2												
3	3	2												
4	3	2												
5	2													

1 **3 Hours**

EXPERIMENT 1

Design and Implementation of Half adder, Full Adder and Half Subtractor, Full Subtractor

2 **4 Hours**

EXPERIMENT 2

Design and Implementation of Code Converter

3 **3 Hours**

EXPERIMENT 3

Design of 4-bit Adder and Subtractor

4 **3 Hours**

EXPERIMENT 4

Design and Implementation of Multiplexer and Demultiplexer

5 **3 Hours**

EXPERIMENT 5

Design and Implementation of Encoder and Decoder

6 **3 Hours**

EXPERIMENT 6

Construction and Verification of Ripple Counter

7 **3 Hours**

EXPERIMENT 7

Design and Implementation of Synchronous UP/Down Counter

8 **3 Hours**

EXPERIMENT 8

Design and Implementation of Shift Register

9 **2 Hours**

EXPERIMENT 9

Implementation of simple combinational circuit using HDL

10 **3 Hours**

EXPERIMENT 10

Implementation of simple sequential circuit using HDL

Total: 30 Hours

18IT308 DATA STRUCTURES AND ALGORITHMS LABORATORY

0 0 2 1

Course Objectives

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

Course Outcomes (COs)

1. Compute the time and space complexity of searching and sorting algorithms with asymptotic notations.
2. Implement all the operations of linear data structures to store and retrieve the given data.
3. Create a hierarchical data structure to represent the given data using tree data structure.
4. Design graph algorithms to compute the shortest path of the given graph and to identify the minimum spanning tree.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2											
2		3	2											
3		3	2			2						2		
4		3	3	2								2	2	

1 **2 Hours**

EXPERIMENT 1

Implementation of searching algorithms
a) Linear Search
b) Binary Search

2 **3 Hours**

EXPERIMENT 2

Implementation of sorting algorithms
a) Insertion sort
b) Selection sort
c) Quick sort
d) Merge sort

3 **4 Hours**

EXPERIMENT 3

Design a Singly linked list and perform insertion, deletion and searching.
a) Array implementation of List ADT
b) Linked list implementation of List ADT

4 **4 Hours**

EXPERIMENT 4

Construct a stack ADT and perform push and pop operations.
a) Array implementation of Stack ADT
b) Linked list implementation of Stack ADT

5 **3 Hours**

EXPERIMENT 5

Construct a Queue ADT and perform enqueue and dequeue operations.
a) Array implementation of queue ADT
b) Linked list implementation of queue ADT

6 **4 Hours**

EXPERIMENT 6

Develop a program to create a Binary Search Tree and to traverse the tree.

7 **3 Hours**

EXPERIMENT 7

Compute the shortest path from a single source node using Dijikstras Algorithm.

8 **3 Hours**

EXPERIMENT 8

Construct a graph and perform graph traversal (BFS, DFS)

9 **4 Hours**

EXPERIMENT 9

Develop a program to construct a minimum spanning tree with the given graph using:
a) Prims Algorithm
b) Krushkals Algorithm

Total: 30 Hours

18IT401 ENGINEERING MATHEMATICS IV 3 1 0 4

Course Objectives

- Understand the concepts of Fourier series, Transforms and Boundary Conditions, which will enable them to model and analyze the physical phenomena
- Implement the Fourier analysis, an elegant method in the study of heat flow, fluid mechanics and electromagnetic fields
- Summarize and apply the mathematical aspects that contribute to the solution of one dimensional wave equation

Course Outcomes (COs)

1. Identify the periodicity of a function and formulate the same as a combination of sine and cosine using Fourier series and Fourier transform, which converts the time function into a sum of sine waves of different frequencies, each of which represents a frequency component
2. Formulate a function in frequency domain whenever the function is defined in time domain
3. Interpret the classification of a partial differential equation and able to solve them
4. Demonstrate and apply the basic probability axioms and concepts of probability distributions in an appropriate place of science and Engineering
5. Apply basic statistical inference techniques, including confidence intervals, hypothesis testing to information theory

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1												
2	2	2												
3	2	1												
4	2	2												
5	1	2												

UNIT I **10 Hours**

FOURIER ANALYSIS

Fourier series for periodic functions- Dirichlets conditions - The Euler coefficients - General Fourier series. Fourier transforms- Properties of Fourier transform- Applications of Fourier series and transform analysis.

UNIT II **9 Hours**

LAPLACE TRANSFORM

Laplace Transform- Existence Condition -Transforms of Standard Functions - Unit step function, Unit impulse function- Properties- Transforms of Derivatives and Integrals - Initial and Final Value Theorems - Laplace transform of Periodic Functions - Inverse Laplace Transform-Convolution.

UNIT III **9 Hours**

Z - TRANSFORM

Z-Transform - Elementary Properties - Inverse Z-Transform - Convolution Method- Partial fraction method - Solution of Difference Equations using Z-Transform.

UNIT IV **8 Hours**

PROBABILITY THEORY

Probability- Conditional probability - Bayes theorem- Random variables-Probability densities and distributions- Mean and variance of a distribution- Binomial, Poisson and Normal distributions

UNIT V **9 Hours**

MATHEMATICAL STATISTICS AND INFORMATION THEORY

Sampling - Large sample test: Tests for mean. Small sample test: Tests for mean (t test), F- test - Chi- square test for Goodness of fit. Information Theory- Entropy-Information measures- Average uncertainty- Shannons measure of information and its properties.

Total: 60 Hours

Reference(s)

1. Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993
2. Johnson Richard A. and Bhattacharyya Gouri K., Statistics, Principles and Methods, 3rd Edition, John Wiley, 1996
3. James Glyn, Advanced Modern Engineering Mathematics, Addison-Wesley, 1993
4. Milton J. S. and Arnold Jesse C., Introduction to Probability and Statistics: Principles and Applications for Engineering and The Computing Sciences, McGraw Hill Inc, 3rd Edition, 1995
5. Thomas T.M and Cover, Elements of Information theory, Wiley, Newyork,2006

18IT402 DATABASE MANAGEMENT SYSTEMS 3 1 0 4

Course Objectives

- Understand functional components of the Database Management System
- Understand need for concurrency and transaction property
- Compare and contrast various indexing strategies in different database systems

Course Outcomes (COs)

1. Identify and analyze the essential concepts and key issues involved in the design of a database
2. Apply the concepts of normalization and ER model to guarantee an efficient database
3. Analyze the concurrent execution of transaction process and various recoveries from failures
4. Apply indexing and query optimization techniques for a database design
5. Analyze the various advanced databases for efficient data storage.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		2		2			3						
2	2	3	3		2									
3	3		2		3									
4	3		3		3									
5	3	2	3											

UNIT I **9 Hours**

RELATIONAL DATABASES

Purpose of Database System - Views of data - Data Models - Database System Architecture - Introduction to relational databases - Relational Model - Keys - Relational Algebra - SQL fundamentals - Advanced SQL features -Embedded SQL- Dynamic SQL

UNIT II **9 Hours**

DATABASE DESIGN

Entity-Relationship model - E-R Diagrams - Enhanced-ER Model - ER-to-Relational Mapping - Functional Dependencies - Non-loss Decomposition - First, Second, Third Normal Forms, Dependency Preservation - Boyce/Codd Normal Form- Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form

UNIT III **9 Hours**

TRANSACTION

Transaction Concepts - ACID Properties - Schedules - Serializability - Concurrency Control -Need for Concurrency - Locking Protocols - Two-Phase Locking - Deadlock - Transaction Recovery - Save Points - Isolation Levels - SQL Facilities for Concurrency and Recovery.

UNIT IV **9 Hours**

FILE AND QUERY PROCESSING

RAID - File Organization - Organization of Records in Files - Indexing and Hashing -Ordered Indices - B+ tree Index Files - B tree Index Files -Static Hashing - Dynamic Hashing - Query Processing Overview - Algorithms for SELECT and JOIN operations - Query optimization using Heuristics and Cost Estimation.

UNIT V **9 Hours**

ADVANCED DATABASES

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

Spatial and Temporal Databases - Mobile Databases - Multimedia and Web Databases.

Total: 60 Hours

Reference(s)

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition, Pearson Education, 2011.
3. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
5. G.K.Gupta,Database Management Systems, Tata McGraw Hill, 2011.

18IT403 WEB TECHNOLOGY 2 0 2 3

Course Objectives

- Study about designing web pages with the help of frames and scripting languages
- Develop web sites which are secure and dynamic in nature using Javascript
- Learn the importance of server-side scripts like JSP and servlets for web Interactivity and Web Hosting

Course Outcomes (COs)

1. Analyse and determine an appropriate web server configuration based on stated user needs
2. Design web-applications using open source technologies such as HTML, DHTML CSS and PHP.
3. Implement static, dynamic and interactive web pages and web applications using Javascript, Jquery and Ajax.
4. Apply dynamic page functionality in web pages using Servlets.
5. Develop JSP applications with Model View Control architecture.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2											
2	1	2	2		2									
3	1	2	3		2									
4	1	2	2		2								2	
5	1	2	2		2									2

UNIT I **6 Hours**

INTRODUCTION TO WEB

Web Concepts - Web Technology Protocols - Web Servers - Internet Web Server - Personal Web Server - Apache Web Server - Client server architecture - XAMP - Emerging Technologies in web.

UNIT II **6 Hours**

SCRIPTING BASICS

HTML Basics - Forms - Tables - Links - DHTML - XHTML - CSS - Internal Style sheets - External Style sheets- PHP Basics - Dynamic Content - Form processing - XML - DTD - XSD.

UNIT III **6 Hours**

SCRIPTING LANGUAGES

JavaScript - Variables - Statements - Popup Boxes - Functions - Loops - Error Handling - Date and String objects - Ajax Basics, Accessing database - Jquery.

UNIT IV **6 Hours**

SERVLETS

Introduction- Servlet features - Servlet Overview Architecture - Three Tier Applications - Servlet package and API - Configuring Servlet - Handling HTTP Request - Get and post request - Redirecting request- Session Tracking and Cookies.

UNIT V **6 Hours**

JAVA SERVER PAGES

Introduction - JSP architecture - Life cycle - JSP Tags and Implicit objects - JSTL - Core Tags - SQL Tags - Formatting Tags - JDBC - Accessing database

FOR FURTHER READING

Web Hosting - Web Configuration - Web Development Tools

1 **3 Hours**

EXPERIMENT 1

Create a web page using HTML Elements and Frames

2 **3 Hours**

EXPERIMENT 2

Use Cascading Style sheets for designing the DHTML web page

3 **3 Hours**

EXPERIMENT 3

Design a dynamic web page with validation using JavaScript

4 **3 Hours**

EXPERIMENT 4

Create the DTD and XML Schema to validate XML File

5 **3 Hours**

EXPERIMENT 5

Design a web page using PHP with MySQL as backend

6 **3 Hours**

EXPERIMENT 6

Create a AJAX program to Receive data and Process XML Objects in the DOM

7 **3 Hours**

EXPERIMENT 7

Demonstrate a web application with Servlets

8 **3 Hours**

EXPERIMENT 8

Write the JSTL Formatting tags todesigna and validate web forms

9 **3 Hours**

EXPERIMENT 9

Implement a JSP script to access information from a Database using JDBC

10 **3 Hours**

EXPERIMENT 10

Design a web catalog with JSF

Total: 60 Hours

Reference(s)

1. Kogent Learning Solutions, Web Technologies: Black Book, Dreamtech press, 2014.
2. Harvey M Deitel and Paul J Deitel, Internet and World Wide Web - How to Program, Fifth Edition, Pearson Education, 2012.
3. John Pollock, JavaScript- A Beginners Guide,Fourth Edition, Tata McGraw-Hill, 2010.
4. Jeffrey C Jackson, Web Technologies: A Computer Science Perspective,Second Edition, Pearson, 2009.

18IT404 PRINCIPLES OF COMMUNICATION 3 0 0 3

Course Objectives

- Understand the basic concepts of communication and its types
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques
- Gain knowledge on various mobile communication technologies and their performances

Course Outcomes (COs)

1. Analyze the performance of AM,FM and PM systems
2. Analyze and design various pulse modulation schemes for the transmission of analog message signal
3. Analyze the performance of various digital modulation techniques
4. Compare and analyze different multiple access techniques used for wireless communication systems
5. Design the spread spectrum modulation schemes for secured communication

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	2												
3	1	2												
4		2	1											
5		2	2											

UNIT I **9 Hours**

ANALOG COMMUNICATION

Elements of Communication systems - Basic principles of Amplitude Modulation, Frequency Modulation and Phase Modulation - Frequency Translation - Superheterodyne Receiver - Envelope Detector - FM Receiver.

UNIT II **9 Hours**

PULSE MODULATION

Sampling process - Pulse Amplitude modulation - Pulse width modulation - Pulse position modulation - Bandwidth Noise trade off - Quantization process - Pulse Code Modulation - Noise considerations in PCM systems - Time Division Multiplexing.

UNIT III **9 Hours**

DIGITAL MODULATION

Introduction to pass band data transmission - Pass band transmission model - Coherent binary modulation techniques: BPSK, QPSK - Coherent Quadrature modulation techniques: QAM - Non-coherent binary modulation: BFSK, DPSK - performance of digital modulation systems based on probability of error, band width.

UNIT IV **9 Hours**

MOBILE COMMUNICATION TECHNOLOGIES

Wireless transmission - Signal propagation - Medium access control: Motivation for a specialized MAC - TDMA - FDMA - CDMA - GSM : System architecture - Radio interface - Protocols - Localization and calling - Handover - Security.

UNIT V **9 Hours**

SPREAD SPECTRUM MODULATION

Pseudo noise Sequences - A Notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Frequency hopping spread spectrum : Slow Frequency hopping, Fast Frequency hopping - RAKE receiver for wireless communication using CDMA

FOR FURTHER READING

A survey on 5G Communication and its applications

Total: 45 Hours

Reference(s)

1. Simon Haykin, Communication systems, 5th Edition, John Wiley and Sons, 2018.
2. John Proakis, Massoud Salehi, Digital Communication, 5th Edition, McGraw-Hill, 2014.
3. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson, 2014.
4. K Sam Shanmugam, Digital and Analog Communication Systems, John Wiley, 2018.
5. A B Carlson and Paul Crilly, Communication Systems, 5th Edition, McGraw-Hill, 2017.

18IT405 SYSTEM SOFTWARE 3 1 0 4

Course Objectives

- Understand the role of system software in improving the system performance
- Design Assembler, Linker, Loader and Macro processor

Course Outcomes (COs)

1. Explore the machine architecture of SIC, SIC/XE, CISC and RISC.
2. Compare the features of one pass, two pass and multipass assembler in terms of performance and analyze the suitable assembler for the given program.
3. Design and Implement assembler programs
4. Analyze the features of loaders and linkers
5. Implement the algorithm and data structure of machine independent macro processors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	1	2	2	2										
3		2	3											
4	1	2	3	3										
5	1		2	2										

UNIT I **9 Hours**

INTRODUCTION

System Software Vs. Application Software SIC & SIC/XE Architecture, Addressing modes, SIC & SIC/XE Instruction set, Assembler Directives and Programming-Traditional CISC Machine - RISC Machine.

UNIT II **9 Hours**

ASSEMBLERS

Basic Functions of Assembler-Assembler output format -Header, Text and End Records- Assembler data structures, two pass assembler algorithm, and Machine dependent assembler features.

UNIT III **9 Hours**

ASSEMBLER DESIGN OPTIONS

Machine Independent assembler features - program blocks, Control sections, Assembler design options-Algorithm for Single Pass assembler, Multi pass assembler, Implementation example of MASM Assembler

UNIT IV **9 Hours**

LOADERS AND LINKER

Basic functions of loader, Machine dependent loader feature, Machine Independent loader features,Bootstrap Loaders, Loader design options- Linker: Introduction, Relocation and Linking concepts, Design a linker, Self relocating program linking for overlays.

UNIT V **9 Hours**

MACRO PROCESSORS

Basic macro processor functions - Macro Definition and Expansion - Macro Processor Algorithm and data structures - Machine-independent macro processor features - Concatenation of Macro Parameters - Generation of Unique Labels - Conditional Macro Expansion - Keyword Macro Parameters - Macro within Macro - Implementation example - MASM Macro Processor.

Total: 60 Hours

Reference(s)

1. Leland L Beck and D Manjula, System Software - An Introduction to Systems Programming, Pearson Education 2011.
2. Srimanta Pal,Systems Programming,Oxford University Press, 2011
3. John R. Levine,Linkers & Loaders, Morgan Kauffman, 2003
4. John J.Donovan,Systems Programming,Tata McGraw-Hill, 1991

18IT406 COMPUTER NETWORKS 3 0 0 3

Course Objectives

- To understand the division of network functionality into layers and to familiarize the functions and protocols of each layer of TCP/IP protocol suite.
- To understand the components required to build different types of network and to learn concepts related to network addressing.
- To understand the flow of information from one node to another node in the network and to learn the application layer utilities.

Course Outcomes (COs)

1. Compare OSI model with TCP/IP protocol suite and design a network based on four different topologies.
2. Design and analyze error and flow control algorithms for communication between adjacent nodes in a network.
3. Identify and apply the suitable routing algorithms for the given network.
4. Develop a client/server application using TCP/UDP and design algorithms for end-end communication.
5. Analyze the capabilities of application layer utilities and replicate the same for new applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	3								1			
2	1	2	3	1	1						2			
3	3	2	2								2			
4	1	3	2	1							2			
5	3	2									1			

UNIT I **9 Hours**

DATA COMMUNICATIONS

Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Introduction to Physical Layer, Multiplexing and Spectrum Spreading - Transmission Media: Guided Media, Unguided Media.

UNIT II **9 Hours**

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.

UNIT III **9 Hours**

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 - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

UNIT IV **9 Hours**

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.

UNIT V **9 Hours**

APPLICATION LAYER

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

FOR FURTHER READING

HTTPS, IPSec, SCTP, ICMPv6, Multimedia in the Internet.

Total: 45 Hours

Reference(s)

1. Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2013.
2. Andrew S Tanenbaum and David J Wetherall, Computer Networks, Fifth Edition, Pearson Education, 2011.
3. William Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall, 2013.
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.

18IT407 DATABASE MANAGEMENT SYSTEMS LABORATORY

0 0 2 1

Course Objectives

- understand the basic of database design
- gain knowledge about various operations that can be done in database design
- impart knowledge about database connectivity with front end tools

Course Outcomes (COs)

1. Design a database with different types of integrity constraint using
2. Implement stored procedures, stored functions and cursors
3. Implement database connectivity using JDBC and ODBC driver.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2	2									
2	3	3	3	2	3									1
3	2	2	3	3										2

1 **10 Hours**

EXPERIMENT 1

Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.

2 **4 Hours**

EXPERIMENT 2

Database Querying - Simple queries, Nested queries, Sub queries and Joins

3 **3 Hours**

EXPERIMENT 3

Views, Sequences, Synonyms

4 **3 Hours**

EXPERIMENT 4

Database Programming: Implicit and Explicit Cursors

5 **4 Hours**

EXPERIMENT 5

Procedures and Functions

10 **6 Hours**

EXPERIMENT 10

Case Study using real life database applications

Total: 30 Hours

18IT408 COMPUTER NETWORKS LABORATORY 0 0 2 1

Course Objectives

- Give emphasis to the hands-on experience of networking issues in a real time environment.
- Explore the design of abstract concepts of network and observe its behaviors in real life.
- Understand the basics and working of the various networking protocols.

Course Outcomes (COs)

1. Implement protocols to understand and describe the devices and services used to support communications in data networks and the Internet.
2. Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4.
3. Implement transport and application layer protocols in data networks.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		2						2		1	
2	3	3			2						3		1	
3	2	3	1		2						3	2	2	

1 **4 Hours**

EXPERIMENT 1
Experiment on configuring network topology using packet tracer.

2 **4 Hours**

EXPERIMENT 2
Experiment on packet capturing and analyzing using packet tracer.

3 **3 Hours**

EXPERIMENT 3
Experiment on error correction code like CRC and Checksum.

4 **4 Hours**

EXPERIMENT 4
Experiment on IP address classification and network address translation.

5 **4 Hours**

EXPERIMENT 5
Experiment on configuring router and switch.

6 **4 Hours**

EXPERIMENT 6
Experiment on ARP and RARP in live network using Wireshark.

7 **3 Hours**

EXPERIMENT 7

Experiment on routing algorithms like Distance Vector and Link State Routing.

8 **4 Hours**

EXPERIMENT 8

Experiment on chat programming using TCP and UDP sockets.

Total: 30 Hours

18HS001 ENVIRONMENTAL SCIENCE 2 0 0 0

Course Objectives

- Understand the interdisciplinary and holistic nature of the environment
- Identify the significance of natural resources and environment on the quality of life and stimulate the quest for sustainable development
- Assess the socio-economic, political and ethical issues in environmental science

Course Outcomes (COs)

1. Explain the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment from degradation
3. Identify the existing environmental challenges related to pollution and its management
4. Select suitable strategies for sustainable management of components of environmental science
5. Correlate the impacts of population and human activities on environment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	1												
3	2	2					1							
4	1													
5	2													

UNIT I **6 Hours**

NATURAL RESOURCES

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer-pesticide problems (eutrophication, blue baby syndrome, biomagnification) - water logging - salinity - case studies. Energy resources: renewable(solar, wind, tidal, geothermal and hydroelectric power) - non renewable energy sources

UNIT II **6 Hours**

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features: forest ecosystem - desert ecosystem - ecological succession. Biodiversity - value of biodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity - field study

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - water pollution : (Sewage water treatment by activated sludge and trickling filter process) - marine pollution - thermal pollution - noise pollution. Disaster management: causes - effects - control measures of floods - earthquake - cyclone - landslides

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development : Definition - Unsustainable to sustainable development - urban problemsrelated to energy. Environmental ethics - issues and possible solutions - solid waste management - causes - effects - 3R Principles (landfills, incineration, composting). Water conservation - rain water harvesting - watershed management. Climate change - global warming - acid rain - ozone layer depletion. Environment protection act: Air (Prevention and control of pollution) act - wildlife protection act.

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - women and child welfare programmes - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

FOR FURTHER READING

Human rights: E - waste and biomedical waste -Identification of adulterants in food materials

Total: 30 Hours

Reference(s)

1. Anubha Kaushik, C.P. Kaushik, Environmental Science and Engineering , 4th Multi Colour Edtion, New Age International Publishers, New Delhi, 2014
2. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons
3. T. G. Jr. Miller, S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi, 2014
4. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press
5. A. K. De, Environmental Chemistry, 7th Edition , New age international publishers, New Delhi, 2014

21IT501 CLOUD COMPUTING 3 0 0 3

Course Objectives

- Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud based applications
- Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure
- Identify major security and privacy problems in cloud computing environment

Course Outcomes (COs)

1. Analyze the components of cloud computing showing how business agility in an organization can be created.
2. Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud.
3. Analyze the key concepts of AWS storage for load balancing in cloud architecture.
4. Investigate how a Windows Azure solution can be optimized so that it can be delivered successfully from the windows cloud
5. Identify the risks and benefits of implementing cloud computing.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3										
2			1	3	2									
3			2	1	3				1					
4	1		2	1	3									
5	1		3		2									

UNIT I **9 Hours**

INTRODUCTION TO CLOUD COMPUTING

Cloud computing at a glance - Historical developments -building cloud computing environments -Cloud Computing Architecture: The cloud reference model, deployment model & service model - computing platforms and technologies.

UNIT II **9 Hours**

VIRTUALIZATION

Introduction & benefit of Virtualization -Implementation Levels of Virtualization- Virtualization at OS level - Virtualization structure - Xen Virtualization Architecture - Binary Translation with full Virtualization - Para Virtualization with Compiler Support - Virtualization in Intex x86processor

UNIT III **9 Hours**

AMAZON WEB SERVICES

AWS Infrastructure - AWS ecosystem - AWS API & security - Amazon Storage - Simple Storage Service(S3) - Elastic Block Storage (EBS) - AWS Security policies, AWS compliance initiatives, Understanding public/private keys - AWS networking and databases service.

UNIT IV **9 Hours**

WINDOWS AZURE

Windows Azure Architecture and components of the Windows Azure Platform, Role of the Fabric Controller - Web worker, VM in Windows Azure, Azure Storage, SQL Azure - Windows Azure Web roles - Windows Azure API- Windows Azure local storage- Blob Storage & Table Storage

UNIT V **9 Hours**

SECURITY

Security for Virtualization Platform - Host security for SaaS, PaaS and IaaS - Data Security - Data Security Concerns - Data Confidentiality and Encryption - Data Availability - Data Integrity - Cloud Storage Gateways - Cloud Firewall.

Total: 45 Hours

Reference(s)

1. Matthew Portney , virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press ,2015
3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013.
4. Bernard Golden ,Amazon Web Services For Dummies, John Wiley & Sons, First Edition,2013
5. http//www.microsoft.com/learning/default.mspx.
6. https://www.oreilly.com/library/view/cloud-security-and/9780596806453/ch04.html

21IT502 OPERATING SYSTEMS 3 1 0 4

Course Objectives

- Summarize the basic concepts and functions of operating systems.
- Outline Processes / Threads, concepts of deadlock and analyze Scheduling algorithms.
- Analyze various memory management schemes.
- Summarize the concepts of I/O management and File systems management.
- Outline the basics of Linux system and Mobile OS like iOS and Android.

Course Outcomes (COs)

1. Demonstrate how system will execute the instruction using system call and system programs
2. Compare the various CPU scheduling algorithm and deadlock, prevention and avoidance algorithms.
3. Demonstrate the Paging and segmentation memory management schemes.
4. Identify the functionality of file systems and implement the file system and directory structures in OS.
5. Perform administrative tasks on Linux Servers and Compare iOS and Android Operating Systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2											
2	3	3	3											
3	2	3	3											
4	3	3	3											
5	1	2	2											

UNIT I **7 Hours**

UNIT I OPERATING SYSTEM OVERVIEW

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System. Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II **11 Hours**

UNIT II PROCESS MANAGEMENT

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-processCommunication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III **9 Hours**

UNIT III STORAGE MANAGEMENT

Main Memory - Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64-bit architecture Examples; Virtual Memory - Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV **9 Hours**

UNIT IV FILE SYSTEMS AND I/O SYSTEMS

Mass Storage system - Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems - I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT V **9 Hours**

UNIT V CASE STUDY

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

FURTHER READING

Windows: Process Management - File Management- Storage Management

Total: 60 Hours

Reference(s)

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.
2. Ramaz Elmasri, A. Gil Carrick, David Levine, Operating Systems - A Spiral Approach, Tata McGraw Hill Edition, 2010.
3. Achyut S.Godbole, Atul Kahate, Operating Systems, McGraw Hill Education, 2016.
4. Andrew S. Tanenbaum, Modern Operating Systems, Second Edition, Pearson Education, 2004.
5. Daniel P Bovet and Marco Cesati, Understanding the Linux kernel, 3rd edition, O'Reilly, 2005.
6. Neil Smyth, iPhone iOS 4 Development Essentials - Xcode, Fourth Edition, Payload media, 2011.

21IT503 COMPUTATIONAL THEORY AND COMPILERS

3 1 0 4

Course Objectives

- Acquire knowledge of Automata Theory as the basis of all computer science languages design
- Learn the tools used for Lexical and Syntax analysis
- Enrich the knowledge in various phases of compiler ant its use

Course Outcomes (COs)

1. Construct finite automata for given pattern and find its equivalent regular expressions.
2. Design and simplify context free grammar and find equivalent pushdown automata for given language.
3. Generate the machine code considering the functionalities involved in different phases of the compilation process.
4. Implement the parsing techniques including Bottom-up and Top-down parsing for the given programming construct described in Context Free Grammar
5. Design code generators for the specified machine and apply the various optimization techniques to speedup the compilation time.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2									2		
2	2	1	2											
3	1		2									2		
4	1		2									2		
5	1		2									2		

UNIT I **10 Hours**

FINITE AUTOMATA

Introduction - Basic Mathematical Notation and techniques - Finite State systems - Basic Definitions - Finite Automaton - DFA & NDFA - Regular Languages- Regular Expression - Equivalence of NFA and DFA - Equivalence of NDFAs with and without input moves - Equivalence of finite Automaton and regular expressions - Minimization of DFA.

UNIT II **9 Hours**

GRAMMARS AND PUSHDOWN AUTOMATA

Grammar Introduction - Types of Grammar - Context Free Grammars and Languages - Derivations and Languages - Ambiguity - Relationship between derivation and derivation trees - Simplification of CFG - Elimination of Useless symbols - Unit productions - Null productions - Pushdown Automata - Definitions - Moves - Instantaneous descriptions - Deterministic pushdown automata - Equivalence of Pushdown automata.

UNIT III **8 Hours**

LEXICAL ANALYSIS

Introduction to Compiling - The grouping of phases - Compiler construction tools. The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens - A language for specifying lexical analyzer.

UNIT IV **8 Hours**

SYNTAX ANALYSIS

Syntax Analysis - The role of the parser - Context-free grammars - Writing a grammar - Top-down parsing - Bottom-up Parsing - SR parsers - LR parsers - Constructing an SLR(1) parsing table. Type checking - Type Systems - Specification of a simple type checker.

UNIT V **10 Hours**

CODE GENERATION AND OPTIMIZATION

Intermediate languages - Declarations - Assignment statements - Boolean expressions - Case statements - Backpatching - Procedure calls - Issues in the design of a code generator - The target machine - Run-time storage - management - Basic blocks and flow graphs - Next-use information - A simple code - generator - Register allocation and assignment - The dag representation of basic blocks - Generating code from DAGs.

FOR FURTHER READING

The recursion theorem - Decidability of logical theories - Turing reducibility

Total: 60 Hours

Reference(s)

1. Hopcroft J E, Motwani R and Ullman J D, Introduction to Automata Theory, Languages and Computations, Second Edition, Pearson Education, 2012.
2. Alfred V Aho, Ravi Sethi Jeffrey D Ullman, Compilers- Principles, Techniques, and Tools, Third Edition, Pearson Education Asia, 2009.
3. Steven S Muchnick, Advanced Compiler Design and Implementation, Second Edition, Morgan Kaufmann Pulishers, 2008.
4. Raghavan V, Principles of Compiler Design, Third Edition, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009

21IT504 DIGITAL SIGNAL PROCESSING 3 0 2 4

Course Objectives

- Study the classification and analyze discrete time signals and systems
- Design the digital filters and realize the digital filters by different structures
- Learn the finite word length effects in real time processing

Course Outcomes (COs)

1. Understand and analyze different types of signals and systems
2. Analyze the Discrete-time signals using Fourier and Z-Transform
3. Design a digital IIR filter from analog filter using suitable transformation techniques
4. Design a digital FIR filter using different windowing techniques and implement it for different applications
5. Analyze the finite word length effects in real time processing and use the concepts in signal processing applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2												
2	1	2												
3		1	2											
4		1	2											
5		2	1											

UNIT I **9 Hours**

SIGNALS AND SYSTEMS

Continuous and discrete time signals - Classification of Discrete time signals: Periodic and Aperiodic - Even and Odd - Energy and Power signals - Deterministic and Random signals - Complex exponential and Sinusoidal signals - Periodicity - Analysis of Linear time invariant systems using Convolution.

UNIT II **9 Hours**

ANALYSIS OF DISCRETE TIME SIGNALS

Discrete Fourier Transform (DFT), FFT: Radix - 2 DIT and DIF algorithms, Analysis of DT signals using Z- Transform -Properties of Z-transform - Inverse z-transform using Power Series expansion, Relationship between Z-transform and Fourier transform.

UNIT III **9 Hours**

IIR FILTER DESIGN

Butterworth and Chebyshev approximations - Design of Discrete time IIR filter from continuous time filter - IIR filter design by Impulse Invariance method, Bilinear transformation method - Structure of IIR System.

UNIT IV **9 Hours**

FIR FILTER DESIGN

Linear phase filter - Symmetric and Anti-symmetric FIR filters - Windowing technique: Rectangular, Hamming, Hanning windows - Frequency sampling techniques - Structure for FIR systems: Direct form, Linear phase realization structure.

UNIT V **9 Hours**

FINITE WORD LENGTH EFFECTS

Quantization noise - Over flow error - Truncation error - Limit cycle oscillation - Signal scaling - Interpolation and Decimation: Decimation by an integer factor - Interpolation by an integer factor - Sampling rate conversion by a rational factor.

FOR FURTHER READING

Case study on digital signal processors

1 **3 Hours**

EXPERIMENT 1

Generate standard discrete time signals which are used in real time systems.

2 **3 Hours**

EXPERIMENT 2

Sample the continuous time signal by different sampling rate, verify the sampling theorem. With the results find the effect of aliasing.

3 **6 Hours**

EXPERIMENT 3

In an LTI system the input signal is of x (n) and the impulse response of the system is of h (n). Find the output of the system using the concept of Convolution. (LTI systems like Amplifier, filters, modulators can be considered as the given system)

4 **4 Hours**

EXPERIMENT 4

Convert the given time domain signal into frequency domain signal with minimum number of operations.

5 **6 Hours**

EXPERIMENT 5

Using Rectangular, Hamming and Hanning windows design FIR filter for different band specifications.

6 **6 Hours**

EXPERIMENT 6

Design an analog Butterworth and Chebyshev filters and convert them into digital IIR filters.

7 **2 Hours**

EXPERIMENT 7

Perform interpolation and decimation process for a sinusoidal signal.

Total: 75 Hours

Reference(s)

1. John G Proakis and Dimtris G Manolakis, Digital Signal Processing Principles, Algorithms and Application, 4th Edition, PHI/Pearson Education, 2014.
2. Michael J Roberts, Govind Sharma, Fundamentals of Signals and Systems, 2nd Edition, McGraw-Hill, 2017.
3. Alan V Oppenheim, Alan S Willsky and S Hamid Nawab, Signals and Systems, 2nd Edition, PHI/Pearson Education, 2016.
4. Vinay K Ingle, John G Proakis, Digital Signal Processing with Matlab, 3rd Edition, Cengage Learning India Pvt. Ltd., 2017.

21IT507 CLOUD COMPUTING LABORATORY 0 0 2 1

Course Objectives

- Understand the basic networking fundamentals to use different devices to build network
- To install, use, and manage virtual machines in Oracle VirtualBox
- To deploy applications on Windows Azure,Amazon Webservices and Google Cloud

Course Outcomes (COs)

1. Understand the fundamental concepts of networking and analyze the networking components for communication
2. To Install,Configure and administer Windows and Linux OS on Virtualbox
3. Deploy virtual machines in openstack cloud through horizon dashboard.
4. Deploy applications in Microsoft Windows Azure platform
5. Deploy applications in Amazon Web Services and Google Cloud

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2			3									
2		2			3									
3			2		3								2	
4			2		3								2	
5		2			3								2	

1 **3 Hours**

EXPERIMENT 1
Experiments on Networking Fundamentals

2 **3 Hours**

EXPERIMENT 2
Installation and configuration of Oracle Virtualbox

3 **5 Hours**

EXPERIMENT 3
Installation of Operating System in Virtualbox

4 **3 Hours**

EXPERIMENT 4
Openstack Administration- I

5 **6 Hours**
EXPERIMENT 5
Openstack Administration- II

6 **4 Hours**
EXPERIMENT 6
Create and Deploy applications on Microsoft Windows Azure

7 **3 Hours**
EXPERIMENT 7
Create and Deploy applications on Amazon Web Services

8 **3 Hours**
EXPERIMENT 8
Create and Deploy applications on Google Cloud

Total: 30 Hours

21IT508 OPERATING SYSTEMS LABORATORY 0 0 2 1

Course Objectives

- learn Unix commands and shell programming
- implement Deadlock Avoidance and Deadlock Detection Algorithms
- implement Page Replacement Algorithms
- implement File Organization and File Allocation Strategies

Course Outcomes (COs)

1. Simulate the basic UNIX Commands using system calls and simulate the utility code using shell programming.
2. Compare the performance of various CPU Scheduling Algorithms and Implement Deadlock avoidance and Detection Algorithms
3. Create processes and implement IPC
4. Analyze the performance of the various Page Replacement Algorithms
5. Implement File Organization and File Allocation Strategies

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	3											
2	3	2	3											
3	2	2	2										2	
4	2	3	1											2
5	2	3	3											2

1 **2 Hours**

EXPERIMENT 1

Basics of UNIX commands

2 **2 Hours**

EXPERIMENT 2

Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir

3 **2 Hours**

EXPERIMENT 3

Write C programs to simulate UNIX commands like cp, ls, grep, etc.

4 **2 Hours**

EXPERIMENT 4

Shell Programming in Linux Platform

5 **2 Hours**

EXPERIMENT 5

Write C programs to implement the various CPU Scheduling Algorithms

6 **2 Hours**

EXPERIMENT 6

Implementation of Semaphores

7 **2 Hours**

EXPERIMENT 7

Implementation of Shared memory and IPC

8 **2 Hours**

EXPERIMENT 8

Bankers Algorithm for Deadlock Avoidance

9 **2 Hours**

EXPERIMENT 9

Implementation of Deadlock Detection Algorithm

10 **2 Hours**

EXPERIMENT 10

Write C program to implement Threading and Synchronization Applications

11 **2 Hours**

EXPERIMENT 11

Implementation of the following Memory Allocation Methods for fixed partition
a) First Fit b) Worst Fit c) Best Fit

12 **2 Hours**

EXPERIMENT 12

Implementation of Paging Technique of Memory Management

13 **2 Hours**

EXPERIMENT 13

Implementation of the following Page Replacement Algorithms
a) FIFO b) LRU c) LFU

14 **2 Hours**

EXPERIMENT 14

Implementation of the various File Organization Techniques

15 **2 Hours**

EXPERIMENT 15

Implementation of the following File Allocation Strategies
a) Sequential b) Indexed c) Linked

Total: 30 Hours

21HS003 PRINCIPLES OF MANAGEMENT 2 0 0 2

Course Objectives

- To develop cognizance about importance of management principles.
- Extract the functions and responsibilities of managers.
- To Study and understand the various HR related activities.
- Learn the application of the theories in an organization.
- Analyze the position of self and company goals towards business.

Course Outcomes (COs)

1. Students will be able to understand the basic concepts of Management.
2. Have some basic knowledge on planning process and its Tools & Techniques.
3. Ability to understand management concept of organizing and staffing.
4. Ability to understand management concept of directing.
5. Ability to understand management concept of controlling.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1								1	1	2				
2								1						
3								2		2				
4									2	2				
5									2	2				

UNIT I **6 Hours**

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management -Science or Art - Manager Vs Entrepreneur- types of managers - Managerial roles and skills - Evolution of Management - Scientific, Human Relations, System and Contingency approaches - Types of Business organization- Sole proprietorship, partnership, Company-public and private sector enterprises-Organization culture and Environment -Current Trends and issues in Management.

UNIT II **6 Hours**

PLANNING

Nature and purpose of planning-Planning process-Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III **6 Hours**

ORGANISING

Nature and purpose - Formal and informal organization - Organization chart - Organization Structure and Types - Line and staff authority - Departmentalization - delegation of authority - Centralization and decentralization - Job Design-Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV **6 Hours**

DIRECTING

Foundations of individual and group behaviour - Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership - Communication - Process of communication - Barrier in communication - Effective communication - Communication and IT.

UNIT V **6 Hours**

CONTROLLING

System and process of controlling - Budgetary and non-Budgetary control techniques - Use of Computers and IT in Management control - Productivity problems and management - Control and Performance - Direct and preventive control -Reporting.

Total: 30 Hours

Reference(s)

1. Robbins, S. (2017). Management, (13th ed.), Pearson Education, New Delhi.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management, Pearson Education,7th Edition, 2011.
3. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
4. L. M. Prasad, Principles and Practice of Management. 7th Edition, Sultan Chand & Sons, 2007..
5. P. C. Tripathi and P. N. Reddy, Principles of Management, Fourth Edition, Tata McGraw Hill, 2008

21IT601 ARTIFICIAL INTELLIGENCE 3 1 0 4

Course Objectives

- Provide comprehensive and in-depth knowledge of AI principles and techniques by introducing AI fundamental problems
- Understand the basic concepts of analytic functions and method of construction in complex analysis
- Acquire the knowledge of complex integration to apply them in areas such as networking, and Machine Learning

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 searching, reasoning and inference
3. Analyze the Importance of machine learning techniques, training models and its types
4. Apply and evaluate regression, classification and clustering models to given real time dataset
5. Understand the structures of Neural Networks and discuss its applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	2		1						1		
2	2	2	3		3									
3	2	1	3	1	2									
4	1	2	2	1	3				1				1	
5	2	2	1		2				1					

UNIT I **9 Hours**

INTRODUCTION TO AL

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, - Problem solving methods - Problem graphs, Matching,Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms

UNIT II **9 Hours**

KNOWLEDGE REPRESENTATION AND INFERENCE

Game playing - Knowledge representation, Knowledge representation using Predicate logic. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning

UNIT III **9 Hours**

MACHINE LEARNING INTRODUCTION

Definition of learning systems. Goals and applications of machine learning. Aspects to develop a Learning system: training data, concept representation, function approximation. Learning Techniques Supervised learning, unsupervised learning and Reinforcement learning

UNIT IV **9 Hours**

MACHINE LEARNING ALGORITHMS

Regression- Simple Linear Regression, Logistic Regression, Mean Square Error. Classification - Decision Tree Information Gain and Entropy. Support Vector Machines, Clustering - K Means, Hierarchical Agglomerative Clustering

UNIT V **9 Hours**

ARTIFICIAL NEURAL NETWORKS

Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks

FOR FURTHER READING

Text Classification - Information Retrieval, Natural Language Processing

Total: 60 Hours

Reference(s)

1. Deepak Khemani,Artificial Intelligence,, Tata McGraw Hill Education 2013
2. Mishra R B, Artificial Intelligence, PHI Learning Pvt. Ltd., New Delhi, 2013.
3. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
4. Christopher M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
5. Stuart Russel and Peter Norvig,AI A Modern Approach, 2nd Edition, Pearson Education 2007.
6. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze, Introduction to Information Retrieval, Cambridge University Press, Cambridge, 2008

21IT602 DESIGN AND ANALYSIS OF ALGORITHMS 3 1 0 4

Course Objectives

- Analyze the asymptotic performance of algorithms
- Apply important algorithmic design paradigms and methods of analysis
- Acquire knowledge run time analysis of algorithms
- Understanding the computational problems

Course Outcomes (COs)

1. Analyze the running time complexities for the given recursive and non recursive problems
2. Analyze the execution time for the given problems in divide and conquer and greedy techniques
3. Apply the Dynamic programming and iterative improvement problem solving technique to solve the given problems
4. Apply the Branch and Bound and Backtracking problem solving technique to solve the given problems
5. Analyze the P, NP-Hard and NP-Complete problem

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2											
2	2	2	3											
3	1	3	3											
4	1	2	2											
5	1	3	2	1										

UNIT I **9 Hours**

UNIT I INTRODUCTION TO ALGORITHM ANALYSIS

Algorithm and its properties-Asymptotic notations and its properties-Mathematical Analysis for recursive Algorithms (Binary search, Tower of Hanoi) and Non-Recursive Algorithms (Matrix multiplication, Bubble sort)

UNIT II **9 Hours**

UNIT II DIVIDE AND CONQUER AND GREEDY TECHNIQUE

Divide and Conquer-Quick sort-Finding Maximum and Minimum-Strassen's Matrix Multiplication-Greedy Technique-Fractional Knapsack Problem-Huffman Trees

UNIT III **9 Hours**

UNIT III DYANIMIC PROGRAMMING AND ITERATIVE IMPROVEMENT

Dynamic Programming-All pair shortest Path: Floyd's Algorithm-Optimal Binary search Tree -0/1 Knapsack Problem- Iterative Improvement-Maximum Matching in BiPartite Graphs-Stable Marriage Problem

UNIT IV **9 Hours**

UNIT IV BRANCH AND BOUND AND BACKTRACKING

Branch and Bound-Assignment Problem-8 Puzzle Problem-Back Tracking-8 Queens problem-Subset-sum problems-Hamiltonian Circuit Problem

UNIT V **9 Hours**

UNIT V OTHER TECHNIQUES AND COMPUTATIONAL COMPLEXITY

Decrease and conquer-Insertion sort-Topological sorting-Transform and conquer-Horner's Rule for Polynomial-Introduction to P, NP-Hard and NP-Complete problems

FURTHER READING

Empirical analysis of Algorithms-Approximation for NP-Hard problems-Decision trees-Deterministic and Non Deterministic Algorithms

Total: 60 Hours

Reference(s)

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012
2. E Horowitz, S Sahni, and S Rajsekaran, Fundamentals of Computer Algorithms, Galgotia Publication, 2008
3. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006
5. Sridhar S, "Design and Analysis of Algorithms", Oxford Higher Education, First edition
6. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition , PHI Learning Private Limited,2012

21IT603 INFORMATION CODING TECHNIQUES 3 1 0 4

Course Objectives

- Apply the concept of probability to model information and compress text
- Use the principles of differential coding to compress speech
- Exploit the three types of redundancies to design image compression algorithms
- Identify the temporal redundancy component along with coding, spatial and inter-pixel redundancy to design video compression algorithms

Course Outcomes (COs)

1. Apply the concept of probability to model information and compress text
2. Apply the principles of differential coding to compress speech
3. understand the need for channel coding and design efficient channel coders
4. Identify the temporal redundancy component along with coding, spatial and inter-pixel redundancy to design video compression algorithms
5. Design algorithms to ensure error free communication / information retrieval

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1											
2	1		2											
3		2	1											
4	1	1	2											
5		2												

UNIT I **9 Hours**

INFORMATION ENTROPY FUNDAMENTALS

Uncertainty - Information and Entropy - Source coding Theorem - Shannon Fano coding - Huffman coding: static and dynamic - Discrete Memory less channels - Channel coding Theorem - Channel capacity - Channel capacity Theorem.

UNIT II **9 Hours**

DATA AND VOICE CODING

Differential Pulse code Modulation - Adaptive Differential Pulse Code Modulation - Delta Modulation - Adaptive Delta Modulation - Adaptive subband coding - Coding of speech signal at low bit rates - Linear Predictive Coding.

UNIT III **9 Hours**

IMAGE CODING

Image Compression - Types: spatial, transform based - Bit plane coding - DCT, Walsh, and Hadamard Transforms for compression - Graphics Interchange format - Tagged Image File Format - Digitized Pictures - JPEG standards.

UNIT IV **9 Hours**

MULTIMEDIA CODING

Perceptual coding - MPEG audio coders - Dolby audio coders - Video compression - Principles - H.261 and MPEG Video.

UNIT V **9 Hours**

ERROR CONTROL CODING

Linear Block codes - Syndrome Decoding- Minimum distance consideration - Cyclic codes - Generator Polynomial - Parity check polynomial - Encoder for cyclic codes - Calculation of syndrome - Convolutional Coding - Decoding using Viterbi Algorithm.

FOR FURTHER READING

Case study on Wavelet compression.

Total: 60 Hours

Reference(s)

1. Simon Haykin, Communication Systems, John Wiley and Sons, 4th Edition, 2014
2. Fred Halsall, Multimedia Communications, Applications Networks Protocols and Standards, Pearson Education, 2012
3. Mark Nelson, Data Compression Book, BPB Publication, 2010
4. Rafael C.Gonzalez and Richard E.Woods, Digital image processing, PHI, 2013

21IT607 ARTIFICIAL INTELLIGENCE LABORATORY

0 0 2 1

Course Objectives

- To design and Implement algorithms that allow computers to automatically learn from data to improve their performance of applications
- Learn Techniques for problem specific approaches and design a learning environment and evaluate the goodness of the learned solution

Course Outcomes (COs)

1. To Design and Implement machine learning solutions to classification, regression and clustering problems, evaluate and Interpret the results of the algorithms
2. To carryout forecasting with use of statistics to measure the Seasonality and Stationarity in real time data

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	3					1				2
2	2	3	3	2	3									2

1 **3 Hours**

EXPERIMENT 1

Loading Real Time data Set and Python Libraries, Installing Libraries through Anaconda Prompt

2 **3 Hours**

EXPERIMENT 2

Perform Slicing, Filtering, Group by and other basic operation through Pandas Library

3 **3 Hours**

EXPERIMENT 3

Linear Regression Model to car dataset with One dependent Variables to predict the relationship between distance and speed

4 **3 Hours**

EXPERIMENT 4

Perform Multi-linear Regression to predict the Price of a House using Boston House Price Prediction Dataset.

5 **3 Hours**

EXPERIMENT 5

To detect outliers in the cars dataset and compare the results of Linear regression models without outliers

6 **3 Hours**

EXPERIMENT 6

Apply Binary Classification Algorithms to predict the Onset of diabetes in female Indians from medical data record

7 **3 Hours**

EXPERIMENT 7

Perform Fruit Classification Algorithms to predict the fruit based on the Classification Algorithms

8 **3 Hours**

EXPERIMENT 8

Logistic Regression model to predict the outcome whether he will earn more than 50K$ based on the Professional data

9 **3 Hours**

EXPERIMENT 9

Apply Binary Classification Algorithms to predict the Onset of diabetes in female Indians from medical data record.

10 **3 Hours**

EXPERIMENT 10

Extract the Trend, Seasonality and Error for a Stock market Time series data

Total: 30 Hours

21IT608 DESIGN AND ANALYSIS OF ALGORITHMSLABORATORY

Course Objectives

- Understanding the basic algorithm techniques
- Solve different algorithmic technique problems
- Synthesize the efficiency of the algorithms in common engineering design situation

Course Outcomes (COs)

1. Analyze the complexities of various problems
2. Apply different algorithmic design paradigms and methods of analysis
3. Analyzing the different complexity for different algorithmic techniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2											
2	2	2	3											
3	1	3	3											

1 **4 Hours**

EXPERIMENT 1

Implement Binary Search Trees

2 **6 Hours**

EXPERIMENT 2

Implement merge and quick sort algorithms and test their correctness and efficiency

3 **4 Hours**

EXPERIMENT 3

Implement Floyd-Warshall Algorithm and test their efficiency

4 **4 Hours**

EXPERIMENT 4

Implement stable marriage problem using Iterative Improvement methodology

5 **4 Hours**

EXPERIMENT 5

Implement 8 puzzle problem using Branch and Bound

6 **4 Hours**

EXPERIMENT 6

Implement and analyze the running time of eight-queen problem using backtracking

7 **4 Hours**

EXPERIMENT 7

Implement insertion and topological sorting and test their efficiency

Total: 30 Hours

21HS002 PROFESSIONAL ETHICS IN ENGINEERING 2 0 0 2

Course Objectives

- To understand Human Values and ethical theory.
- To understand codes of ethics, work place responsibilities, rights, engineering experimentation, global issues and contemporary ethical issues.
- To understand personal ethics, legal ethics, cultural ethics and engineers responsibility.

Programme Outcomes (POs)
Course Outcomes (COs)

1. Articulate engineering ethics theory with sustained lifelong learning.
2. Adopt a good character and follow high professional ethical life.
3. Contribute to shape a better character by following ethical actions.
4. Confront and resolve moral issues occurred during technological activities.
5. Resolve moral and ethical problems through exploration and assessment by established experiments.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1								1	1					
2								1	1					
3								2						
4								2						
5								2						

UNIT I **6 Hours**

HUMAN VALUES

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others - Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment - Empathy.

UNIT II **6 Hours**

ENGINEERING ETHICS AND PROFESSIONALISM

Scope of Engineering Ethics- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlbergs and Gilligans theory - Consensus and controversy - Profession and Professionalism - Models of Professional Roles - Right action theories - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse.

UNIT III **6 Hours**

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study - Bhopal Gas Tragedy - The Three Mile Island and Chernobyl.

UNIT IV **6 Hours**

WORKPLACE RESPONSIBILITIES AND RIGHTS

Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate climate - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights.

UNIT V **6 Hours**

GLOBAL ISSUES

Multinational corporations: Technology transfer and appropriate technology - International rights - promoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Computer ethics and internet - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership.

FOR FURTHER READING

Sample code of ethics like IETE,ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management.

Total: 30 Hours

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international (P)limited, New Delhi,2006.
4. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
5. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
6. http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics

21IT702 DATA MINING AND WAREHOUSING 3 1 0 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

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		3		2									
2			2		3	2						1		
3	1		3		2									
4	1		3		2	2						1		
5	1		3		2	2						1		

UNIT I **9 Hours**

INTRODUCTION TO DATA WAREHOUSING

Raw data to valuable information-Lifecycle of Data - What is data warehousing - The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Basic elements of data warehousing - Principles of dimensional modeling:Star schema,Snowflake schema and Galaxy schema .

UNIT II **9 Hours**

INTRODUCTION TO DATA MINING

Introduction to Data Mining Systems, Knowledge Discovery Process -Data Objects and attribute types, Statistical description of data, Data Preprocessing- Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Market Basket Analysis, Frequent Item sets, Closed Itemsets, Association Rules, Frequent Itemset Mining Methods- Apriori algorithm, Generating Association rules from Frequent Itemsets, A Pattern- Growth Approach for mining frequent Itemsets, Mining Frequent Itemsets using the Vertical Data Format.

UNIT IV **9 Hours**

CLASSIFICATION

Classification and Prediction ,Basic Concepts, Decision Tree Induction,Bayesian Classification ,Rule Based Classification, Classification by Back propagation , Support Vector Machines,Lazy learners.

UNIT V **9 Hours**

CLUSTERING

Types of Data in Cluster Analysis , Data similarity and dissimilarity measures ,A Categorization of Major Clustering Methods -Partitioning Methods-K-means, K-medoids , Hierarchical Methods-Agglomerative vs Divisive, Distance measures, BIRCH, Clustering High-Dimensional Data- Outlier Analysis and Detection.

UNIT VI

FURTHER READING

Text mining, Web mining ,Multimedia mining,Spatial data mining

Total: 60 Hours

Reference(s)

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

0 0 2 1

21IT707 DATA MINING AND WAREHOUSING LABORATORY

Course Objectives

- Demonstrate the preprocessing statistical methods for any given raw data
- Select and apply data mining algorithms to build analytical application

Course Outcomes (COs)

1. Design a multidimensional model and perform analytical processing on real world data
2. Implement association rule mining techniques for finding hidden and interesting patterns in data in R.
3. Implement supervised learning techniques using association mining and data classification algorithms in R
4. Implement unsupervised learning techniques using data clustering algorithms in R

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		3		2									
2			1		3	2								
3	1		3		2							1		
4	1		3		2									

2 **3 Hours**

EXPERIMENT 1
Creation of a Data Warehouse

3 **3 Hours**

EXPERIMENT 2
Apriori Algorithm for market Basket Analysis

4 **3 Hours**

EXPERIMENT 3
Frequent Pattern-Growth Algorithm

5 **3 Hours**

EXPERIMENT 4
Bayesian Classification

6 **3 Hours**

EXPERIMENT 5
Decision Tree Induction Algorithm

7 **3 Hours**

EXPERIMENT 6

Support Vector Machines

8 **4 Hours**

EXPERIMENT 7

K-means clustering algorithm

9 **4 Hours**

EXPERIMENT 8

Hierarchical clustering algorithm

10 **4Hours**

EXPERIMENT 9

Case Study on Text Mining or any commercial application

Total: 30 Hours

21IT001 EXPLORATORY DATA ANALYSIS 3 0 0 3

Course Objectives

- To outline an overview of exploratory data analysis
- To implement data cleaning and preparation techniques
- To perform descriptive statistics and data visualization techniques to present insights from the data
- To apply univariate, bivariate, multivariate, correlation, and time series data exploration and analysis techniques
- To use dimensionality reduction techniques for simplifying complex datasets and visualize high- dimensional data

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Understand the fundamentals of exploratory data analysis
2. Implement the data cleaning and preparation techniques
3. Apply advanced data visualization techniques to explore complex relationships and patterns in the data
4. Analyze and interpret relationships between variables using EDA analysis techniques to gain insights into complex data patterns
5. Apply dimensionality reduction techniques, such as Principal Component Analysis (PCA), to simplify complex datasets and extract essential features

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	3	3									
2	2	2	2	3	3									
3	2	3	2	2	3									
4	2	2	2	2	3									
5	2	2	3	2	1									

UNIT I **6 Hours**

EXPLORATORY DATA ANALYSIS

Overview of Exploratory Data Analysis- importance of EDA - data analysis process: data collection, data cleaning, and data exploration- Introduction to common data types and formats - Introduction to Python - data analysis libraries

UNIT II **6 Hours**

DATA CLEANING AND PREPARATION

Introduction to data quality issues and common data cleaning techniques - Handling missing data and outliers - Data transformation techniques - Feature engineering and variable creation

UNIT III **6 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Descriptive statistics: measures of central tendency, dispersion, and shape - Data visualization principles and best practices - Exploratory data visualization using Matplotlib and Seaborn

UNIT IV **6 Hours**

EXPLORATORY DATA ANALYSIS TECHNIQUES

Univariate analysis: exploring single variables - Bivariate analysis: exploring relationships between variables - Multivariate analysis: analyzing relationships among multiple variables - Exploring time series data.

UNIT V **6 Hours**

DIMENSIONALITY REDUCTION TECHNIQUES

Introduction to dimensionality reduction - Principal Component Analysis (PCA) and its applications - Distributed Stochastic Neighbor Embedding (t-SNE) for visualization

Total: 30 Hours

Reference(s)

1. Provost Foster and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking O Reilly Media Inc. 2013. (Unit 1)
2. McKinney Wes Python for Data Analysis O Reilly Media Inc 2022 Unit 1 3 5
3. Knaflic Cole Nussbaumer Storytelling with data A data visualization guide for business professionals John Wiley & Sons 2015 (Unit 2)
4. Kazil Jacqueline and Katharine Jarmul Data wrangling with python tips and tools to make your life easier O Rilly Media Inc 2016 (Unit 3)
5. Wickham Hadley and Garrett Grolemund R for data science import tidy transform visualize and model data O Reilly Media Inc 2016 (Unit 4, 5)
6. Matthew O Ward Georges Grinstein, Daniel Keim Interactive Data Visualization Foundations Techniques and Applications 2nd Edition CRC press 2015

21IT002 RECOMMENDER SYSTEMS **3 0 0 3**

Course Objectives

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

Programme Outcomes (POs)

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.

Course Outcomes (COs)

1. Understand the basic concepts of recommender systems.
2. Implement machine-learning and data-mining algorithms in recommender systems data sets.
3. Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics
4. Implement a simple recommender system.
5. Learn about Evaluating Paradigms of recommender systems and its applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	2	1									
2	1	2	1	1	1									
3	2	3	1	1	1									
4	3	2	2	2	1									
5	2	2	1	2	1									

UNIT I **9 Hours**

INTRODUCTION

Introduction and basic taxonomy of recommender systems Traditional and non-personalized Recommender Systems Overview of data mining methods for recommender systems similarity measures Dimensionality reduction Singular Value Decomposition SVD

UNIT II **9 Hours**

CONTENT-BASED RECOMMENDATION SYSTEMS

High-level architecture of content-based systems Item profiles Representing item profiles Methods for learning user profiles

Similarity-based retrieval and Classification algorithms.

UNIT III **9 Hours**

COLLABORATIVE FILTERING

A systematic approach Nearest-neighbor collaborative filtering (CF) user-based and item-based CF components of neighborhood methods (rating normalization similarity weight computation and neighborhood selection

UNIT IV **9 Hours**

ATTACK-RESISTANT RECOMMENDER SYSTEMS

Introduction Types of Attacks Detecting attacks on recommender systems Individual attack Group attack Strategies for robust recommender design Robust recommendation algorithms.

UNIT V **9 Hours**

EVALUATING RECOMMENDER SYSTEMS

Evaluating Paradigms User Studies Online and Offline evaluation Goals of evaluation design Design Issues Accuracy metrics Limitations of Evaluation measures

Total: 45 Hours

Reference(s)

1. Charu C Aggarwal Recommender Systems The Textbook Springer 2016
2. Dietmar Jannach Markus Zanker Alexander Felfernig and Gerhard Friedrich Recommender Systems An Introduction Cambridge University Press (2011) 1st ed.
3. Francesco Ricci Lior Rokach Bracha Shapira Recommender Systems Handbook 1st ed Springer (2011)
4. Jure Leskovec Anand Rajaraman Jeffrey David Ullman Mining of massive datasets 3rd edition Cambridge University Press 2020

21IT003 BIG DATA ANALYTICS **3 0 0 3**

Course Objectives

- Acquire a deep understanding of big data and NoSQL.
- Develop expertise in MapReduce analytics using Hadoop and related tools
- Explore the Hadoop related tools for Big Data Analytics.

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the big data and use cases from selected business domains.
2. Understand NoSQL big data management.
3. Utilize map reduce analytics and related tools
4. Understand the basics of Hadoop
5. Apply the usage of Hadoop related tools for Big Data Analytics

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								2	2
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								1	3

UNIT I **9 Hours**

UNDERSTANDING BIG DATA

Introduction to big data Convergence of key trends Unstructured data Industry examples of big data Web analytics Big data applications Big data technologies Introduction to Hadoop Open source technologies Cloud and big data Mobile business intelligence Crowd sourcing analytics Inter and trans firewall analytics.

UNIT II **9 Hours**

NOSQL DATA MANAGEMENT

Introduction to NoSQL Aggregate data models Key value and document data models Relationships Graph databases Schema less databases Materialized views Distribution models Master-slave replication Consistency Cassandra Cassandra data model Cassandra examples Cassandra clients

UNIT III **9 Hours**

MAP REDUCE APPLICATIONS

MapReduce workflows Unit tests with MRUnit Test data and local tests Anatomy of MapReduce job run Classic Map reduce YARN Failures in classic Map-reduce and YARN Job scheduling Shuffle and sort Task execution MapReduce types Input formats Output formats

UNIT IV **9 Hours**

BASICS OF HADOOP

Data format Analyzing data with Hadoop Scaling out Hadoop streaming Hadoop pipes Design of Hadoop distributed file system (HDFS) HDFS concepts Java interface Data flow Hadoop I/O Data integrity Compression Serialization Avro File based data structures Cassandra Hadoop integration.

UNIT V **9 Hours**

HADOOP RELATED TOOLS

Hbase Data model and implementations Hbase clients Hbase examples Praxis. Pig Grunt Pig data model Pig Latin Developing and testing Pig Latin scripts. Hive Data types and file formats HiveQL data definition HiveQL data manipulation HiveQL queries.

Total: 45 Hours

Reference(s)

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today"s Businesses", Wiley,2013
2. Eric Sammer, "Hadoop Operations", O"Reilley, 2012.
3. Sadalage Pramod J. NoSQL distilled 2013
4. E. Capriolo D. Wampler and J. Rutherglen Programming Hive O Reilley 2012.
5. Lars George HBase The Definitive Guide O Reilley 2011
6. Eben Hewitt Cassandra The Definitive Guide O Reilley 2010.

21IT004 NEURAL NETWORKS AND DEEP LEARNING **3 0 0 3**

Course Objectives

- To understand the major concepts in deep neural networks.
- To apply Convolutional Neural Network architectures for any real-life applications
- To analyze the key computations underlying deep learning to build and train deep neural networks for various tasks.

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply Convolution Neural Network for any suitable applications
2. Analyze the various categories of associative memory and unsupervised learning networks
3. Apply Convolutional Neural Networks and its variants for any suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks
5. Apply autoencoders and generative models for suitable applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **6 Hours**

UNDERSTANDING NEURAL NETWORKS

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II **6 Hours**

ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS

Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.

UNIT III **6 Hours**

THIRD-GENERATION NEURAL NETWORKS

Spiking Neural Networks-Convolutional Neural Networks Deep Learning Neural Networks-Extreme Learning Machine Model Convolutional Neural Networks The Convolution Operation Mo ivation Pooling Variants of the basic Convolution Function Structured Outputs Data Types Efficient Convolution Algorithms Neuroscientific Basis Applications Computer Vision Image Generation Image Compression

UNIT IV **6 Hours**

DEEP FEEDFORWARD NETWORKS

History of Deep Learning A Probabilistic Theory of Deep Learning Gradient Learning Chain Rule and Backpropagation Regularization Dataset Augmentation Noise Robustness Early Stopping Bagging and Dropout batch normalization VC Dimension and Neural Nets

UNIT V **6 Hours**

RECURRENT NEURAL NETWORKS

Recurrent Neural Networks Introduction Recursive Neural Networks Bidirectional RNNs Deep Recurrent Networks Applications Image Generation Image Compression Natural Language Processing Complete Auto encoder Regularized Autoencoder Stochastic Encoders and Decoders Contractive Encoders

Total: 30 Hours

Reference(s)

1. S Rajasekaran, G A Vijayalakshmi Pai, Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications, PHI Learning, 2017
2. Charu C. Aggarwal, Neural Networks and Deep Learning A Textbook, Springer International Publishing, 1st Edition, 2018
3. James A Freeman, David M S Kapura, Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016
5. Francois Chollet, Deep Learning with Python, Second Edition, Manning Publications, 2021
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

21IT005 NATURAL LANGUAGE PROCESSING 3 0 0 3

Course Objectives

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

Programme Outcomes (POs)

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.

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.

m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand basics of linguistics, probability and statistics associated with NLP
2. Implement a Part-of-Speech Tagger
3. Design and implement a sequence labeling problem for a given domain
4. Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
5. Implement a simple chatbot using dialogue system concepts

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	
2	2	2	3		3								2	
3	1	3	3		3								2	
4	2	2	2		3								2	
5	2	2	1		3								2	

UNIT I **9 Hours**

INTRODUCTION

Natural Language Processing - Components - Basics of Linguistics and Probability and Statistics - Words-Tokenization-Morphology-Finite State Automata.

UNIT II **9 Hours**

STATISTICAL NLP AND SEQUENCE LABELING

N-grams and Language models -Smoothing -Text classification-NaÃƒÂ¯ve Bayes classifier -Evaluation - Vector Semantics - TF-IDF - Word2Vec- Evaluating Vector Models -Sequence Labeling - Part of Speech - Part of Speech Tagging -Named

Entities -Named Entity Tagging.

UNIT III **9 Hours**

CONTEXTUAL EMBEDDING

Constituency -Context Free Grammar -Lexicalized Grammars- CKY Parsing - Earleys algorithm Evaluating Parsers -Partial Parsing - Dependency Relations- Dependency Parsing -Transition Based -Graph Based

UNIT IV **9 Hours**

COMPUTATIONAL SEMANTICS

Word Senses and WordNet - Word Sense Disambiguation - Semantic Role Labeling - Proposition Bank- FrameNet- Selectional Restrictions - Information Extraction - Template Filling.

UNIT V **9 Hours**

DISCOURSE ANALYSIS AND SPEECH PROCESSING

Discourse Coherence - Discourse Structure Parsing - Centering and Entity Based Coherence - Question Answering - Factoid Question Answering - Classical QA Models - Chatbots and Dialogue systems - Frame-based Dialogue Systems - Dialogue-State Architecture

FOR FURTHER READING

Frame-based Dialogue Systems - Dialogue - State Architecture

Total: 45 Hours

Reference(s)

1. 1.Daniel Jurafsky and James H.Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (Prentice Hall Series in Artificial Intelligence), 2020.
2. 2.Jacob Eisenstein. Natural Language Processing , MIT Press, 2019.
3. 3.Samuel Burns - Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019.
4. 4.Christopher Manning, Foundations of Statistical Natural Language Processing, MIT Press,2009.
5. 5.Nitin Indurkhya,Fred J. Damerau, Handbook of Natural Language Processing, Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010.

21IT006 COMPUTER VISION **3 0 0 3**

Course Objectives

- To understand the fundamental concepts related to Image formation and processing
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image-based rendering and recognition

Programme Outcomes (POs)

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
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 ones 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. To understand basic knowledge, theories and methods in image processing and computer vision.
2. To implement basic and some advanced image processing techniques in OpenCV.
3. To apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To apply 3D image reconstruction techniques
5. To design and develop innovative image processing and computer vision applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

1	3	1	1	1	1				2	1	3	2	2	
2	3	3	3	2	3		2		2	1	2	2	3	
3	3	3	2	2	3				1	1	2	2	3	-
4	2	3	3	2	3				2	1	2	3	2	
5	2	3	3	2	2	2			2	1	2	3	3	

UNIT I **9 Hours**

INTRODUCTION TO IMAGE FORMATION AND PROCESSING

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization

UNIT II **8 Hours**

FEATURE DETECTION, MATCHING AND SEGMENTATION

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods

UNIT III **10 Hours**

FEATURE-BASED ALIGNMENT

2D and 3D feature-based alignment- Pose estimation - Geometric intrinsic calibration -Triangulation -Two-frame structure from motion -Factorization -Bundle adjustment -Constrained structure and motion -Translational alignment -Parametric motion -Spline-based motion-Optical flow - Layered motion

UNIT IV **9 Hours**

3D RECONSTRUCTION

Shape from X - Active range finding - Surface representations -Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT V **9 Hours**

IMAGE-BASED RENDERING AND RECOGNITION

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video- based Rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding-Recognition databases and test sets.

Total: 45 Hours

Reference(s)

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

21IT007 AGILE SOFTWARE DEVELOPMENT **3 0 0 3**

Course Objectives

- To provide students with a theoretical as well as practical understanding of agile software development practices.
- To understand the Agile Scrum framework and development practices.
- To apply software design principles and refactoring techniques to achieve agility.
- To understand Agile requirements and perform testing activities within an agile project.
- To understand the benefits and pitfalls of working in an Agile team in terms of quality assurance.

Programme Outcomes (POs)

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.
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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand genesis of Agile and driving forces for choosing Agile techniques.
2. Apply the Agile Scrum framework and development practices.
3. Apply iterative software development processes by planning and executing them.
4. Analyze the impact of the success of social aspects behind the software testing.
5. Analyze techniques and tools for improving team collaboration and management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	2		-							2	2	
2	1	2	2									-	2	
3	1		2		2							2	2	
4	1		2		2							2	2	
5	1		1		2							2	2	

UNIT I **9 Hours**

AGILE METHODOLOGY

Theories for Agile management - agile software development - traditional model vs. agile model - classification of agile methods - agile manifesto and principles - agile project management - agile team interactions - ethics in agile teams - agility in design - testing - agile documentations - agile drivers - capabilities and values

UNIT II **9 Hours**

AGILE PROCESSES

Extreme Programming: Method overview - lifecycle - work products, roles and practices - Lean production - SCRUM, Crystal, Feature Driven Development, Adaptive Software Development, Kanban model

UNIT III **9 Hours**

AGILITY AND KNOWLEDGE MANAGEMENT

Agile information systems - agile decision making - Earls schools of KM - institutional knowledge evolution cycle - development, acquisition, refinement, distribution, deployment, leveraging - KM in software engineering - managing software knowledge - challenges of migrating to agile methodologies - agile knowledge sharing - role of story-cards - Story - card Maturity Model (SMM)

UNIT IV **9 Hours**

AGILITY AND REQUIREMENTS ENGINEERING

Impact of agile processes in RE - current agile practices - variance - overview of RE using agile - managing unstable requirements - requirements elicitation - agile requirements abstraction model - requirements management in agile environment, agile requirements prioritization - agile requirements modeling and generation - concurrency in agile requirements generation

UNIT V **9 Hours**

AGILITY AND QUALITY ASSURANCE

Agile Interaction Design - Agile product development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile approach to Quality Assurance - Test Driven Development - Pair programming: Issues and Challenges - Agile approach to Global Software Development

Total: 45 Hours

Reference(s)

1. 1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds), Agile Software Development, Current Research and Future Directions, Springer - Verlag Berlin Heidelberg, 2010
2. 2.David J. Anderson; Eli Schragenheim, - Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003
3. 3. Hazza& Dubinsky, - Agile Software Engineering, Series - Undergraduate Topics in Computer Science, Springer, VIII edition, 2009
4. 4. Craig Larman, - Agile and Iterative Development -A manager""s Guide, Addison - Wesley, 2004
5. 5. Kevin C. Desouza, - Agile information systems: conceptualization, construction, and managemen, Butterworth - Heinemann, 2007

21IT008 UI AND UX DESIGN **3 0 0 3**

Course Objectives

- Study about designing web pages and understand the difference between UI and UX Design.
- To understand the concept of UX design and how it has evolved Able o to understand UX design process and methodology.
- Learning the Importance and scope of Interaction design, User centered design

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand to do user research, persona mapping, customer journey mapping
2. Design of interactive products Methods of interaction design Tools for interaction design
3. Design wireframes on paper and translate paper concepts into digital wireframes.
4. Apply and practice the techniques involved in designing digital wireframes using various UI elements.
5. Implement the process of conducting usability tests Learning steps for digital products.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1												1	1
2	1	2	2		1								2	1
3		3	3		1								2	1
4		2	2										1	2
5		2	2										1	2

UNIT I **9 Hours**

USER-CENTERED DESIGN PROCESS

Scripting Languages - HTML, CSS - Fundamentals of graphics design, principles of visual design - Overview of UI & UX Design - Overview of the UX Design Process - Difference between User Interface (UI) vs User Experience (UX) - Defining problem and vision statement - Persona creation - Primary and Secondary persona - Requirement definition - Creative ideation - brainstorming and ideation techniques - Scenarios and functionality extraction - Information Architecture - Task flows - Wireframe design

UNIT II **9 Hours**

FUNDAMENTALS OF UI, HEURISTICS, AND INTERACTION DESIGN

Design Principles for UX and UI Design - UI Elements-Patterns - Material Design (Google) and Human Interface Design (Apple) guidelines - Interaction Principles & Interaction Behaviour - Master the Brand Platforms & Style Guides - comments and current UI patterns - Understand problems and design solutions for e-commerce, social media, message, data, and dashboard design

UNIT III **9 Hours**

ELEMENTARY SKETCHING

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

UNIT IV **9 Hours**

UNDERSTAND STYLE GUIDES, ELEMENTS, PROTOTYPING

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

UNIT V **9 Hours**

USABILITY EVALUATION AND PRODUCT DESIGN

Type of usability evaluation - Qualitative & Quantitative evaluation - Guerilla testing , A/B Testing, Unmoderated remote usability testing, Card sorting, Session recording, think aloud - Think aloud - Introduction and advantages - Designing evaluation protocol - Conducting usability evaluation study - Conduct Usability Test explicit - Synthesize Test Findings - practices in corporate World

Product Design : Types of products & solutions - Design Psychology for e-commerce sites , CMS - Design Thinking Life Cycle

Total: 45 Hours

Reference(s)

1. 1.Norman, Donald A. The Design of Everyday Things. Basic Books, 2002. ISBN: 9780465067107.
2. 2.Nielsen, Jakob. Usability Engineering. Morgan Kaufmann, 1993. ISBN: 9780125184069.
3. 3.Mullet, Kevin, and Darrell Sano. Designing Visual Interfaces: Communication Oriented Techniques. Prentice Hall, 1994. ISBN: 9780133033892.
4. 4.Wilbent. O. Galitz ,The Essential Guide To User Interface Design, John Wiley&Sons, 2001.
5. 5.Ben Sheiderman, Design The User Interface, Pearson Education, 1998.
6. 6.Alan Cooper, The Essential Of User Interface Design, Wiley- Dream Tech Ltd.,2002.

21IT009 WEB FRAMEWORKS **3 0 0 3**

Course Objectives

- Understand the architecture behind an Angular application and how to use it
- To understand the significance of using MongoDB as a database system
- To understand the role of React in designing front-end components
- Build a Web Server in Node and understand how it really works
- Develop a web application and API using web frameworks

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply modules and components and Animations for creating Forms and developing web pages
2. Create web applications by performing CRUD operations in database using web frameworks
3. Design Progressive Web Application with dynamic HTML web pages using Angular.
4. Designing single page applications with reusable UI components using React CSS and SaaS
5. Use Node Package Manager and Node packages for Server Side programming.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2				2	2			2	
2	1		1		3				2	2			3	
3	1		2		2				2	2			3	
4	1		1		3				2	2			2	
5	1		1		3				1	1			2	

UNIT I **9 Hours**

ANGULAR FRONT-END FRAMEWORK

Introduction - Setup - Architecture: Modules, Components, Services and DI fundamentals - Components and Templates - Configuration - Forms - Observables & RxJS - Boot Strapping - Ng Modules - Dependency Injection - Http Client - Routing and Navigation - Animations

UNIT II **9 Hours**

FRAMEWORKS WITH DATABASES

MongoDB - MongoDB Basics - Documents - Collections - Query Language - Installation - The mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB - CRUD operations - projections - Indexing - Aggregation - Replication - Sharding - Creating backup - Deployment

UNIT III **9 Hours**

ANGULAR TECHNIQUES

Service workers & PWA - Server side rendering - Angular Libraries - Schematics - CLI Builders - Angular Ivy - Web Workers

UNIT IV **9 Hours**

REACT

React Introduction - React ES6 - React Render HTML - React JSX - Components - React Classes - Composing Components - Passing Data - Dynamic Composition - React state - setting State - Async State Initialization - Event Handling Communicating from Child to Parent - Stateless Components - Designing components - React Forms - React CSS - React SaaS

UNIT V **9 Hours**

NODE JS BACK-END FRAMEWORK

Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js EventEmitter - Frameworks for Node.js - Express.js Web App - Serving static Resource - Node.js Data Access

Total: 45 Hours

Reference(s)

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Christoffer Noring, Pablo Deeleman,Learning Angular, Packt Publishing Limited, 2nd Revised edition edition, 2017.
3. Caleb Dayley Brad Dayley,Brendan Dayley ,Node.js, MongoDB and Angular Web Development, 2nd Edition,Pearson, 2018.
4. Shyam Seshadri, Angular: Up and Running- Learning Angular, Step by Step , O"Reilly; First edition, 2018

21IT010 APP DEVELOPMENT 2 0 2 3

Course Objectives

- To facilitate students to understand android SDK
- To help students to gain a basic understanding of Android application development
- To inculcate working knowledge of Android Studio development tool

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Identify fundamental concepts of mobile programming that make it unique from programming for other platforms
2. Analyze the essential of Android Application with their anatomy and terminologies
3. Apply rapid prototyping techniques to design, develop and deploy the Android Applications
4. Analyze the essentials of User Interface Design in IOS with SQLite Database
5. Design the flutter applications on the Android marketplace for distribution

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3								1	
2	1	2	2		3								2	
3	1		2		3								2	
4	1	1	2		3								3	
5	1	2	2		3								3	

UNIT I **6 Hours**

INTRODUCTION TO ANDROID

The Android Platform - Android SDK - Eclipse Installation - Android Installation - building your First Android application - Understanding the Android Manifest file

UNIT II **6 Hours**

ANDROID APPLICATION DESIGN ESSENTIALS

Anatomy of Android applications - Android terminologies - Application Context - Activities - Services - Intents - Receiving and Broadcasting Intents - Using Intent Filter - Permissions

UNIT III **9 Hours**

COMMON ANDROID APIS

Testing Android applications - Publishing Android applications - Using Android Data and Storage APIs - managing data using SQLite - Using Android Web APIs - Using Android Telephony APIs - Deploying Android Applications to the World

UNIT IV **9 Hours**

IOS USER INTERFACE DESIGN ESSENTIALS

IOS features - UI implementation - Touch frameworks - Data persistence using Core Data and SQLite - Integrating calendar and address book with social media application - Using WIFI - iPhone marketplace

UNIT V **10 Hours**

APP DEVELOPMENT WITH FLUTTER

Flutter Introduction - Create First Flutter Application - Exploring commonly used flutter widgets: Container - Margin - Padding and Box Constraints - Custom Fonts - Column and Expanded Widgets - Image Asset - Raised Button - and Alert Dialog

1 **2 Hours**

EXPERIMENT 1

Develop a simple application with one EditText so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice

2 **2 Hours**

EXPERIMENT 2

Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number

3 **3 Hours**

EXPERIMENT 3

Create a SIGNUp activity with Username and Password. Validation of password should happen based on the following rules:
Password should contain uppercase and lowercase letters.
Password should contain letters and numbers.
Password should contain special characters.
Minimum length of the password (the default value is 8).
On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another

4 **4 Hours**

EXPERIMENT 4

Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name

5 **4 Hours**

EXPERIMENT 5

Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds

6 **3 Hours**

EXPERIMENT 6

Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts

7 **2 Hours**

EXPERIMENT 7

Implement UI elements like TextFields, Label, Toolbar, Statusbar, Tabbar

Total: 60 Hours

Text Book(s)

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Second Edition, Pearson Education, 2011

Reference(s)

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd 3. R3. Android Application Development All in one for Dummies by Barry Burd
3. Alberto Miola, "Flutter Complete Reference: Create beautiful, fast and native apps for any device" ISBN-13 9780141044804
4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.55

21IT011 SOFTWARE TESTING AND AUTOMATION **3 0 0 3**

Course Objectives

- Understand the importance of software testing in the software development process
- Analyze different testing methodologies and techniques to create test plans, test cases, and test scripts
- Apply automation testing tools and frameworks to design and implement automated test suites

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the importance of testing in the software development process
2. Compare the different test case design strategies
3. Analyze the different levels of testing and their importance
4. Apply test management techniques and the role of a test specialist
5. Analyze the software test automation and its requirements

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		1								1	
2	2	3	2		2								1	
3	2	2	2		2								1	
4	2	3	2		3								1	
5	3	2	1		3								2	

UNIT I **9 Hours**

INTRODUCTION

Basic definitions - Software Testing Principles - The Tester"s Role in a Software Development Organization - Origins of Defects - Cost of Defects - Defect Classes - The Defect Repository and Test Design - Defect Examples - Developer/Tester Support of Developing a Defect Repository

UNIT II **9 Hours**

TEST CASE DESIGN STRATEGIES

Test Scenarios - Test Cases - Test case Design Strategies - Black Box Approach to Test Case Design - Using White Box Approach to Test design - Test Adequacy Criteria - Static testing vs. Structural testing - Code functional testing - Coverage and Control Flow Graphs - Covering Code Logic - Paths - Code complexity testing - Additional White box testing approaches - Test Coverage

UNIT III **9 Hours**

LEVELS OF TESTING

Types of testing - manual and automation - Introduction to testing methods - White-box, Black-box and Grey-box - Functional testing - Non-functional testing - Introduction to levels of testing - Unit Testing, Integration Testing, System Testing, User Acceptance Testing - Introduction to types of testing - Regression Testing, Smoke Testing, Database Testing, Usability Testing, Load Testing, Stress Testing, Performance Testing, Compatibility Testing, Security Testing, Internationalization Testing, Localization Testing

UNIT IV **9 Hours**

TEST MANAGEMENT

People and organizational issues in testing - Organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management - test process - Reporting Test Results - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group - The Structure of Testing Group - The Technical Training Program

UNIT V **9 Hours**

TEST AUTOMATION

Software test automation - Design and Architecture for Automation - Automation testing - Automation Tools - Selenium Web Driver - Create Selenese Commands - TestNG - TestNG Annotations - Jmeter - Assertions in JMeter - Junit

Total: 45 Hours

Reference(s)

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing - Principles and Practices", Pearson Education, 2006
2. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007
3. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003
4. Edward Kit, "Software Testing in the Real World - Improving the Process", Pearson Education, 1995
5. Boris Beizer, "Software Testing Techniques", Second Edition, Van Nostrand Reinhold, New York, 1990
6. Aditya P. Mathur, "Foundations of Software Testing - Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

21IT012 DEVOPS 3 0 0 3

Course Objectives

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based DevOps tools to solve real-world problems

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand different actions performed through Version control tools like Git
2. Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle
3. Ability to Perform Automated Continuous Deployment
4. Ability to do configuration management using Ansible
5. Understand to leverage Cloud-based DevOps tools using Azure DevOps

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2								3	
2	3	3	3	3	2								2	
3	2	2	2	3	2								2	
4	2	2	2	2	2								2	
5	2	2	2	2	2								3	

UNIT I **7 Hours**

INTRODUCTION TO DEVOPS

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and GitHub

UNIT II **10 Hours**

COMPILE AND BUILD USING MAVEN

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven

Profiles - Maven repositories (local, central, global) - Maven plugins - Maven create and build Artifacts - Dependency Management - Installation of Gradle - understanding build using Gradle

UNIT III **12 Hours**

CONTINUOUS INTEGRATION USING JENKINS

Install & Configure Jenkins - Jenkins Architecture Overview - creating a Jenkins Job - Configuring a Jenkins job - Introduction to Plugins - Adding Plugins to Jenkins - commonly used plugins (Git Plugin, Parameter Plugin- HTML Publisher - Copy Artifact, and Extended choice parameters). Configuring Jenkins to work with Java - Git - and Maven - Creating a Jenkins Build and Jenkins workspace

UNIT IV **9 Hours**

CONFIGURATION MANAGEMENT USING ANSIBLE

Ansible Introduction - Installation - Ansible master/slave configuration - YAML basics - Ansible Modules - Ansible Inventory files - Ansible playbooks - Ansible Roles - and ad-hoc commands in Ansible

UNIT V **7 Hours**

BUILDING DEVOPS PIPELINES USING AZURE

Create GitHub Account, Create Repository - Create Azure Organization - Create a new pipeline - Build a sample code - Modify azure - pipelines - yaml file

Total: 45 Hours

Reference(s)

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014
3. Mitesh Soni, "Hands-On Azure DevOps: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure DevOps And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure, English Edition, Paperback - 1 January 2020
4. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015
5. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016
6. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019

21IT013 VIRTUALIZATION IN CLOUD COMPUTING 3 0 0 3

Course Objectives

- 1. Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud based applications
- 2. Create an application by utilizing cloud platforms such as Amazon Web Services and Windows Azure
- 3. Identify major security and privacy problems in cloud computing environment
- 4. Apply the ability to use the architecture of cloud, service and delivery models
- 5. Implement the key enabling technologies that help in the development of cloud.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. 1. Analyze the concept of virtualization and its properties.
2. 2. Apply different forms of virtualization.
3. 3. Implement various architectures for implementing virtualization methods.
4. 4. Create virtual machines and installing various operating systems.
5. 5. Evaluate the performance of the virtual machines and deployed applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	3									1	
2			1	2	3								-	1
3			2	1	3									2
4	1		2	1	3									2
5	1		3		2									2

UNIT I **9 Hours**

UNDERSTANDING VIRTUALIZATION

Describing Virtualization-Microsoft Windows Drives Server Growth -Explaining Moores Law-Understanding the Importance of Virtualization -Examining Todays Trends -Virtualization and Cloud Computing -Understanding Virtualization Software Operation -Virtualizing Servers -Virtualizing Desktops -Virtualizing Applications.

UNIT II **9 Hours**

HYPERVISORS

Describing a Hypervisor -Exploring the History of Hypervisors -Understanding Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor -Holodecks and Traffic Cops -Resource Allocation -Comparing Todays Hypervisors -VMware ESX -Citrix Xen -Microsoft Hyper-V -Other Solutions.

UNIT III **9 Hours**

UNIT III

Introduction to Virtual Machine - CPUs in a Virtual Machine -Memory in a Virtual Machine -Network Resources in a Virtual Machine - Storage in a Virtual Machine -Understanding How a Virtual Machine Works -Working with Virtual Machines -Virtual Machine Clones -Templates -Snapshots -OVF -Containers

UNIT IV **9 Hours**

CREATION OF VIRTUAL MACHINES

Understanding Configuration Options-Installing Windows on a Virtual Machine- Installing Linux on a Virtual Machine-Installing VirtualBox Guest Additions- Managing CPUs for a Virtual Machine- Configuring VM CPU Options-Managing Storage for a Virtual Machine- Managing Networking for a Virtual Machine- Copying a Virtual Machine- Managing Additional Devices in Virtual Machines

UNIT V **9 Hours**

AVAILABILITY

Increasing Availability-Protecting a Virtual Machine-Protecting Multiple Virtual Machines-Protecting Data Centers -Examining Virtual Infrastructure Performance Capabilities -Deploying Applications in a Virtual Environment-Understanding Virtual Appliances and vApps -Open Stack and Containers.

Total: 45 Hours

Reference(s)

1. 1. Matthew Portney, Virtualization Essentials, John Wiley & Sons, Second Edition, 2016
2. 2. Kailash Jayaswal, Jagannath Kallakurchi,Donald J.Houde,Dr.devan Shah, Cloud Computing Black Book, Dreamtech press, 2015
3. 3. Rajkumar Buyya, Christian Vecchiola and Thamarai Selvi S,Mastering in Cloud Computing, McGraw Hill Education, (India) Private Limited, 2013
4. 4. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
5. 5. http//www.microsoft.com/learning/default.mspx
6. 6. https://www.oreilly.com/library/view/cloud- security-and/9780596806453/ch04.html

21IT014 CLOUD SERVICES AND DATA MANAGEMENT 3 0 0 3

Course Objectives

- 1. Analyze the basic concepts of Cloud and capabilities across the various Cloud service models
- Analyze the basic concepts of Cloud and capabilities across the various Cloud service models
- 3. Create an application by utilizing cloud platforms such as Google App Engine, Microsoft Azure and OpenStack
- 4. Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- 5. Select appropriate structures for designing, deploying and running cloud-based services in a business environment

Programme Outcomes (POs)

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.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. 1. Apply Cloud Computing reference architecture for developing clouds
2. 2. Analyze the different forms of cloud service models
3. 3. Apply the characteristics and architecture of IaaS using various real world applications.
4. 4. Evaluate PaaS concepts and architectures with real-world examples
5. 5. Analyze, and synthesize concepts related to the SaaS delivery model.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	1									
2	3	1	2	3	2									
3	1	1	3	1	3									2
4	1	1	1	2	3									2
5	1	3	3	2	2									1

UNIT I **9 Hours**

CLOUD COMPUTING REFERENCE ARCHITECTURE (CCRA)

Introduction to Cloud Computing Reference Architecture (CCRA), Benefits of CCRA, Architecture Overview, Versions and Application of CCRA for Developing Clouds.

UNIT II **9 Hours**

INTRODUCTION OF DELIVERY MODELS IN CLOUD COMPUTING

Introduction to Cloud Delivery Models, List Various Cloud Delivery Models, Advantages of Delivery Models in Cloud, Trade-off in Cost to Install Versus Flexibility, Cloud Service Model Architecture.

UNIT III **9 Hours**

INFRASTRUCTURE AS A SERVICE (IAAS)

Introduction to Infrastructure as a Service Delivery Model, Characteristics of IaaS, Architecture, Examples of IaaS, Applicability of IaaS in the Industry.

UNIT IV **9 Hours**

PLATFORM AS A SERVICE (PAAS)

Introduction to Platform as a Service Delivery Model, Characteristics of PaaS, Patterns, Architecture and Examples of PaaS, Applicability of PaaS in the Industry.

UNIT V **9 Hours**

SOFTWARE AS A SERVICE (SAAS)

Introduction to Software as a Service Delivery Model, Characteristics of SaaS, Architecture, Examples of SaaS, Applicability of SaaS in the Industry.

Total: 45 Hours

Reference(s)

1. 1. (IBM ICE), Cloud Computing Architecture, IBM Global Technology Services Thought Leadership White Paper, April 2011
2. 2. Bernard Golden, Amazon Web Services for Dummies, John Wiley & Sons, First Edition, 2013
3. 3. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, 2011
4. 4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010
5. 5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O reilly, SPD, 2011

21IT015 CLOUD STORAGE TECHNOLOGIES 3 0 0 3

Course Objectives

- 1. Characterize the functionalities of logical and physical components of storage
- 2. Describe various storage networking technologies
- 3. Identify different storage virtualization technologies
- 4. Discuss the different backup and recovery strategies
- 5. Understand common storage management activities and solutions

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. 1. Analyze the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
2. 2. Apply the usage of advanced intelligent storage systems and RAID.
3. 3. Evaluate various storage networking architectures - SAN, including storage subsystems and virtualization.
4. 4. Execute the different roles in providing disaster recovery and remote replication technologies.
5. 5. Implement the security needs and security measures to be employed in information storage management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	3	3								2	
2	3	1	2	3	3									1
3	1	1	2	3	3									2
4	3	2	1	2	2									1
5	1	3	2	1	2									2

UNIT I **8 Hours**

STORAGE SYSTEMS

Cloud Storage Fundamentals and Architecture - Cloud Storage Providers and Services - Access methods (RESTful APIs, SDKs) for cloud object storage - Block storage technologies in cloud environments - File Storage in the Cloud: Network File System (NFS) and Server Message Block (SMB) protocols -Hybrid Cloud Storage - Data Migration - Data Lifecycle

Management in the Cloud

UNIT II **9 Hours**

INTELLIGENT STORAGE SYSTEMS AND RAID

Storage Tiering and Caching - Automated Data Placement and Load Balancing: Intelligent Algorithms for Data Placement, Load Balancing Strategies for Distributed Storage Systems, Dynamic Resource Allocation - RAID Technologies in Cloud Storage: RAID Levels - Data Striping, Mirroring, and Parity for Fault Tolerance - RAID Configuration and Performance Optimization

UNIT III **10 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Storage Networking in Cloud Environments - Understanding storage protocols - Network-attached storage (NAS) vs. storage area network (SAN) - Storage virtualization techniques and technologies - Network-Attached Storage (NAS) - Storage Area Network (SAN) - iSCSI and Fiber Channel over IP (FCIP) in Cloud Storage - Network Virtualization and Overlay Networks - Storage Virtualization and Abstraction - Network Performance Optimization - Network Security in Cloud Storage

UNIT IV **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Cloud Backup: Strategies and Architecture, Data Deduplication and Compression, Security - Cloud Archive: Strategies and Architecture, Replication for Data Redundancy: Synchronous and asynchronous replication methods - Disaster Recovery in the Cloud - Hybrid Backup and Archiving in Cloud Environments - Backup and Archive Management in Cloud Environments

UNIT V **9 Hours**

SECURING STORAGE INFRASTRUCTURE

Storage Security Fundamentals: Key Security Principles, Threats and Vulnerabilities in Storage Infrastructure, Access Control and Authentication: Role-based Access Control (RBAC) and Permissions Management, Multi-factor authentication (MFA) for Storage Systems - Storage-level Encryption and Application-level Encryption - Storage infrastructure Management Functions and Processes.

Total: 45 Hours

Reference(s)

1. 1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O Reilly, 2009.
2. 2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. 3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. 4. Rittinghouse, John W., and James F. Ransome, Cloud Computing Implementation, Management and Security, CRC Press, 2017.
5. 5. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

21IT016 CLOUD AUTOMATION TOOLS AND APPLICATIONS **3 0 0 3**

Course Objectives

- 1. To learn the options for running automation tools, and load balancers in the cloud-native applications.
- 2. To learn the configuration management in the cloud.
- 3. To know why cloud automation is important.
- 4. To learn what types of cloud automation tools can be used.
- 5. To learn load balancing and auto scaling in the cloud.

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Implement cloud native applications on AWS, Terraform etc.
2. Apply VM provisioning and migration in the cloud.
3. Analyze cloud automation and configuration.
4. Apply balance load and auto scaling in the cloud.
5. Analyze the AWS cloud formation use-case.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		2	1	3									2
2		2			3									1
3			3	2	3									2
4			2		3								2	
5			2		3									2

UNIT I **7 Hours**

UNDERSTANDING THE CLOUD AUTOMATION

Introduction to Automation & Configuration Tools. Introduction to Terraform. Understanding Terraform Vs CloudFormation. Deploying & Destroying AWS environment with Terraform. Introduction to Packer.

UNIT II **9 Hours**

ABSTRACTION AND VIRTUALIZATION

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding hypervisors Porting Applications, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Centre Automation.

UNIT III **9 Hours**

AUTOMATION AND CONFIGURATION MANAGEMENT IN THE CLOUD

Cloud automation at scale, Cloud Configuration Management unmanaged and managed configuration management, Modification of the capacity of the service, horizontal and vertical scaling, and automatic versus manual scaling. Migrating the business to Cloud. Automating cloud deployments Balancers.

UNIT IV **9 Hours**

LOAD BALANCING AND AUTO SCALING IN CLOUD

Managed instance groups, Auto scaling and health check, Overview of HTTP(S) load balancing. Example: HTTP load balancer, HTTP(S) load balancing, Configuring an HTTP Load Balancer with Auto scaling, SSL proxy load balancing, TCP proxy load balancing, Network load balancing, Internal load balancing, Configuring an Internal Load Balancer, Choosing a load balancer

UNIT V **11 Hours**

AWS CLOUDFORMATION USE-CASE

Introduction to AWS CloudFormation, AWS CloudFormation Features and Components, Working of AWS CloudFormation, setting up AWS CloudFormation, building a Pipeline for Test and Production Stacks, AWS CloudFormation Artifacts, Parameter Override Functions with Code Pipeline, Using AWS CLI. AWS CloudFormation, Terraform, VMware vs Center Configuration Manager (VCM), and Puppet.

Total: 45 Hours

Reference(s)

1. 1. Bernd Ruecker, Practical Process Automation: Orchestration and Integration in Micro services and Cloud Native Architectures,O"Reilly Media, First Edition, 2021.
2. 2. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC, First Edition, 2021.
3. 3. Karen Tovmasyan, Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Packt Publishing Limited, First Edition, 2020.
4. 4. Mikael Krief, Mitchell Hashimoto, Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms, Packet Publishing Limited, 2020.
5. 5. Yogesh Raheja, Dennis McCarthy, Automation with Puppet 5.0, Wiley, First Edition, 2018.

21IT017 SOFTWARE DEFINED NETWORKS **2 0 2 3**

Course Objectives

- understand the need for SDN and its data plane operations
- understand the functions of control plane
- comprehend the migration of networking functions to SDN environment
- explore various techniques of network function virtualization
- comprehend the concepts behind network virtualization

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Apply the motivation behind SDN
2. Analyze the functions of the data plane and control plane
3. Evaluate and develop network applications using SDN
4. Execute network services using NFV
5. Implement various use cases of SDN and NFV

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	3	1	3									
2	2	1	2	2	3								1	
3	2	2	2	3	3									
4	2	2	2	3	1									
5	3	3	1	1	3								2	

UNIT I **6 Hours**

SDN:INTRODUCTION

History of Software Defined Networking (SDN)-Modern Data Center - Traditional Switch Architecture - Why SDN - Evolution of SDN - How SDN Works - Centralized and Distributed Control and Date Planes

UNIT II **6 Hours**

SDN DATA PLANE AND CONTROL PLANE

Data Plane functions and protocols - OpenFLow Protocol - Packet Processing and Performance Optimization - Flow Table

- Control Plane Functions - Southbound Interface, Northbound Interface - SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III **6 Hours**

SDN APPLICATIONS

SDN Application Plane Architecture - Network Services Abstraction Layer - Traffic Engineering - Measurement and Monitoring - Security - Data Center Networking - Wide Area Networks (WAN) - Service Provider Networks - Internet Service Providers (ISPs)

UNIT IV **6 Hours**

NETWORK FUNCTION VIRTUALIZATION

Network Virtualization - NFV Architecture - Virtual LANs - OpenFlow VLAN Support - NFV Standards and Frameworks - NFV Concepts - Benefits and Requirements - Reference Architecture

UNIT V **6 Hours**

NFV FUNCTIONALITY

NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases: Virtual Customer Premises Equipment, Virtual Evolved Packet Cor, Virtualized Network Monitoring and Traffic Analysis, Network Slicing, Edge Computing and NFV

1 **5 Hours**

EXPERIMENT 1

Setup your own virtual SDN lab
i) Virtualbox/Mininet Environment for SDN - http://mininet.org
ii) https://www.kathara.org
iii) GNS3

2 **5 Hours**

EXPERIMENT 2

Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.

3 **6 Hours**

EXPERIMENT 3

Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.

4 **6 Hours**

EXPERIMENT 4

Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu

5 **6 Hours**

EXPERIMENT 5

Install OSM and onboard and orchestrate network service.

Total: 58 Hours

Reference(s)

1. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design, 1st Edition, CRC Press, 2014.
2. Ken Gray, Thomas D. Nadeau, Network Function Virtualization, Morgan Kauffman, 2016.

3. Oswald Coker, Siamak Azodolmolky, Software-Defined Networking with OpenFlow, 2nd Edition, O"Reilly Media, 2017.
4. Paul Goransson, Chuck Black Timothy Culver, Software Defined Networks: A Comprehensive Approach, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Thomas D Nadeau, Ken Gray, SDN: Software Defined Networks, O"Reilly Media, 2013.

21IT018 SECURITY AND PRIVACY IN CLOUD 3 0 0 3

Course Objectives

- To Introduce Cloud Computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To understand the Identity, Access control in Cloud.
- To follow best practices for Cloud security using various design patterns.
- To be able to monitor and audit cloud applications for security.

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the cloud security concepts and fundamentals.
2. Explain the security challenges in the cloud.
3. Analyze the cloud policy, identity and Access Management.
4. Delivers various risks, audit and monitoring mechanisms in the cloud.
5. Applying the various architectural and design considerations for security in the cloud.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	1	2									
2	1	3	2	3	1									
3	3	2	2	3	2								1	
4	2	1	2	3	3									
5	1	3	3	1	1									3

UNIT I **8 Hours**

FUNDAMENTALS OF CLOUD SECURITY CONCEPTS

Overview of Cloud Security - Security Services - Confidentiality, Integrity, Authentication, Non- repudiation, Access Control - Basic of Cryptography - Conventional and Public-key cryptography, Hash Functions, Authentication and Digital Signatures

UNIT II **11 Hours**

SECURITY DESIGN AND ARCHITECTURE FOR CLOUD

Security Design Principles for Cloud Computing - Comprehensive Data Protection - End-to-end access control - Common Attack Vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III **9 Hours**

ACCESS CONTROL AND IDENTITY MANAGEMENT

Access Control Requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection

UNIT IV **9 Hours**

CLOUD SECURITY DESIGN PATTERNS

Introduction to Design Patterns, Cloud Bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V **9 Hours**

MONITORING, AUDITING AND MANAGEMENT

Proactive Activity Monitoring - Incident Response, Monitoring for Unauthorized Access, Malicious Traffic, Abuse of System Privileges - Events and Alerts - Auditing - Record generation, Reporting and Management, Tamper-Proofing Audit logs, Quality of Services, Secure Management, User Management, Identity Management, Security Information and Event Management

Total: 46 Hours

Reference(s)

1. Dave Shackleford, Virtualization Security, SYBEX a Wiley Brand, 2013
2. Mark C. Chu-Carroll, Code in the Cloud, CRC Press, 2011
3. Mather, Kumaraswamy and Latif, Cloud Security and Privacy, Oreilly, 2011
4. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing Foundations and Applications Programming, 2013.
5. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing, Wiley 2013.

21IT019 CYBER SECURITY 3 0 0 3

Course Objectives

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the basics of cyber security, cybercrime and cyber law.
2. Classify various types of attacks and learn the tools to launch the attacks.
3. Apply various tools to perform information gathering for data security and integrity.
4. Apply intrusion techniques to detect intrusion and to observe network traffic for malicious transactions in the network.
5. Apply intrusion prevention techniques to prevent intrusion and to protect against known and unknown threats.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	2								2	
2	1	3	1	3	3								2	
3	2	1	1	1	2								2	
4	3	3	2	2	1								3	
5	3	2	2	2	3								3	

UNIT I **9 Hours**

INTRODUCTION

Cyber Security - History of Internet - Impact of Internet - CIA Triad; Reason for Cyber Crime - Need for Cyber Security - History of Cyber Crime; Cybercriminals - A Global Perspective on Cyber Crimes - Classification of Cybercrimes

UNIT II **9 Hours**

ATTACKS AND COUNTER MEASURES

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks - Security Breach - Types of Malicious Attacks - Malicious Software - Common Attack Vectors - Social engineering Attack - Wireless Network Attack - Web Application Attack - Attack Tools - Countermeasures

UNIT III **9 Hours**

RECONNAISSANCE

Harvester - Who is - Netcraft - Host - Extracting Information from DNS- Extracting Information from E-mail Servers - Social Engineering Reconnaissance; Scanning - Port Scanning - Network Scanning and Vulnerability Scanning - Scanning Methodology - Ping Sweer Techniques - Nmap Command Switches - SYN - Stealth - XMAS - NULL - IDLE - FIN Scans - Banner Grabbing and OS Fingerprinting Techniques

UNIT IV **9 Hours**

INTRUSION DETECTION

Host -Based Intrusion Detection-Network -Based Intrusion Detection-Distributed or Hybrid Intrusion Detection-Intrusion Detection Exchange Format -Honeypots - Example System Snort -Cyber Laws-The Indian IT Act - Cyber Crime and Punishment

UNIT V **9 Hours**

INTRUSION PREVENTION

Firewalls and Intrusion Prevention Systems: Need for Firewalls -Firewall Characteristics and Access Policy - Types of Firewalls - Firewall Basing - Firewall Location and Configurations - Intrusion Prevention Systems - Example Unified Threat Management Products

Total: 45 Hours

Reference(s)

1. Anand Shinde,Introduction to Cyber Security Guide to the World of Cyber Security, Notion Press, 2021
2. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publishers, 2011
3. David Kim, Michael G. Solomon, Fundamentals of Information Systems Security, Jones & Bartlett Learning Publishers, 2013.
4. Patrick Engebretson,The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy, Elsevier, 2011.
5. Kimberly Graves,CEH Official Certified Ethical hacker Review Guide, Wiley Publishers, 2007.
6. William Stallings, Lawrie Brown,Computer Security Principles and Practice, Third Edition, Pearson Education, 2015.

21IT020 MODERN CRYPTOGRAPHY 3 0 0 3

Course Objectives

- To learn about the basics of modern cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct the basics of cryptanalytic techniques for ensuring data integrity.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Interpret the basic principles of cryptography and general cryptanalysis.
2. Determine the concepts of symmetric encryption and authentication.
3. Identify the use of public key encryption, digital signatures, and key establishment.
4. Apply the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
5. Demonstrate the use of Message Authentication Codes to authenticate information transmitted between the users.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	1							2	2	-
2	1	3	2	1	2							2	2	-
3	1	1	2	3	2							3	1	-
4	3	1	2	1	3							2	3	-
5	2	3	3	3	3							1	2	-

UNIT I **9 Hours**

INTRODUCTION

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations

UNIT II **9 Hours**

FORMAL NOTIONS OF ATTACKS

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2, Inter-relations among the attack model

UNIT III **9 Hours**

RANDOM ORACLES

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV **9 Hours**

BUILDING A PSEUDORANDOM PERMUTATION

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction

UNIT V **9 Hours**

MESSAGE AUTHENTICATION CODES

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir"s Secret Sharing Scheme- Formally Analyzing Cryptographic Protocols- Zero Knowledge Proofs and Protocols

Total: 45 Hours

Reference(s)

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2017.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), 2009.
3. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2007.
4. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2004.

21IT021 CYBER FORENSICS **3 0 0 3**

Course Objectives

- To understand the principles and concepts of computer forensics.
- To learn to utilize forensic tools for network-based attacks.
- To identify and apply appropriate methodologies for forensics data.
- To identify and analyze the vulnerabilities in the network.
- To analyze the various hacking techniques and their impacts.

Programme Outcomes (POs)

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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. To understand the basics of computer forensics, legal and ethical considerations, and the importance of maintaining the integrity of digital evidence.
2. Apply different types of computer forensic tools to preserve the integrity of data in the network.
3. Analyze and validate forensics data from the communicating devices to detect intruders.
4. Apply the various firewall techniques to detect the vulnerabilities in the networks.
5. Implement real-world hacking techniques to test system security and to ensure the system"s safety from hackers.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	2			2					2	
2	2	2	3	2	3			2					2	
3	2	1	3	2	2			3					2	
4	2	1	2	3	3			3					3	
5	2	2	2	2	3			3					3	

UNIT I **9 Hours**

INTRODUCTION TO COMPUTER FORENSICS

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques Incident and incident response methodology Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. Forensics Technology and Systems, Understanding

Computer Investigation, Data Acquisition.

UNIT II **9 Hours**

EVIDENCE COLLECTION AND FORENSICS TOOLS

Processing Crime and Incident Scenes, Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT III **9 Hours**

ANALYSIS AND VALIDATION

Validating Forensics Data, Data Hiding Techniques, Performing Remote Acquisition, Network Forensics, Email Investigations, Cell Phone and Mobile Devices Forensics.

UNIT IV **9 Hours**

E-MAIL SECURITY

PGP - S/MIME, Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology, Types of Firewalls, Firewall designs, SET for E-Commerce Transactions

UNIT V **9 Hours**

ETHICAL HACKING IN WEB

Social Engineering, Denial of Service, Session Hijacking, Hacking Web servers, Hacking Web Applications, SQL Injection, Hacking Wireless Networks, Hacking Mobile Platforms.

Total: 45 Hours

Reference(s)

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
4. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Cengage Learning, 2nd Edition, 2005.
5. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003.

21IT022 ETHICAL HACKING 3 0 0 3

Course Objectives

- To learn about the importance of information security.
- To learn different scanning and enumeration methodologies and tools.
- To understand various hacking techniques and attacks.
- To be exposed to programming languages for security professionals.
- To understand the different phases in penetration testing

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Enumerate the numerous assaults carried out during ethical hacking and penetration testing.
2. Apply the hacking techniques and understand the tools to be used for hacking
3. Understand the various vulnerabilities of Windows and Linux OS
4. Apply the techniques to hack web servers and tools for it.
5. Determine the characteristics of the firewall, the intruder detection mechanisms, and the malicious software to protect the system.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	1	2								1	
2	2	2	2	3	3								2	
3	2	1	1	2	1					-			2	
4	1	2	2	3	3								2	
5	1	2	2	3	3								3	

UNIT I **9 Hours**

INTRODUCTION

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

UNIT II **9 Hours**

SCANNING AND ENUMERATION

Introduction to Scanning - Objectives - Scanning Methodology - Tools - Introduction to Enumeration - Enumeration Techniques - Enumeration Procedure - Tools

UNIT III **9 Hours**

SYSTEM HACKING

Introduction - Cracking Passwords - Password Cracking Websites - Password Guessing - Password Cracking Tools - Password Cracking Countermeasures - Escalating Privileges - Executing Applications - Keyloggers and Spyware

UNIT IV **9 Hours**

PROGRAMMING FOR SECURITY PROFESSIONALS

Programming Fundamentals - C language - HTML - Perl - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures - Linux OS Vulnerabilities - Tools for Identifying Vulnerabilities - Countermeasures

UNIT V **9 Hours**

NETWORK PROTECTION SYSTEMS

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

Total: 45 Hours

Reference(s)

1. EC-Council,"Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. Jon Erickson,"Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2013.
4. Patrick Engebretson,"The Basics of Hacking and Penetration Testing - Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
5. RafayBoloch,"Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

21IT023 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- To understand the basics of Blockchain Technology.
- To learn Different protocols and consensus algorithms in Blockchain.
- To learn the Blockchain implementation frameworks.
- To experiment the Hyperledger Fabric, Ethereum networks.
- To understand the Blockchain Applications.

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand emerging abstract models for Blockchain Technology.
2. Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.
3. Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.
5. Analyze the real life applications of Blockchain Technologies.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1	-								-	
4	-	2	2	-	3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain, Public Ledgers, Blockchain as Public Ledgers, Block in a Blockchain, Transactions, The Chain and the Longest Chain, Permissioned Model of Blockchain, Cryptographic, Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH, the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW), Hashcash PoW , Bitcoin PoW, Attacks on PoW, monopoly problem, Proof of Stake, Proof of Burn, Proof of Elapsed Time, Bitcoin Miner, Mining Difficulty, Mining Pool, Permissioned model and use cases.

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue, DApps, NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc, Case Study.

1 **5 Hours**

EXPERIMENT 1

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

2 **5 Hours**

EXPERIMENT 2

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

3 **5 Hours**

EXPERIMENT 3

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.

4 **5 Hours**

EXPERIMENT 4

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.

5 **5 Hours**

EXPERIMENT 5

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6 **5 Hours**

EXPERIMENT 6

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan.

Total: 60 Hours

Text Book(s)

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, OReilly, 2014.

Reference(s)

1. Daniel Drescher, Blockchain Basics, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, Blockchain: Blueprint for a New Economy, OReilly, 2015
4. Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

21IT024 MALWARE ANALYSIS 3 0 0 3

Course Objectives

- Understand the fundamentals of malware, types and its effects.
- Identify and analyze various malware types by static and dynamic analysis.
- To deal with detection, analysis, understanding, controlling, and eradication of malware.

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Understand the various concepts of malware analysis and their technologies used.
2. Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
3. Understand the methods and techniques used by professional malware analysts.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2								2	
2	3	3	2	2	2								2	
3	3	3	3	3	3								3	
4	3	3	3	3	3								3	
5	3	3	3	3	3								3	

UNIT I **9 Hours**

INTRODUCTION AND BASIC ANALYSIS

Introduction to Malware - Malware threats - Malware types: Viruses, Worms, Rootkits, Trojans, Bots, Spyware, Adware, Logic Bombs - Goals of Malware Analysis - AV Scanning - Hashing - Finding Strings - Packing and Obfuscation - PE file format - Static - Linked Libraries and Functions - Static Analysis tools - Virtual Machines and their usage in Malware analysis - Sandboxing - Basic dynamic analysis - Malware execution - Process Monitoring - Viewing processes - Registry snapshots

UNIT II **9 Hours**

ADVANCED STATIC ANALYSIS

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

UNIT III **9 Hours**

ADVANCED DYNAMIC ANALYSIS

Live malware analysis - dead malware analysis - analyzing traces of malware - system calls - api calls - registries - network activities. Anti-dynamic analysis techniques - VM detection techniques - Evasion techniques - Malware Sandbox - Monitoring with Process Monitor - Packet Sniffing with Wireshark - Kernel vs. User-Mode Debugging - OllyDbg - Breakpoints - Tracing - Exception Handling - Patching

UNIT IV **9 Hours**

MALWARE FUNCTIONALITY

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

UNIT V **9 Hours**

ANDROID MALWARE ANALYSIS

Android Malware Analysis: Android architecture - App development cycle - APKTool - APKInspector - Dex2Jar - JD-GUI - Static and Dynamic Analysis - Case Study: Smartphone (Apps) Security

Total: 45 Hours

Reference(s)

1. Michael Sikorski and Andrew Honig,"Practical Malware Analysis" by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden,"The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System", Second Edition, Jones & Bartlett Publishers, 2009.
3. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
4. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SÃƒÂ©bastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
5. Victor Marak,"Windows Malware Analysis Essentials" Packt Publishing, O"Reilly, 2015.
6. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere,"Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.

21IT025 MULTIMEDIA AND ANIMATION **2 0 2 3**

Course Objectives

- Understand the basic knowledge of multimedia Systems and related technologies
- To learn about multimedia elements in a comprehensive way
- Understand the basics of digital 2D animation to create story and multimedia production
- Design the technical and artistic skills to produce 3D animations.

Programme Outcomes (POs)

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.

m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the multimedia elements, image processing and animation
2. Analyze the encode and decode the multimedia elements
3. Apply the author 2D and 3D creative and interactive presentations for different target multimedia applications.
4. Create the 2D animation and develop the storyboards.
5. Create and animate the 3D models using software tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		2									
2	2	1	1	1	2								3	
3	3												2	2
4	2	2	2											2
5	2	3	2											2

UNIT I **6 Hours**

INTRODUCTION TO MULTIMEDIA ELEMENTS

Multimedia-Medium Properties of a Multimedia System-Traditional Data Stream Characteristics-Text-Basic Sound Concept-Speech-Computer Image Processing

UNIT II **6 Hours**

MULTIMEDIA COMPRESSION

Storage Space-Coding Requirements-Hybrid Coding-JPEG Image Preparation-Lossy Mode-Lossless Mode-Hierarchical

Mode-H.261- MPEG Video Encoding-Data Stream-MPEG3-MPEG7-MPEG21

UNIT III **6 Hours**

MULTIMEDIA AUTHORING

Authoring metaphors-Tools Features and Types-Card and Page Based Tools-Icon and Object Based Tools-Time Based Tools-3D Modeling and Animation Tools-Image Editing Tools-audio Editing Tools-Digital Movie Tools-Creating interactive presentations-virtual learning-simulations.

UNIT IV **6 Hours**

2D ANIMATION

Introduction to 2D Animation-Colour theory and basics-Layout and Designing Basic of sketching-Composition of basic elements-Graphics and advertising-Creating Digital Layout-Professional image editing-Story Boarding-stop motion animation-Production-Post-Production-Background composition, 2D animation and techniques

UNIT V **6 Hours**

3D ANIMATION

3D Modeling-Modeling Techniques-Types of Modeling-3D Shading-Use of Material-Shader and Texture editing-Introduction to 3D Animation-3D Animation and Rigging-Setting up controllers for joints-Simple Skeleton structure with proper joint orientation-3D Lighting and Rendering

1 **3 Hours**

EXPERIMENT 1

Image Editing and Manipulation - Basic Operations on images using any image editing software

2 **3 Hours**

EXPERIMENT 2

Implementation of audio and Video Editing techniques

3 **3 Hours**

EXPERIMENT 3

Sketching of cartoon characters

4 **3 Hours**

EXPERIMENT 4

Design 2D Logo using the image editing tool

5 **3 Hours**

EXPERIMENT 5

Creating gif animated images in 2D Animation

6 **3 Hours**

EXPERIMENT 6

Exploring the Interface of 3D application

7 **3 Hours**

EXPERIMENT 7

Create different types of Materials and Shading

8 **3 Hours**

EXPERIMENT 8

Create a simple walk cycle using the character Rigs

9 **3 Hours**

EXPERIMENT 9

Create a 3-point Light Setup

10 **3 Hours**

EXPERIMENT 10

Create particle Simulation and Rendering

Total: 60 Hours

Reference(s)

1. Ze-Nian Li,Mark S Drew,Jiangchuan Liu,Fundamentals of Multimedia,Third Edition,Springer Texts in Computer Science-2021
2. Andleigh,P K and Kiran Thakrar,Multimedia Systems and Design,PHI,2003 Multimedia: Making It Work, Tay Vaughan, 9th Edition
3. The Illusion of Life:Disney Animation-Frank Thomas and Ollie Johnston Maraffi, Chris, Maya Character Creation: Modeling and Animation Controls New Riders,2008
4. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016
5. Mark Gaimbruno, 3D Graphics and Animation, Second Edition, New Riders, 2002.
6. Rogers David,Animation master-A Complete Guide,Charles River Media,2006

21IT026 AUGMENTED REALITY/VIRTUAL REALITY 2 0 2 3

Course Objectives

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.

Programme Outcomes (POs)

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.
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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Analyze the tools and technologies related to AR/VR.
2. Design various models using modelling techniques.
3. Apply programming concepts and techniques specific to VR development, including 3D graphics.
4. Develop AR/VR applications in different domains.
5. Apply the technologies related to AR to build AR-enabled devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2			2	2	2		2	2	2
2	2	3	3	3	3			2	2	2		2	3	3
3	2	2	2	2	2			2	2	2		2	3	3
4	3	3	3	3	3			2	2	2		2	3	3

5	3	3	3	3	3			2	2	2		2	3	3

UNIT I **6 Hours**

INTRODUCTION

Introduction to Virtual Reality and Augmented Reality - Definition - Introduction to Trajectories and Hybrid Space -Three Is of Virtual Reality - Virtual Reality Vs 3D Computer Graphics - Benefits of Virtual Reality - Components of VR System - Introduction to AR-AR Technologies - Input Devices -Types of Trackers - Human Visual System - Personal Graphics Displays - Human Auditory System.

UNIT II **6 Hours**

VR MODELING

Modelling - Geometric Modelling - Virtual Object Shape - Object Visual Appearance - Kinematics Modelling - Transformation Matrices - Object Position - Transformation Invariants - Object Hierarchies - Physical Modelling - Behavior Modelling - Model Management.

UNIT III **6 Hours**

VR PROGRAMMING

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

UNIT IV **6 Hours**

APPLICATIONS

Human Factors in VR - Methodology and Terminology - VR Health and Safety Issues - VR and Society-Medical Applications of VR - Education, Arts and Entertainment - Military VR Applications - Emerging Applications of VR.

UNIT V **6 Hours**

AUGMENTED REALITY

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

1 **3 Hours**

EXPERIMENT 1

Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.

2 **3 Hours**

EXPERIMENT 2

Use the primitive objects and apply various projection types by handling camera.

3 **3 Hours**

EXPERIMENT 3

Download objects from asset store and apply various lighting and shading effects

4 **3 Hours**

EXPERIMENT 4

Model three dimensional objects using various modelling techniques and apply textures over them.

5 **3 Hours**

EXPERIMENT 5

Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.

6 **3 Hours**

EXPERIMENT 6

Add audio and text special effects to the developed application.

7 **3 Hours**

EXPERIMENT 7

Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity

8 **3 Hours**

EXPERIMENT 8

Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.

9 **3 Hours**

EXPERIMENT 9

Develop AR enabled simple applications like human anatomy, DNA/RNA structure visualization and surgery simulation

10 **3 Hours**

EXPERIMENT 10

Develop simple MR enabled gaming applications

Total: 60 Hours

Reference(s)

1. Charles Palmer, John Williamson, Virtual Reality Blueprints :Create compelling VR experiences for mobile , Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, Augmented Reality: Principles & Practice, Addison Wesley, 2016
3. John Vince, Introduction to Virtual Reality, Springer - Verlag, 2004
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality - Interface, Application, Design, Morgan Kaufmann, 2003

21IT027 GAME DEVELOPMENT 2 0 2 3

Course Objectives

- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- To learn and develop simple games using Pygame environment

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand the foundations of 2D and 3d Graphics
2. Design game design documents
3. Implementation of gaming engines.
4. Survey gaming environments and frameworks.
5. Develop and construct a simple game in Pygame.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								2	1
2	2	2	3		3								1	1
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **6 Hours**

3D GRAPHICS FOR GAME DESIGN

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components - 2D and 3D Transformations - Projections -Color Models - Illumination and Shader Models - Animation -Controller Based Animation.

UNIT II **6 Hours**

GAME DESIGN PRINCIPLES

Character Development, Storyboard Development for Gaming -Script Design - Script Narration, Game Balancing, Core

Mechanics, Principles of Level Design - Proposals - Writing for Preproduction, Production and Post - Production.

UNIT III **6 Hours**

GAME ENGINE DESIGN

Rendering Concept - Software Rendering - Hardware Rendering -Spatial Sorting Algorithms - Algorithms for Game Engine - Collision Detection - Game Logic - Game AI - Pathfinding.

UNIT IV **6 Hours**

OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS

Pygame Game development - Unity - Unity Scripts - Mobile Gaming, Game Studio, Unity Single player and Multi - Player games.

UNIT V **6 Hours**

GAME DEVELOPMENT USING PYGAME

Developing 2D and 3D interactive games using Pygame - Avatar Creation - 2D and 3D Graphics Programming - Incorporating music and sound - Asset Creations - Game Physics Algorithms Development - Device Handling in Pygame - Overview of Isometric and Tile Based Arcade Games - Puzzle Games.

1 **3 Hours**

EXPERIMENT 1

Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game

2 **3 Hours**

EXPERIMENT 2

Character design, sprites, movement and character control

3 **3 Hours**

EXPERIMENT 3

Level design: design of the world in the form of tiles along with interactive and collectible objects

4 **4 Hours**

EXPERIMENT 4

Design of interaction between the player and the world, optionally using the physics engine.

5 **4 Hours**

EXPERIMENT 5

Developing a 2D interactive using Pygame

6 **4 Hours**

EXPERIMENT 6

Developing a Puzzle game

7 **3 Hours**

EXPERIMENT 7

Design of menus and user interaction in mobile platforms.

8 **3 Hours**

EXPERIMENT 8

Developing a 3D Game using Unreal

9 **3 Hours**

EXPERIMENT 9

Developing a Multiplayer game using unity

Total: 60 Hours

Reference(s)

1. Sanjay Madhav, Game Programming Algorithms and Techniques: A Platform Agnostic Approach, Addison Wesley,2013.
2. Will McGugan, Beginning Game Development with Python and Pygame: From Novice to Professional, Apress,2007.
3. Paul Craven, Python Arcade games, Apress Publishers,2016.
4. David H. Eberly, 3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics, Second Edition, CRC Press,2006.
5. Jung Hyun Han, 3D Graphics for Game Programming, Chapman and Hall/CRC, 2011.

21IT028 VIDEO CREATION AND EDITING 2 0 2 3

Course Objectives

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

Programme Outcomes (POs)

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.
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 ones 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Compare the strengths and limitations of Nonlinear editing
2. Identify the infrastructure and significance of storytelling.
3. Apply suitable methods for recording to CDs and VCDs.
4. Address the core issues of advanced editing and training techniques.
5. Design and develop projects using AVID XPRESS DV 4.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	2	1	1				1	2	3	2	3	1
2	2	3	3	3	1				1	2	2	1	1	1
3	2	2	3	3	1				3	1	1	1	2	1
4	2	2	2	2	1				3	1	1	1	2	2

5	2	1	3	3	1				3	2	1	2	2	2

UNIT I **6 Hours**

FUNDAMENTALS

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II **6 Hours**

STORYTELLING

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - Understanding video color - Color Correcting Basics - Color Enhancement Effects mechanics of digital editing - pointer files - media management.

UNIT III **6 Hours**

USING AUDIO AND VIDEO

Audio: Timeline Audio Tracks - Editing Audio- Gaining, Fading and Balancing Audio- Video: Capturing digital and analog video - importing audio on putting video - exporting digital video to tape - recording to CDs and VCDs.

UNIT IV **6 Hours**

WORKING WITH FINAL CUT PRO

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V **6 Hours**

WORKING WITH AVID XPRESS DV 4

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

1 **3 Hours**

EXPERIMENT 1

Write a Movie Synopsis (Individual/Team Writing)

2 **3 Hours**

EXPERIMENT 2

Present team stories in class

3 **4 Hours**

EXPERIMENT 3

Script/Storyboard Writing(Individual Assignment)

4 **4 Hours**

EXPERIMENT 4

Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts

5 **4 Hours**

EXPERIMENT 5

Production: Single camera production personnel

6 **3 Hours**

EXPERIMENT 6

Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching

7 **4 Hours**

EXPERIMENT 7

Write Documentary and Animation Treatment

8 **5 Hours**

EXPERIMENT 8

Post-production: Editing, Sound design, Finishing

Total: 60 Hours

Reference(s)

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, Digital Video for Dummies, Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, Editing Digital Video: The Complete Creative and Technical Guide, Digital Video and Audio, McGraw - Hill 2003.

21IT029 DIGITAL MARKETING 3 0 0 3

Course Objectives

- Understand the overview of Digital Marketing.
- Examine the role and importance of digital marketing in the business environment.
- Determine the focuses on digital marketing and its measure

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Identify some of the latest digital marketing trends and skills sets needed for today""s Marketer.
2. Compare the strengths and limitations of search engine optimisation.
3. Apply the suitable techniques for E-Mail Marketing.
4. Discover the hottest techniques to help to successfully plan, predict, and manage your digital Marketing campaigns.
5. Evaluate the importance of your digital marketing assets, which ones actually matter the most to your business.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1		1								1	1
2	2	2	3		3								2	3
3	1	3	3		3								2	2
4	2	2	2		3								1	2
5	2	2	1		3								2	3

UNIT I **9 Hours**

INTRODUCTION TO ONLINE MARKET

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II **9 Hours**

SEARCH ENGINE OPTIMISATION

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT IV **9 Hours**

SOCIAL MEDIA MARKETING

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V **9 Hours**

DIGITAL TRANSFORMATION

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

FOR FURTHER READING

Conversion Tracking - Personality Development - Google AdSense - Getting Started as Freelancer - Affiliate Marketing.

Total: 36 Hours

Reference(s)

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373
2. Digital Marketing by Vandana Ahuja; Publisher: Oxford University Press (April 2015). ISBN- 10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition(April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses,first edition, Que Biz-Tech series2012.
5. Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

21IT030 PROGRAMMING ON EDGE DEVICES 3 0 0 3

Course Objectives

- Compare Fog and Edge Computing with different sets of use cases.
- Illustrate the architecture for the edge device.
- Implement the Microcomputer RaspberryPi and device Interfacing.

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Analyze, with different use cases, the difference between Fog and Edge Computing.
2. Develop the architecture for IoT edge computing devices based on the requirements.
3. Design and configure the edge devices using RaspberryPi.
4. Implement the Microcomputer RaspberryPi and device Interfacing.
5. Analyze the requirements of Industrial and Commercial edge devices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1		2										
2	3	2	2	3	2								2	
3	3	2	3	3	3								3	
4	3	2	3	2	3								3	
5	3	2	-	-	-								2	

UNIT I **6 Hours**

IOT AND EDGE COMPUTING DEFINITION AND USE CASES

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

UNIT II **6 Hours**

IOT ARCHITECTURE AND CORE IOT MODULES

A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples.

UNIT III **6 Hours**

RASPBERRYPI

Introduction to Aurdino and RaspberryPi, RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools.

UNIT IV **6 Hours**

IMPLEMENTATION OF DEVICE INTERFACING

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT communication formats.

UNIT V **6 Hours**

INDUSTRIAL AND COMMERCIAL IOT

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Total: 30 Hours

Reference(s)

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, Wiley publication, 2019, ISBN: 9781119524984.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O"Reilly Media, Inc., 2019, ISBN: 978149204322.
3. IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, 2nd Edition, 2020 by Perry Lea.

21IT031 ROBOTIC PROCESS AUTOMATION 3 0 0 3

Course Objectives

- Understand the basic concepts, methodologies and tools in RPA.
- Implement the exception handling and automation techniques using RPA.

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Interpret the basic concepts and methodologies in RPA.
2. Infer the UiPath building blocks in the RPA.
3. Apply the RPA techniques to automate the application.
4. Implement the exception handling and BOT in RPA.
5. Implement the RPA to solve real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2		2								2	
2	2	2	3		3								2	
3	2	2	3		3								3	
4	2	3	3		3								3	
5	2	3	3		3								3	

UNIT I **9 Hours**

RPA AND PROCESS METHODOLOGIES

BPM, and BPA-Understanding RPA Skills: On-Premise Vs. the Cloud - Lean and Six Sigma Methodologies for Process Improvement - Overview of Agile Methodologies and its importance in RPA

UNIT II **9 Hours**

UIPATH ESSENTIALS

Introduction to UiPath: Installation and activation-UiPath Activities: Flowcharts, Sequences, and Data Manipulation-UiPath Variables and Data Types-Debugging techniques in UiPath-Overview of UiPath Orchestrator: BOT Development and Management-UiPath Automation Best Practices

UNIT III **9 Hours**

ADVANCED RPA TECHNIQUES

Data Manipulation: Collections and Data Table Usage-File Operations: CSV/Excel to data table and vice versa-Working with UiExplorer and Desktop Automation-Web Automation: Basic and Desktop Recording-Advanced Screen Scraping Techniques-Data Scraping and Extraction from Websites

UNIT IV **9 Hours**

HANDLING EXCEPTIONS AND USER EVENTS

Exception Handling Techniques: Try-Catch, Re-throwing Exceptions, and Custom Exception Handling- Logging, Debugging, and Error Reporting Techniques- Handling User Events: Assistant bots, System Event Triggers, and Image and Element Triggers- Monitoring Techniques in RPA-Launching an Assistant bot on a Keyboard Event

UNIT V **9 Hours**

DEPLOYMENT AND MAINTENANCE OF BOT

Overview of Orchestration Server and its functionalities- Orchestrator to Control Bots and Deploy Bots- Uploading Packages, Managing Packages, and Deleting Packages- Publishing and Managing Updates- Continuous Integration and Continuous Deployment (CI/CD) in RPA

Total: 45 Hours

Reference(s)

1. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant.
2. Srikanth Miranda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

21IT032 AI ON EDGE COMPUTING 3 0 0 3

Course Objectives

- Understanding of the fundamental concepts, principles, and techniques of Artificial Intelligence, including its history, subfields, and applications.
- Reduce network latency and improve response times by processing data and running computations closer to the source or at the network edge.
- Address data privacy and security concerns by keeping sensitive data and computations localized at the edge devices or edge nodes.

Programme Outcomes (POs)

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.
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.

Course Outcomes (COs)

1. Enable the application of machine learning and deep learning approaches to real-world problems.
2. Explore the software services, standard bodies and open source communities available for edge computing.
3. Design and optimize edge device architectures, enabling efficient and resource-constrained processing for AI applications at the edge
4. Build an intelligent data driven applications by applying the edge data processing and analytics techniques to enable the easier decision making process.
5. Deploying AI models on edge devices, ensuring efficient inference, optimization, and integration to enable AI capabilities directly at the edge.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2								2		
2	2	2	3	3								2		
3	2	2	3	3								2		
4	2	3	3	3								2		
5	2	3	3	3								2		

UNIT I **9 Hours**

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Introduction to Artificial Intelligence and its subfields - Machine Learning algorithms and techniques - Supervised Learning - Unsupervised Learning - Reinforcement Learning - Deep Learning models and architectures

UNIT II **9 Hours**

INTRODUCTION TO EDGE COMPUTING

Overview of Edge Computing and its significance in AI applications - Edge devices and infrastructure -Challenges and opportunities in AI on Edge Computing

UNIT III **9 Hours**

EDGE DEVICE ARCHITECTURES

Edge devices and hardware platforms for AI - Accelerators and GPUs for Edge Computing - Edge computing frameworks and software tools

UNIT IV **9 Hours**

EDGE DATA PROCESSING AND ANALYTICS

Data preprocessing and feature extraction at the Edge - Real-time analytics and decision-making at the Edge - Edge-based data storage and retrieval

UNIT V **9 Hours**

AI MODEL DEPLOYMENT ON EDGE DEVICES

Model compression and optimization for resource-constrained Edge devices - On-device training and transfer learning - Model deployment and inference techniques on Edge devices

Total: 45 Hours

Text Book(s)

1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Nils J Nilsson, Principles of Artificial Intelligence, Illustrated Reprint Edition, Springer Heidelberg, 2014.
3. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), Wiley, 2019
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, by Pethuru Raj and Anupama C. Raman (CRC Press)

Reference(s)

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, PHI 2009.
2. Edge Computing for Internet of Things: From Device to Cloud-Based Services" by Hassan Fouad and Ammar Rayes.

21IT033 NATURAL LANGUAGE PROCESSING **3 0 0 3**

Course Objectives

- * To learn the fundamentals of natural language processing
- * To understand the use of CFG and PCFG in NLP
- * To understand the role of semantics of sentences and pragmatics
- * To apply the NLP techniques to IR applications

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. 1. To understand the basic Language features
2. 2. To design an innovative application using NLP components
3. 3. To apply a rule based system to tackle morphology/syntax of a language
4. 4. To design a tag set to be used for statistical processing for real-time applications
5. 5. To compare and contrast the use of different statistical approaches for different types of NLP applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1										1	
2	2	2	2										1	
3	2	2	3										1	
4	2	2	3										1	
5	2	1	2										1	

UNIT I **9 Hours**

INTRODUCTION

Origins and challenges of NLP-Language Modeling: Grammar-based LM-Statistical LM - Regular Expressions, Finite-State Automata-English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II **9 Hours**

WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff-Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging-Hidden Markov and Maximum Entropy models, Vector Based models

UNIT III **9 Hours**

SYNTACTIC ANALYSIS

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar-Dependency Grammar-Syntactic Parsing, Ambiguity, Dynamic Programming parsing-Shallow parsing-Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs-Feature structures, Unification of feature structures

UNIT IV **10 Hours**

SEMANTICS AND PRAGMATICS

Requirements for representation, First-Order Logic, Description Logics-Syntax-Driven Semantic analysis, Semantic attachments-Word Senses, Relations between Senses, Thematic Roles, selectional restrictions-Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods-Word Similarity using Thesaurus and Distributional methods

UNIT V **8 Hours**

DISCOURSE ANALYSIS AND LEXICAL RESOURCES

Discourse segmentation, Coherence-Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm-Coreference Resolution-Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brills Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus.

Total: 45 Hours

Reference(s)

1. 1.Daniel Jurafsky, James H. Martin-Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 3rd edition 2023.
2. 2.Breck Baldwin,Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
3. 3.Richard M Reese,Natural Language Processing with Java, OReilly Media, 2015
4. 4.Nitin Indurkhya and Fred J. Damerau,Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010

21IT033 IOT ANALYTICS **3 0 0 3**

Course Objectives

- * Understand the challenges of IoT analytics systems development and deployment
- * To learn about data analytics and use cloud offerings related to IoT.
- * Ability to understand the Searching and security requirements of IoT.
- * Acquire the knowledge of Tools, Platform and Services for IoT Analytics
- * To Develop IoT infrastructure for real time scenarios.

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. 1. Identify the networking protocols for connecting devices and challenges of IoT Analytics
2. 2. Understand the cloud based IoT and IoT in Data Analytics
3. 3. Explain the concepts of Security requirements and Searching the IoT
4. 4. Apply the different tools and services for the IoT Analytics platform
5. 5. Analyze applications of IoT Analytics in a real time scenario

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	3				2	2			2	
2	2	1	3	2	3				2	2			2	
3	2	2	2	3	3				2	2			2	
4	3	2	3	3	3				2	2			3	
5	3	3	3	3	3				2	3			3	

UNIT I **8 Hours**

INTRODUCTION TO IOT ANALYTICS

Introduction-IoT Data and Big Data - Challenges of IoT Analytics - Applications - IoT Devices and Networking Protocols

UNIT II **9 Hours**

IOT CLOUD, WEB SERVICES AND DATA ANALYTICS

IoT Hardware devices and its limitation - Cloud based IoT Platform - Iaas, Paas and Saas paradigms - Requirements of IoT in Big Data Analytics Platform - Functional Architecture - Data Collection Using Low-power, Long-range Radios - Web server: Web server for IoT applications

UNIT III **10 Hours**

SEARCHING THE INTERNET THINGS AND IOT SECURITY

Introduction - A search architecture for social and physical sensors - Local Event Retrieval - Sensor Metadata - Venue Recommendation - Security Requirements in IoT - Security Concerns in IoT Applications - Security Architecture in the Internet of Things - Insufficient Authentication Authorization - Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT

UNIT IV **9 Hours**

TOOLS AND SERVICE FOR IOT ANALYTICS

Architecture for IoT Analytics Applications - Nodes - Development Examples - Open source framework for IoT Analytics as a service - Sensing as a service Infrastructure Tools and Platforms

UNIT V **9 Hours**

IOT ANALYTICS APPLICATIONS AND CASE STUDIES

Data Analytics and smart Building - Smart City - Data collection to deployment and operationalization using the vital platform - Transportation - Energy - Agriculture - Healthcare

Total: 45 Hours

Text Book(s)

1. Andrew Minteer, Analytics for the Internet of Things: Intelligent analytics for your intelligent devices, Packt Publishing, first edition, July 2017

Reference(s)

1. 1. John Soldatos, Building Blocks for IoT Analytics, River Publishers Series In Signal, Image and Speech Processing, 2017
2. 2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
3. 3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014
4. 4. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things Key applications and Protocols, Wiley, 2012
5. 5. Practical Internet of Things Security by Brian Russell, Drew Van,2018

21IT034 AUTONOMOUS SYSTEMS USING BLOCKCHAIN TECHNOLOGIES

2 0 2 3

Course Objectives

- * To understand the basics of Blockchain Technology
- * To learn Different protocols and consensus algorithms in Blockchain
- * To learn the Blockchain implementation frameworks
- * To experiment the Hyperledger Fabric, Ethereum networks
- * To understand the Blockchain Applications

Programme Outcomes (POs)

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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. 1.Understand emerging abstract models for Blockchain Technology
2. 2.Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain
3. 3.Develop conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable
4. 4.Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application
5. 5.Analyze the real life applications of Blockchain Technologies

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	2	1								1	
2	3	3	3	1	2								2	
3	2	2	1	1										
4		2	2		3								2	
5	1	2	3	1	2								1	

UNIT I **7 Hours**

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions - The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic-Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II **6 Hours**

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH-the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

UNIT III **6 Hours**

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

UNIT IV **5 Hours**

HYPERLEDGER FABRIC

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

UNIT V **6 Hours**

BLOCKCHAIN APPLICATIONS

Smart contracts, Truffle Design and issue- DApps-NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance, etc - Case Study.

1 **5 Hours**

EXPERIMENT 1

Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.

2 **5 Hours**

EXPERIMENT 2

Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.

3 **5 Hours**

EXPERIMENT 3

Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules

4 **5 Hours**

EXPERIMENT 4

Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network

5 **5 Hours**

EXPERIMENT 5

Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6 **5 Hours**

EXPERIMENT 6

Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

Total: 60 Hours

Text Book(s)

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O Reilly, 2014

Reference(s)

1. 1. Daniel Drescher,Blockchain Basics, First Edition, Apress, 2017
2. 2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. 3. Melanie Swan,Blockchain: Blueprint for a New Economy, O Reilly, 2015
4. 4.Ritesh Modi, Solidity Programming Essentials: A Beginners Guide to Build Smart Contracts for Ethereum and Blockchain, Packt Publishing

21IT035 XML AND WEB SERVICES **3 0 0 3**

Course Objectives

- * Understand the proficiency in creating, manipulating, and validating XML documents, including understanding XML syntax, structure, and key concepts and use XML technologies such as XML Schema, XPath, and XSLT
- * Understanding of web services and their role in distributed systems. Explore SOAP and REST architectures, understand their differences
- * Acquire practical skills in implementing XML-based web services using industry-standard technologies like SOAP and WSDL

Programme Outcomes (POs)

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.
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.
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.

Course Outcomes (COs)

1. 1. Infer XML technologies including XML Schema, XPath, and XSLT, enabling effective data transformation and manipulation in XML-based systems
2. 2. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST, ensuring interoperability and efficient communication between distributed systems
3. 3. Design scalable and secure web service architectures using industry-standard protocols like SOAP and REST, ensuring interoperability and efficient communication between distributed systems.
4. 4. Design and implement XML-based solutions for electronic data interchange (EDI), data validation, and interoperability, ensuring compliance with industry standards and optimizing e-business processes
5. 5. Design and implement XML-based content management solutions, including content modeling, metadata management, and content transformation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3					2	2	1		1		
2	2	2	3					2	2	1		2		
3	2	3	3					2	2	2		2		
4	2	3	3					2	2	2		3		
5	2	3	3					2	2	2		3		

UNIT I **9 Hours**

XML TECHNOLOGY FAMILY

XML - benefits - Advantages of XML over HTML - EDL -Databases - XML based standards - DTD -XML Schemas - X-Files - XML processing - DOM -SAXpresentation technologies - XSL - XFORMS - XHTML - voice XML - Transformation - XSLT - XLINK - XPATH -XQ

UNIT II **9 Hours**

ARCHITECTING WEB SERVICES

Business motivations for web services - B2B - B2C- Technical motivations - limitations of CORBA and DCOM - Service - oriented Architecture (SOA) - Architecting web services - Implementation view - web services technology stack - logical view - composition of web services - deployment view - from application server to peer to peer - process view - life in the runtime

UNIT III **9 Hours**

WEB SERVICES BUILDING BLOCK

Transport protocols for web services - messaging with web services - protocols - SOAP - describing web services - WSDL - Anatomy of WSDL - manipulating WSDL - web service policy - Discovering web services - UDDI - Anatomy of UDDI-Web service inspection - Ad-Hoc Discovery - Securing web services.

UNIT IV **9 Hours**

IMPLEMENTING XML IN E-BUSINESS

B2B - B2C Applications - Different types of B2B interaction - Components of ebusiness XML systems - ebXML - Rosetta Net Applied XML in vertical industry - Web services for mobile devices

UNIT V **9 Hours**

XML AND CONTENT MANAGEMENT

Semantic Web - Role of Meta data in web content - Resource Description Framework - RDF schema - Architecture of semantic web - content management workflow - XLANG -WSFL

Total: 45 Hours

Text Book(s)

1. Ron schmelzer et al, XML and Web Services, Pearson Education, 2002
2. Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architects Guide, Prentice Hall, 2004.

Reference(s)

1. 1. Frank P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2002
2. 2. Keith Ballinger,NET Web Services Architecture and Implementation, Pearson Education, 2003.
3. 3. Henry Bequet and MeerajKunnumpurath, Beginning Java Web Services, Apress, 2004.
4. 4. Russ Basiura and Mike Batongbacal, Professional ASP.NET Web Services, Apress,2. ASP .NET Web Services, Apress, 2003.

21IT036 MINING AND SOCIAL MEDIA WEB ANALYTICS 3 0 0 3

Course Objectives

- To understand the foundations of Social Media and Web Analytics.
- To visualize and understand the data mining aspects in social networks.
- To solve mining problems by different algorithms.
- To understand network measures for social data.
- To understand behavioral part of web applications for Analysis.

Programme Outcomes (POs)

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.
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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Understand social media, web and social media analytics and their potential impact.
2. Understand the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Apply Behavior Analytics techniques to applications that leverage social media data, such as Facebook and Twitter.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1		2			2				1	3	2
2	2	2	3		2			2				1	1	2
3	2	2	3		2			1				1	2	3
4	2	2	3		2			1				1	1	2
5	2	2	3		2			2				1	2	2

UNIT I **10 Hours**

ANALYTICS IN SOCIAL MEDIA AND WEB ANALYTICS TOOLS

Social Media Analytics: The foundation for analytics, Social media data sources, Defining social media data, data sources in social media channels, Estimated Data sources and Factual Data Sources, Public and Private data, data gathering in social

media analytics.
Web Analytics: Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT II **9 Hours**

VISUALIZING SOCIAL NETWORKS

Introduction, A Taxonomy of Visualization, The convergence of Visualization, Interaction and Analytics. Data mining in Social Media: Introduction, Motivations for Data mining in Social Media, Data mining methods for Social Media, Related Efforts.

UNIT III **9 Hours**

TEXT MINING IN SOCIAL NETWORKS

Introduction, Keyword search, Classification Algorithms, Clustering Algorithms-Greedy Clustering, Hierarchical clustering, k-means clustering, Transfer Learning in heterogeneous Networks, Sampling of online social networks, Comparison of different algorithms used for mining, tools for text mining.

UNIT IV **8 Hours**

NETWORK MEASURES

Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Betweenness Centrality, Closeness Centrality, Group Centrality, Transitivity and Reciprocity, Balance and Status, Similarity: Structural Equivalence, Regular Equivalence.

UNIT V **9 Hours**

BEHAVIOR ANALYTICS

Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction.

Case Study: Mining Twitter: Overview, Exploring Twitters API, Analyzing 140 Characters; Mining Facebook: Overview, Exploring Facebooks Social Graph APIs, Analyzing Social Graph Connections.

Total: 45 Hours

Reference(s)

1. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 9th Edition, 2019.
2. Matthew A. Russell, Mining the Social Web, O"Reilly, 3rd Edition, ISBN:10:1449367615, 2019.
3. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
4. Eric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004.
5. Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, ISBN: 10: 1107018854.
6. Charu C. Aggarwal, Social Network Data Analytics, Springer, ISBN: 978-1-4419-8461-6.

21IT037 OPERATION AND SUPPLY CHAIN ANALYTICS 3 0 0 3

Course Objectives

- Evaluate the effectiveness of different supply chain analytics techniques in optimizing supply chain operations.
- Synthesize data from multiple sources to develop comprehensive supply chain optimization strategies.
- Create and implement solutions to complex supply chain problems using advanced analytics techniques.

Programme Outcomes (POs)

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.
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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.
n. Identify and analyze large and heterogeneous data by applying suitable machine and deep learning algorithms and analytical tools to enable information retrieval and decision making in scientific and business applications.

Course Outcomes (COs)

1. Apply the fundamental concepts of operation in supply chain analytics.
2. Analyze supply chain data and identify opportunities for improvement.
3. Use various tools and techniques for supply chain analytics.
4. Develop strategies for optimizing supply chain operations.
5. Analyze Understand the impact of analytics on supply chain management.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	2			1	1			1	1	1
2	3	3	3	3	3			1	1				1	1
3	2	2	2	3	3			1	1			1		1
4	2	2	2	2	2			1	1			1		1
5	2	2	2	2	2			1	1					1

UNIT I **9 Hours**

INTRODUCTION TO OPERATION AND SUPPLY CHAIN ANALYTICS

Introduction to Supply chain management - Overview of operation and supply chain analytics - Importance of data-driven decision-making in supply chain management - Key performance indicators (KPIs) in supply chain management.

UNIT II **9 Hours**

DATA ANALYSIS FOR SUPPLY CHAIN MANAGEMENT

Data collection and analysis techniques - Data visualization and reporting - Statistical analysis for supply chain management.

UNIT III **9 Hours**

FORECASTING AND DEMAND PLANNING

Forecasting techniques for supply chain management - Demand planning and management - Sales and operations planning (S&OP).

UNIT IV **10 Hours**

INVENTORY MANAGEMENT AND OPTIMIZATION

Inventory management techniques - Safety stock and lead time optimization - Economic order quantity (EOQ) and reorder point (ROP) analysis.

UNIT V **8 Hours**

LOGISTICS AND TRANSPORTATION ANALYTICS

Transportation network optimization - Route optimization and scheduling - Warehouse and distribution center optimization

Total: 45 Hours

Reference(s)

1. "Supply Chain Analytics: Quantitative Methods for Decision Making" by Nada R. Sanders.
2. "Operations and Supply Chain Management" by F. Robert Jacobs and Richard B. Chase.
3. "Data Analytics for Supply Chain Management: Research and Applications" by Xi Chen, Hui Yang, and Lei Yu.
4. "Supply Chain Management: Strategy, Planning, and Operation" by Sunil Chopra and Peter Meindl.
5. "Business Analytics: Data Analysis and Decision Making" by Christian Albright and Wayne Winston.

21IT038 SOCIAL NETWORK SECURITY 3 0 0 3

Course Objectives

- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To know the applications in real time systems.

Programme Outcomes (POs)

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.
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.

Course Outcomes (COs)

1. Work on the internals components of the social network.
2. Model and visualize the social network.
3. Mine the behaviour of the users in the social network.
4. Predict the possible next outcome of the social network.
5. Apply social network in real time applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3									
2	1	2	2		3									
3	1		2		3									
4	1	1	2		3									
5	1	2	2		3									

UNIT I **9 Hours**

FUNDAMENTALS OF SOCIAL NETWORKING

Introduction to Semantic Web - Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Historical overview of privacy and security - Major paradigms for understanding privacy and security.

UNIT II **9 Hours**

MODELING AND VISUALIZATION

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data - Random Walks and their Applications - Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III **9 Hours**

EXTRACTION AND MINING IN SOCIAL NETWORKING DATA

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Big data and Privacy.

UNIT IV **9 Hours**

EVOLUTION

Evolution in Social Networks - Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation - Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V **9 Hours**

ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT

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

Total: 45 Hours

Text Book(s)

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.

Reference(s)

1. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
2. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, - Computational Social Network Analysis: Trends, Tools and Research Advance, Springer, 2012.
3. Borko Furht, - Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011
4. Charu C. Aggarwal, - Social Network Data Analytics, Springer; 2014
5. Giles, Mark Smith, John Yen, - Advances in Social Network Mining and Analysis, Springer, 2010.

21IT039 HUMAN COMPUTER INTERACATION **3 0 0 3**

Course Objectives

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn the model and theories of human computer interaction.
- To be aware of mobile computer systems and its applications.
- To learn the guidelines for designing web user interfaces.

Programme Outcomes (POs)

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.
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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Collect fundamental design and evaluation methodologies of computer.
2. Design effective HCI for individuals and persons with disabilities.
3. Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.
4. Design mobile application framework using HCI tools
5. Develop a web interface using various tools.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	2				2	2			2	
2	1	2	2	2	2				2	2			2	
3	1	2	2	3					3	3			2	
4	2	2	3	2	3				2	2			2	
5	2	2	1	2	3				2	2			2	

UNIT I **9 Hours**

FOUNDATIONS OF HCI

The Human: I/O channels - Memory - Reasoning and problem solving; The Computer: Devices - Memory - processing and networks; Interaction: Models - frameworks - Ergonomics - styles - elements - interactivity- Paradigms. - Case Studies.

UNIT II **9 Hours**

DESIGN

Interactive Design: Basics - process - scenarios - navigation - screen design - Iteration and prototyping. HCI in software process: Software life cycle - usability engineering - Prototyping in practice - design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques - Universal Design.

UNIT III **9 Hours**

MODELS AND THEORIES

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements - Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV **9 Hours**

MOBILE HCI

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games-Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V **9 Hours**

WEB INTERFACE DESIGN

Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Total: 45 Hours

Reference(s)

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Brian Fling, -Mobile Design and Development, First Edition, OReilly Media Inc., 2009.
3. Bill Scott and Theresa Neil, -Designing Web Interfaces, First Edition, OReilly, 2009.

21IT040 E-COMMERCE 3 0 0 3

Course Objectives

- Learn the Various e-commerce business models.
- Understand how companies use e-commerce to gain competitive advantages.
- Familiarize with the planning and execution of e-commerce projects.

Programme Outcomes (POs)

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones 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.
m. Design and develop cost effective, secure, reliable IT, network and web based solutions with professional expertise in the domains including banking and healthcare and communications.

Course Outcomes (COs)

1. Develop an understanding of the foundations, importance and applications of E-commerce
2. Understand various electronic payment types and the ways to protect against them.
3. Develop innovative new mobile commerce technologies and systems to improve the consumer experience
4. Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
5. Discuss legal issues and privacy in M-Commerce.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2			2					2	2	1	
2	2		2			2					2	2	2	
3	1		3			2					3	3	3	
4	2		2			2					2	2	2	
5	2		2			2					2	2	2	

UNIT I **9 Hours**

ELECTRONIC COMMERCE

Frame work, anatomy of ECommerce applications, ECommerce Consumer applications, ECommerce organization applications.

UNIT II **9 Hours**

CONSUMER ORIENTED ELECTRONIC COMMERCE

Mercantile Process models, Electronic payment systems: Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT III **9 Hours**

E-COMMERCE APPLICATIONS DEVELOPMENT

The Changing Face of Application Development, Enterprise Development Needs, Enhanced Web Server, Based ECommerce Site Business Objectives, Categories of Business Value, Assessing a Site"s Current Business Value, Improving Business Value, Managed Solutions.

UNIT IV **9 Hours**

MOBILE ELECTRONIC COMMERCE

Wireless Industry Standards, Wireless Communication Platforms for LANs, Wireless WANs, Facilitators of a Wireless Environment, Concerns for the Mobile Enterprise.

UNIT V **9 Hours**

MOBILE COMMERCE: TECHNOLOGY

A Framework For The Study Of Mobile Commerce, NTT Docomos IMode, Wireless Devices For Mobile Commerce, Towards A Classification Framework For Mobile Location Based Services, Wireless Personal And Local Area Networks, The Impact Of Technology Advances On Strategy Formulation In Mobile Communications Networks.

FOR FURTHER READING

Security Issues in ECommerce, Social media and Online Retailing, Interaction Design for ECommerce Websites.

Total: 45 Hours

Reference(s)

1. Kenneth C.Laudon, Carol Guercio Traver ECommerce 2021:Business, Technology, and society, Pearson, 16th Edition, 2021.
2. Mobile Commerce: Framework, Development, and Strategies edited by Paul S. Minhas and Zahir Irani,2019
3. Mobile Commerce: Technology, Theory and Applications by Hannu Verkasalo,3rd Edition, 2019
4. Ravi Kalakota, Andrew B Whinston, Frontiers of Electronic Commerce, Pearson, 2017
5. Gary P Schneider ,E-commerce: Strategy, Technology and Implementation, eleventh edition, Cengage Learning, 2011.

18HSH01 HINDI 1 0 2 2

Course Objectives

- To help students acquire the basics of Hindi
- To teach them how to converse in Hindi on simple day-to-day situations
- To help students acquire the ability to understand a simple technical text in Hindi

Course Outcomes (COs)

1. Construct simple sentences and use vocabulary required for day-to-day conversation.
2. Distinguish and understand the basic sounds of Hindi language.
3. Appear for Hindi examinations conducted by Dakshin Bharat Hindi Prachar Sabha.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										2				
2										2				
3										2				

UNIT I **9 Hours**

Hindi Alphabet: Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu & Visarg -Table of Alphabet -Vocabulary.

UNIT II **9 Hours**

Nouns: Genders (Masculine & Feminine Nouns long vowels and short vowels - -Masculine & Feminine - Reading Exercises.

UNIT III **9 Hours**

Pronouns and Tenses: Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

UNIT IV **9 Hours**

Classified Vocabulary: Parts of body - Relatives - Spices - Eatables - Fruit & Vegetables - Clothes - Directions - Seasons - Professions.

UNIT V **9 Hours**

Speaking: Model Sentences and Rhymes - Speaking practice for various occasions.

Total: 45 Hours

Reference(s)

1. Hindi Prachar Vahini-1 by Dakshin Bharat Hindi Prachar Sabha Chennai
2. B.R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People,Vee Kumar Publications(P)Ltd., New Delhi,2009
3. Videos, Stories, Rhymes and Songs

18HSG01 GERMAN **1 0 2 2**

Course Objectives

- To help students appear for the A1 level Examination
- To teach them how to converse fluently in German in day-to-day scenarios

Course Outcomes (COs)

1. listen and identify individual sounds of German
2. use basic sounds and words while speaking
3. read and understand short passages on familiar topics
4. use basic sentence structures while writing
5. understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										2				
2										2				
3										3				
4										2				
5										3				

UNIT I **9 Hours**

Introduction to German language: Alphabet - Numbers - Greetings - Days and Seasons- Working with Dictionary.

UNIT II **9 Hours**

Nouns - articles - Speaking about one self - Listening to CD supplied with the books, paying special attention to pronunciation

UNIT III **9 Hours**

Regular & Irregular verbs - Personal pronouns - family - Introduction to types of sentences

UNIT IV **9 Hours**

Question words-Types of Questions - Nominative case- Verb Conjugation - country - nationalities

UNIT V **9 Hours**

Verbs - to be & to have - conjugation - Hobbys - Framing basic Questions and answers

Total: 45 Hours

Reference(s)

1. Kursbuch and Arbeitsbuch, NETZWERK A1 DEUTSCH ALS FREMDSPRACHE, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2015

2. Langenscheidt Eurodictionary - German - English / English - German, Goyal Publishers & Distributers Pvt. Ltd., New Delhi, 2009
3. Grundkurs, DEUTSCH Lehrbuch Hueber Munichen, 2007.

18HSJ01 JAPANESE 1 0 2 2

Course Objectives

- To train students for N5 Level Examination
- To teach them use basic Japanese sentences in day-to-day conversation
- To make students familiar with the Japanese cultural facets and social etiquettes

Course Outcomes (COs)

1. Recognise and write Japanese alphabet
2. Speak using basic sounds of the Japanese language
3. Apply appropriate vocabulary needed for simple conversation in Japanese language
4. Apply appropriate grammar to write and speak in Japanese language
5. Comprehend the conversation and give correct meaning

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										2				
2										2				
3										3				
4										2				
5										3				

UNIT I **9 Hours**

Introduction to Japanese - Japanese script- Pronunciation of Japanese(Hiragana)- (Katakana) Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. N1 wa N2 desu - N1 wa N2 ja arimasen - S ka N1 mo - N1 no N2 - san - Kore - Sore - Are - Kono N - Sono N - Ano N - Sou desu - Sou ja Arimasen - S1 ka - S2 ka - N1 no N2 - Sou desu ka - Koko - Soko - Asoko - Kochira - Sochira Achira - N1 wa N2 (place) desu - Doko - Dochira - N1 no N2 - Ko - So - A - Do (Demonstrative words) - O kuni Kanji10 - Technical Japanese Vocabulary (30 Numbers)

UNIT II **9 Hours**

Introduction to time - Ji - Fun - Pun - Introduction of verbs - V Masu - V Masen - V Mashita - V Masendeshita N (Time) Ni V - N1 Kara - N2 Made - N1 to N2 - S Ne - N (Place) e Ikimasu - Kimasu - Kaerimasu - Doko (e) Mo Ikimasen - Ikimasendeshita - N (Vechile) de Ikimasu - Kimasu - Kaerimasu - N (Person / Animal) to V - Itsu - S Yo N o (transitive) - N o Shimasu - Nani o Shimasuka - Nan and Nani - N (place) de V - V Masenka - V Mashou - o - Kanji 10 - Technical Japanese Vocabulary (30 Numbers) .

UNIT III **9 Hours**

N (tool/means) de V - Word/Sentence wa Go de Nani desu ka - N (person) Ni Agemasu, etc - N (person) Ni Moraimasu etc - Mou V Mashita - Introduction to Adjectives - N wa Na adj (Na) desu - N wa II adj (II) desu - Na adj Na n - II adj (II) N - Totemo - Amari - N wa Dou desuka - N1 wa Donna N2 desuka - S1 Ga S2 - Dore N ga Arimasu - Wakarimasu - N Ga Sukidesu - Kiraidesu - Jozu desu - Heta desu -

Donna N - Yoku - Daitai - Takusan - Sukoshi - Amari - Zenzen - S1 kara S2 - Doushite - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

UNIT IV **9 Hours**

N ga Arimasu - Imasu - N1 (place) Ni N2 ga Arimasu - Imasu - N1 (thing/person/place) no N2 (position) - N1 ya N2 - Word (s) desuka - Chirisosu wa Arimasuka - Saying numbers - Quantifier (period) Ni kai V - Quantifier Dake - N dake - Past tense of Noun sentences and Na adjective sentences - Past tense of ii adjective sentences - N1 wa N2 yori adjective desu - N1 to N2 to dochira ga adjective desu ka - N1/N2 no houga adjective desu - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

UNIT V **9 Hours**

N ga hoshi desu - V masu form tai desu - N (place) e V masu form - N Ni - ikimasu - kimasu - kaerimasu N ni V - N o V - dou ko ka - nani ka - go chuu mon - Verb conjugation - Verb groups - Verb te form - V te form kudasai - V te form imasu - V masu from mashouka - S1 ga S2 - N ga V - V te form mo ii desu - V te form wa ikemasen - V te form imasu Shrimasen - Kanji 10 - Technical Japanese Vocabulary (30 Numbers)

Total: 45 Hours

Reference(s)

1. Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

18HSF01 FRENCH 1 0 2 2

Course Objectives

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

Course Outcomes (COs)

1. To help students acquire familiarity in the French alphabet & basic vocabulary
2. listen and identify individual sounds of French
3. Use basic sounds and words while speaking
4. Read and understand short passages on familiar topics
5. Understand and use basic grammar and appropriate vocabulary in completing language tasks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										2				
2										2				
3										3				
4										2				
5										3				

UNIT I **9 Hours**

ENTRER EN CONTACT

La langue francaise, alphabets, les numeros, les jours, les mois. Grammaire Les verbes s"appeler,etre, avoir, les articles definis, indefinis Communication - Saluer, s"informer sur quelquun, demander de se presenter Lexique - Les alphabets, les nationalites, age, les pays, les couleurs, les jours de la semaine, les mois de l"annee, les professions

UNIT II **9 Hours**

PARTAGER SON LIEU DE VIE

Les francais et leur habitat, des habitations insolites Grammaire - Verbes - Conjugaison : Present (Avoir / etre / ER, IR, RE : Regulier et Irregulier) - Adjectifs les propositions de lieu Communication - Chercher un logement, d"ecrire son voisin, s"informer sur un logement Lexique - L"habitat, les pieces, l"equipement, la description physique

UNIT III **9 Hours**

VIVRE AU QUOTIDIEN

Grammaire - Articles contractes, verbes vouloir, pouvoir, devoir, adjective interrogative, future proche Communication- Exprimer ses gouts, parler de ses loisirs, justifier un choix, exprimer une envie

Lexique - le temps libre et les loisirs, les saisons, les activites quotidiennes, le temps (le matin, le soir, la nuit)

UNIT IV **9 Hours**

COMPRENDRE SON ENVIRONNEMENT OUVRIR LA CULTURE

Grammaire - Verbes - Finir, Sortir, les adjectifs demonstratifs, le passe compose, l''imparfait Communication - Propose aÃƒ?Ã‚Â quelqu""un de faire quelque chose, raconteur une sortie au passe parler un film Lexique - Les sorties, la famille, art, les vetements et les accessoires

UNIT V **9 Hours**

GOUTER A LA CAMPAGNE

Grammaire La forme negative, les verbes acheter, manger, payer, articles partitifs, le pronom en de quantite Communication Accepter et refuse rune invitation, donner des instructions, commander au restaurant Lexique Les services et les commerces, les aliments, les ustensiles, argent

Total: 45 Hours

Reference(s)

1. Saison A1, Methode de francais
2. Hachette FLE

18GE0P1 NANOMATERIALS SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on Nanoscience
- Explore different techniques of producing nanomaterials
- Create expertise on the applications of nanomaterials in various fields

Course Outcomes (COs)

1. Summarize the origin and advance of nanomaterials and its classification
2. Compare the different types of methods adopted for synthesizing nanomaterials
3. Analyze the characterization techniques for analyzing nanomaterials
4. Explain the physical properties exhibited by nanomaterials
5. Organize the nanomaterials developed for advanced technological applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I **9 Hours**

NANO SCALE MATERIALS

Introduction-Feynman's vision-national nanotechnology initiative (NNI) - past, present, future - classification of nanostructures, nanoscale architecture - effects of the nanometer length scale - changes to the system total energy, and the system structures- effect of nanoscale dimensions on various properties - differences between bulk and nanomaterials and their physical properties.

UNIT II **9 Hours**

NANOMATERIALS SYNTHESIS METHODS

Top down processes - mechanical milling, nanolithography and types based on radiations - Bottom up process physical method: physical vapour deposition, RF sputtering, CVD- chemical method: colloidal and sol-gel methods - template based growth of nanomaterials - ordering of nanosystems, self-assembly and self-organization.

UNIT III **9 Hours**

CHARACTERIZATION TECHNIQUES

General classification of characterization methods - analytical and imaging techniques - microscopy techniques - electron microscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy - diffraction techniques - X-ray spectroscopy - thermogravimetric analysis of nanomaterials.

UNIT IV **9 Hours**

SEMICONDUCTOR NANOSTRUCTURES

Quantum confinement in semiconductor nanostructures - quantum wells, quantum wires, quantum dots, super lattices-epitaxial growth of nanostructures-MBE, metal organic VPE, LPE - carbon nano tubes-structure, synthesis and electrical properties -applications- fuel cells - quantum efficiency of semiconductor nanomaterials

UNIT V **9 Hours**

NANOMACHINES AND NANODEVICES

Microelectromechanical systems (MEMS) and Nanoelectromechanical systems (NEMS)-fabrication, actuators-organic FET- principle, description, requirements, integrated circuits- organic LED: basic processes, carrier injection, excitons, optimization - organic photovoltaic cells- particulate and geometrical nanomagnets-magneto resistance.

Total: 45 Hours

Reference(s)

1. Willam A. Goddard, Donald W.Brenner, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, 2012
2. Charles P. Poole Jr and. Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2007
3. Guozhong Cao, Y. Wang, "Nanostructures and Nanomaterials-Synthesis, Properties & Applications", Imperials College Press, 2011.
4. T. Pradeep, "NANO: The Essentials Understanding Nanoscience and Nanotechnology", McGraw - Hill Education (India) Ltd, 2012
5. Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, "Nanoscale Science and Technology", John Wiley and Sons Ltd, 2006
6. Viswanathan B, Aulice Scibioh M, "Fuel cells: Principles and Applications", University Press, 2009.

18GE0P2 SEMICONDUCTOR PHYSICS AND DEVICES

3 0 0 3

Course Objectives

- Impart knowledge in physical properties of semiconducting materials
- Analyze the factors affecting the operation of semiconductor devices
- Apply the physics of semiconductors to develop semiconductor devices

Course Outcomes (COs)

1. Exemplify the band gap, drift and diffusion current densities due to carrier transport in semiconductors
2. Analyze the energy band diagram in thermal equilibrium and space charge width of PN junction
3. Illustrate the operation of Bipolar Junction transistor at different modes and different configurations
4. Illustrate the operation of metal oxide field effect transistor and their memory devices
5. Represent the working mechanism of opto-electronic devices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I **9 Hours**

ENERGY BANDS AND CARRIER TRANSPORT PROPERTIES

Energy Bands: Formation of energy bands - doping effects - energy levels - electron and hole concept in semiconductor. Carrier transport: Carrier drift-drift current density - conductivity- diffusion current density - total current density

UNIT II **9 Hours**

P-N JUNCTION

Basic structure and fabrication process of p-n junction - current - voltage characteristics - energy band diagram - equilibrium Fermi levels - depletion region - junction breakdown phenomena - zener - avalanche breakdown.

UNIT III **9 Hours**

BIPOLAR JUNCTION TRANSISTOR

The basic transistor action - operation in the active mode - current gain - static characteristics - carrier distribution in emitter, base and collector region - modes of operation - current - voltage characteristics of common base and emitter configuration - frequency response and switching of bipolar transistor

UNIT IV **9 Hours**

MOSFET

The ideal MOS diode - basic fundamentals and characteristics - types - CMOS and BiCMOS - CMOS inverter - MOSFET on insulator - thin film transistor (TFT) - silicon on insulators (SOI) devices - MOS Memory structures - DRAM and SRAM

UNIT V **9 Hours**

PHOTONIC DEVICES

Radiative transitions and optical absorption-light emitting diodes-organic LED - infrared LED - semiconductor laser - temperature effect - photo detector - photo diode - silicon and compound semiconductor solar cells - efficiency

Total: 45 Hours

Reference(s)

1. Donald A Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, 2012
2. S. M. Sze and M. K. Lee, "Semiconductor Devices, Physics and Technology", John-Wiley & Sons, 2015
3. Ben. G. Streetman and S. K. Banerjee , "Solid State Electronic Devices", Pearson Education Ltd, 2015
4. C. Kittel, "Introduction to Solid State Physics", John-Wiley & Sons, 2012
5. J. Millman and C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, 2010
6. Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006

18GE0P3 APPLIED LASER SCIENCE 3 0 0 3

Course Objectives

- Impart knowledge on laser science
- Explore different strategies for producing lasers
- Create expertise on the applications of lasers in various fields

Course Outcomes (COs)

1. Illustrate the transition mechanisms and the components of a laser system
2. Compare the different types of lasers based on pumping method, active medium and energy levels
3. Compute the rotation of earth, velocity and distance using lasers and apply the same for day today applications
4. Analyze the role of lasers in surgical and endoscopy applications
5. Apply the laser techniques in industrial applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I **9 Hours**

LASER FUNDAMENTALS

Introduction - principle - absorption and emission of light - thermal equilibrium - Einstein"s prediction - Einstein"s relations - A and B coefficients - condition for large stimulated emission - spontaneous and stimulated emission in optical region - light amplification - condition for light amplification - population inversion- Components of lasers - pumping methods - pumping mechanisms - optical resonator

UNIT II **9 Hours**

LASER BEAM CHARACTERISTICS AND TYPES

Characteristics of laser - Classification of lasers - principle, construction, working, energy level diagram and applications of molecular gas laser (CO2 laser) - liquid laser (dye laser) - excimer laser - Solid state laser (Nd:YAG laser) - semiconductor laser (homojunction laser).

UNIT III **9 Hours**

LASERS IN SCIENCE

Introduction - Harmonic generation (SHG) - Stimulated Raman emission - lasers in chemistry - laser in nuclear energy - lasers and gravitational waves - rotation of the earth - measurement of distance - Light detection And Ranging (LIDER) - velocity measurement - holography

UNIT IV **9 Hours**

LASERS IN MEDICINE AND SURGERY

Light induced biological hazards: Eye and skin - Eye laser surgery - photocoagulations - homeostasis - dentistry - laser angioplasty - different laser therapies - advantages & disadvantages - laser endoscopy.

UNIT V **9 Hours**

LASERS IN INDUSTRY

Applications in material processing: laser welding - hole drilling - laser cutting- Lasers in electronics industry: information storage - bar code scanner- Lasers in defence: laser based military weapons - laser walls.

Total: 45 Hours

Reference(s)

1. K. Thiyagarajan and A. K. Ghatak, "LASERS: Fundamentals and Applications", Springer, USA, 2015
2. M. N. Avadhanulu, "An Introduction to Lasers Theory and Applications", S. Chand Publisher, 2013
3. W. Koechner, M. Bass, "Solid State Lasers: a graduate text", Springer Verlag, New York, 2006
4. K. P. R. Nair, "Atoms, Molecules and Lasers", Narosa Publishing House, 2009
5. K. R. Nambiar, "Lasers: Principles Types and Applications", New Age International Publications, 2006
6. A. Sennaroglu, "Solid-State Lasers and Applications", CRC Press, 2006.

18GE0C1 CORROSION SCIENCE AND ENGINEERING

3 0 0 3

Course Objectives

- Understand the loss incurred due to corrosion in different sectors and terminologies related to corrosion
- Identify forms and types of corrosion with suitable mechanism
- Apply various methods of corrosion control, corrosion testing and monitoring

Course Outcomes (COs)

1. Explain if corrosion can occur under specific operating conditions in a given equipment or construction and indicate regions of immunity, corrosion and passivity of a metal
2. Compare different corrosion types on metals when exposed to air, water and at high temperatures (> 100 C)
3. Identify the corrosion mechanism on steel, iron, zinc and copper metal surfaces
4. Calculate the rate of corrosion on metals using electrochemical methods of testing
5. Propose the correct materials, design and operation conditions to reduce the likelihood of corrosion in new equipment and constructions

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2						1							
3	1	3												
4	2	2												
5	3	3					1							

UNIT I **9 Hours**

CORROSION

Importance of corrosion - spontaneity of corrosion - units of corrosion rate (mdd and mpy) - direct and indirect damage by corrosion - importance of corrosion prevention in industries - Pilling Bedworth ratio and its significance - passivation - area relationship in both active and passive states of metals - Pourbaix digrams of Mg, Al and Fe and their advantages and disadvantages

UNIT II **7 Hours**

TYPES OF CORROSION

Eight forms of corrosion: uniform, galvanic, crevice corrosion, pitting, intergranular corrosion, selective leaching, erosion corrosion and stress corrosion-Catastrophic oxidation corrosion

UNIT III **9 Hours**

MECHANISM OF CORROSION

Hydrogen embrittlement - corrosion fatigue - filiform corrosion - fretting damage and microbes induced corrosion. Corrosion mechanism on steel, iron, zinc and copper metal surfaces

UNIT IV **10 Hours**

CORROSION RATE AND ITS ESTIMATION

Rate of corrosion: Factors affecting corrosion. Electrochemical methods of polarization: Tafel extrapolation polarization and linear polarization. Weight loss method - testing for intergranular susceptibility and stress corrosion. Non destructive testing methods: Visual testing - liquid penetrant testing - magnetic particle testing and eddy current testing

UNIT V **10 Hours**

CORROSION CONTROL METHODS

Fundamentals of cathodic protection - types of cathodic protection(sacrificial anodic and impressed current cathodic protection). Stray current corrosion, problems and its prevention. Protective coatings: Metal coatings: Hot dipping (galvanizing, tinning and metal cladding) - natural inhibitors. Selection of suitable design for corrosion control

FOR FURTHER READING

Corrosion issues in supercritical water reactor (SCWR) systems

Total: 45 Hours

Reference(s)

1. Mouafak A. Zaher, "Introduction to Corrosion Engineering", CreateSpace Independent Publishing Platform, 2016.
2. E.McCafferty, "Introduction to Corrosion Science", Springer; 2010 Edition, January 2010.
3. R. Winstone Revie and Herbert H. Uhlig, "Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering", 4th Edition, John Wiley & Science, 2008.
4. Mars G. Fontana, "Corrosion Engineering", Tata McGraw Hill, Singapore, 2008
5. David E.J. Talbot (Author), James D.R. Talbot, "Corrosion Science and Technology", Second Edition (Materials Science & Technology), CRC Press; 2nd Edition, 2007.
6. http://corrosion-doctors.org/Corrosion-History/Eight.htm

18GE0C2 ENERGY STORING DEVICES 3 0 0 3

Course Objectives

- Understand the concept, working of different types of batteries and analyze batteries used in electric vehicles
- Identify the types of fuel cells and to relate the factors of energy and environment
- Analyze various energy storage devices and fuel cells

Course Outcomes (COs)

1. Explain the parameters required for operation of a cell to evaluate the capacity of energy storage devices
2. Identify the electrodes, electrolyte and cell reactions of different types of primary, secondary batteries and infer the selection criteria for commercial battery systems with respect to commercial applications
3. Differentiate fuel cells based on its construction, production of current and applications
4. Compare different methods of storing hydrogen fuel and its environmental applications
5. Relate energy and environmental based on the importance and types of renewable energy for sustainable development

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1												
2	2	3												
3	3	1												
4	2	2												
5	3	3												

UNIT I **6 Hours**

BASICS OF CELLS AND BATTERIES

Components - classification - operation of a cell - theoretical cell voltage - capacity - specific energy - energy density of lithium and lead acid battery - charge efficiency- charge rate - charge retention - closed circuit voltage, open circuit voltage current density - cycle life - discharge rate-over charge-over discharge

UNIT II **10 Hours**

BATTERIES FOR PORTABLE DEVICES AND ELECTRIC VEHICLES

Primary batteries - zinc-carbon, magnesium, and mercuric oxide - recycling/safe disposal of used cells. Secondary batteries - introduction, cell reactions, cell representations and applications - lead acid, nickel-cadmium and lithium ion batteries - rechargeable zinc alkaline battery. Reserve batteries: Zinc-silver oxide, lithium anode cell, photogalvanic cells. Battery specifications for cars and automobiles

UNIT III **10 Hours**

TYPES OF FUEL CELLS

Importance and classification of fuel cells - description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate and direct methanol fuel cells

UNIT IV **10 Hours**

HYDROGEN AS A FUEL

Sources and production of hydrogen - electrolysis - photocatalytic water splitting - methods of hydrogen storage- high pressurized gas - liquid hydrogen type - metal hydride - hydrogen as engine fuel - features, application of hydrogen technologies in the future - limitations

UNIT V **9 Hours**

ENERGY AND ENVIRONMENT

Future prospects of renewable energy and efficiency of renewable fuels - economy of hydrogen energy. Solar Cells: First, second, third and fourth generation solar cell - photobiochemical conversion cell

Total: 45 Hours

Reference(s)

1. M. Aulice Scibioh and B. Viswanathan, Fuel Cells: Principles and Applications, University Press, India, 2009
2. F. Barbir,PEM fuel cells: Theory and practice, Elsevier, Burlington, MA, Academic Press, 2013
3. M. R. Dell Ronald and A. J. David, Understanding Batteries, Royal Society of Chemistry, 2001
4. J. S. Newman and K. E. Thomas-Alyea, Electrochemical Systems, Wiley, Hoboken, NJ, 2012
5. Shripad T. Revankar, Pradip Majumdar, Fuel Cells: Principles, Design, and Analysis, CRC Press, 2016
6. Thomas B. Reddy, Linden's Handbook of Batteries, 4th Edition, McGraw Hill Professional, 2010

18GE0C3 POLYMER SCIENCE 3 0 0 3

Course Objectives

- Explain the properties of different polymers with its mechanism
- Select the appropriate polymerization techniques to synthesize the polymers and its processing
- Identify suitable polymers for various industrial applications

Course Outcomes (COs)

1. Illustrate the types of mechanism of polymerization reactions and analyze the natural and synthetic polymers
2. Identify the suitable polymerization techniques to synthesize the high quality polymers
3. Characterize the polymers to identify the structural, thermal ,mechanical and electrical features for specific applications
4. Apply the polymer processing methods to design polymer products
5. Identify and analyze the polymers used in electronic and biomedical applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	1	2												
3	2	2												
4	1	1	2											
5	1	3	2											

UNIT I **10 Hours**

POLYMERS AND ELASTOMERS

Classification of polymers - Mechanism: Addition polymerization - free radical, cationic, anionic and co-ordination (Ziegler-Natta) polymerization - copolymerization - condensation polymerization (nylon-6,6) - ring opening polymerization (nylon-6). Elastomers: Natural rubber and synthetic rubber: styrene - butadiene rubber (SBR), butyl, neoprene, thiocol rubbers. High performance polymers: polyethers, polyether ether ketone (PEEK), polysulphones and polyimides

UNIT II **8 Hours**

POLYMERIZATION TECHNIQUES

Homogeneous and heterogeneous polymerization - bulk polymerization (PMMA, PVC) - solution polymerization - polyacrylic acid, suspension polymerization (ion-exchange resins) - emulsion polymerization (SBR) - advantages and disadvantages of bulk and emulsion polymerization. Melt solution and interfacial poly-condensation

UNIT III **8 Hours**

CHARACTERIZATION AND TESTING

Characterization of polymers by Infrared Spectroscopy (IR) and Nuclear Magnetic Spectroscopy (NMR) - Thermal properties: TGA and DSC - Testing tensile strength - Izod impact - Compressive strength -

Rockwell hardness - Vicot softening point. Test for electrical resistance, dielectric constant, dissipation factor, arc resistance and dielectric strength - water absorption

UNIT IV **9 Hours**

POLYMER PROCESSING

Moulding: Compression - injection - extrusion and blow mouldings. Film casting - calendering. Thermoforming and vacuum formed polystyrene - foamed polyurethanes. Fibre spinning: melt, dry and wet spinning. Fibre reinforced plastics fabrication: hand-layup - filament winding and pultrusion

UNIT V **10 Hours**

SPECIALITY POLYMERS

Preparation and properties of heat resistant and flame retardant polymers. Polymers for electronic applications: liquid crystalline, conducting and photosensitive polymers. Polymer for biomedical applications: artificial organs, controlled drug delivery, hemodialysis and hemofiltration

FOR FURTHER READING

Biodegradable polymers

Total: 45 Hours

Reference(s)

1. V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International (P) Ltd., New Delhi, 2015
2. Joel R. Fried, "Polymer Science and Technology", Prentice Hall of India (P). Ltd., 2014
3. F. W. Billmeyer,"Text Book of Polymer Science", John Wiley & Sons, New York, 2007
4. Barbara H. Stuart, "Polymer Analysis", John Wiley & Sons, New York, 2008
5. George Odian , "Principles of Polymerization", John Wiley & Sons, New York, 2004
6. R. J. Young and P. A. Lovell, "Introduction to Polymers", CRC Press, New York, 2011

18IT001 GAME PROGRAMMING 3 0 0 3

Course Objectives

- Understand the concepts of game design and development.
- Learn the processes, mechanics and issues in game design.
- Be exposed to the core architectures of game programming.
- Know about game programming platforms, frame works and engines.
- Learn to develop games.

Course Outcomes (COs)

1. Discuss the concepts of game design and development.
2. Design the processes, and use mechanics for game development.
3. Explain the core architectures of game programming.
4. Use game programming platforms, frame works and engines.
5. Create interactive games.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		3											
2		1		3									1	
3		3												
4	2	2												
5			3		3									

UNIT I **9 Hours**

3D GRAPHICS FOR GAME PROGRAMMING

3D Transformations, Quaternions, 3D Modeling And Rendering, Ray Tracing,Shader Models,Lighting, Color, Texturing, Camera And Projections, Culling And Clipping, Character Animation,-Ã,Â Physics-Based Simulation, Scene Graphs.

UNIT II **9 Hours**

GAME ENGINE DESIGN

Game Engine Architecture, Engine Support Systems, Resources And File Systems, Game Loop And - Real Time Simulation, Human Interface Devices,Collision And Rigid Body Dynamics, Game Profiling.

UNIT III **9 Hours**

GAME PROGRAMMING

Application Layer, Game Logic, Game Views, Managing Memory, Controlling The Main Loop, Loading And Caching Game Data, User Interface Management, Game Event Management.

UNIT IV **9 Hours**

GAMING PLATFORMS AND FRAMEWORKS

2D And 3D Game Development Using Flash, DirectX, Java, Python, Game Engines-DX Studio,-Unity.

UNIT V **9 Hours**

GAME DEVELOPMENT

Developing 2D And 3D Interactive Games Using DirectX Or Python-Isometric And Tile Based Games,- Puzzle Games, Single Player Games, Multi Player Games.

FOR FUTHER READING

Clutter details, micro-interactions - Networking, substantial AI / decisions / states, or Procedurallygenerated content (PCG)

Total: 45 Hours

Reference(s)

1. Mike Mc Shaffrfy and David Graham,"Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-TimeÃƒ?Ã‚Â Computer Graphics" 2nd Editions, Morgan Kaufmann, 2006.
4. Ernest Adams and Andrew Rollings, "Fundamentals Of Game Design", 2nd Edition Prentice Hall /New Riders, 2009.
5. Eric Lengyel, "Mathematics for 3D Game Programming And Computer Graphics", 3rd Edition,Course Technology PTR, 2011.
6. Jesse Schell, "The Art of Game Design: A Book Of Lenses", 1st Edition, CRC Press, 2008

18IT002 MOBILE APPLICATION DEVELOPMENT 3 0 0 3

Course Objectives

- Design, write, debug, run Android App programs using Android SDK.
- Develop Mobile Apps using SQLite and Google APIs.
- Develop Mobile Apps to utilize the power of and notifications, sensors and events.

Course Outcomes (COs)

1. Design Mobile Apps using UI elements, menus and Fragments.
2. Apply CRUD operations on the data stored in SQLite.
3. Create event-driven Mobile Apps using sensors and event handling mechanisms
4. Develop Mobile Apps with Google Sign-In authentication
5. Develop Location and Places based Mobile Apps using Android SDK.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2		1		3									
2	1	2	2		3									
3	1		2		3									
4	1	1	2		3									
5	1	2	2		3									

UNIT I **9 Hours**

INTRODUCTION TO MOBILE APP DEVELOPMENT

Introduction to Mobile App Development - Android - IOS- Android Studio UI Elements - Activity Intent - Menus Containers - Layouts - Fragments - Permissions.

UNIT II **9 Hours**

ANDROID DATA STORAGE

Data storage - types of Data Storage - Shared Preferences Internal Storage - External Storage - cache Storage - SQLite - Firebase storage

UNIT III **9 Hours**

NOTIFICATIONS AND SENSORS

Notifications - Toast - Alerts - Dialog Builder - Sensor Registers - Reading value - Event Listeners - Handlers.

UNIT IV **9 Hours**

GOOGLE SIGNIN

Developer Console - API Key - Dependencies - Session Management - Revoke Access

UNIT V **9 Hours**

GOOGLE MAPS

Maps API key - Google Map UI - Map types - Getting Location - Places - Search View

Total: 45 Hours

Reference(s)

1. Dawn Griffiths and David Griffiths ,Head First Android Development, Second Edition , OReilly 2018
2. Bill Phillips, Chris Stewart and Kristin Marsicano, Android Programming, Third Edition, Big Nerd Ranch Guides, February 9, 2017.
3. John Horton,Android Programming for Beginners,Packt Publishing - ebooks Account ,December 31, 2015

18IT003 INTERNET SECURITY AND COMPUTER FORENSICS

3 0 0 3

Course Objectives

- Identify the legal, ethical and professional issues in Internet Security
- Summarize the aspects of risk management and various standards to control the Risk
- learn computer forensics
- become familiar with forensics tools
- To learn to analyze and validate forensics data

Course Outcomes (COs)

1. Illustrate the legal, ethical and professional issues in Internet security
2. Demonstrate the aspects of risk management
3. Identify the basics of computer forensics and Apply a number of different computer forensic tools to a given scenario
4. Analyze and validate forensics data and Identify the vulnerabilities in a given network infrastructure
5. Implement real-world Ethical hacking techniques to test system security

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1			1			3		3						
2			1			3		3						
3		1	1			3		3						
4		1	1			3		3						
5			1			3		3						

UNIT I **9 Hours**

SECURITY INVESTIGATION

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.

UNIT II **9 Hours**

SECURITY ANALYSIS

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNIT III **9 Hours**

INTRODUCTION TO COMPUTER FORENSICS

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Processing Crime and Incident Scenes - Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT IV **9 Hours**

ANALYSIS AND VALIDATION

Validating Forensics Data - Data Hiding Techniques - Performing Remote Acquisition - Network Forensics - Email Investigations - Cell Phone and Mobile Devices Forensics

UNIT V **9 Hours**

ETHICAL HACKING

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing

FURTHER READING

Hacking Web Applications - SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

Total: 45 Hours

Reference(s)

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.
3. John R.Vacca, Computer Forensics, Cengage Learning, 2005
4. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
5. AnkitFadia, Ethical Hacking Second Edition, Macmillan India Ltd, 2006
6. Kenneth C.Brancik, Insider Computer Fraud Auerbach Publications Taylor & Francis Group-2008.

18IT004 CRYPTOGRAPHY 3 0 0 3

Course Objectives

- Understand the fundamental principles of access control models and techniques, authentication and secure system design.
- Have a strong understanding of different cryptographic protocols and techniques and be able to use them.
- Apply methods for authentication, access control, intrusion detection and prevention

Course Outcomes (COs)

1. Illustrate the OSI Security Architecture and explain the various classical encryption techniques.
2. Deduce fundamental knowledge on the Concepts of Finite Fields and Number Theory.
3. Examine the general structure of block ciphers such as Data Encryption Standard(DES) and Advanced Encryption Standard (AES).
4. Outline the Principles Of Public Key Cryptosystems with emphasis on RSA and ECC Public Key Cryptosystems
5. Summarize the purpose of cryptographic hash functions, hash algorithms, MAC and digital signatures in maintaining data integrity and mutual trust.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	3										1	
2	1	2	1							2				
3	2	2	3		2									1
4	2	1	3											
5	2	1	3		2									

UNIT I **9 Hours**

INTRODUCTION

Computer Security-Introduction, key requirements, and challenges- OSI security architecture - Model of network security - Security attacks, services, and mechanisms - Classical encryption techniques: substitution techniques, transposition techniques and steganography

UNIT II **9 Hours**

NUMBER THEORY AND FINITE FIELDS

Divisibility and The Division algorithm- Euclidean algorithm- Modular arithmetic- Congruence and matrices - Algebraic structures - Groups, Rings, Fields- Finite fields- Primes - Primality Testing - Factorization - Euler's totient function, Fermat's, and Euler's Theorem - Chinese Remainder Theorem - Discrete Logarithm

UNIT III **9 Hours**

SYMMETRIC KEY CRYPTOGRAPHY

Block cipher -DES -Principles of DES - Strength of DES - Block cipher design principles -Double DES-Triple DES- Block cipher mode of operation- Advanced Encryption Standard -Structure-transformation functions and key expansion-Avalanche effect

UNIT IV **9 Hours**

PUBLIC KEY CRYPTOGRAPHY

Public-key cryptosystem-Applications of Public-key cryptosystem -The RSA algorithm-Security of RSA-Diffie-Hellman Key exchange-Elgamal cryptosystems-Elliptic Curve cryptography-Pseudorandom Number generation based on RSA and ECC.

UNIT V **9 Hours**

DATA INTEGRITY AND MUTUAL TRUST

Cryptographic Hash functions-Secure Hash Algorithm-Message Authentication Codes-Security of MAC-HMAC-Digital Signatures-Elgamal Digital Signature-Digital Signature Algorithm-User authentication-Kerberos-Remote User authentication

FOR FURTHER READING

Blockchain, Cryptocurrencies and BITCOIN

Total: 45 Hours

Reference(s)

1. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India/Pearson Education, New Delhi, 2017.
2. Behrouz A Foruzan, Cryptography and Network Security, Tata McGraw Hill 2008.
3. Bruce Schneier And Neils Ferguson, Practical Cryptography, First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
4. Douglas R Simson, Cryptography Theory And Practice, First Edition, CRC Press, 1995.
5. Joseph J. Bambara, Paul R. Allen, Kedar Iyer, Rene Madsen, Solomon Lederer, Michael Wuehler, Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Tata McGraw Hill 2018.

18IT005 PARALLEL PROGRAMMING USING OPENCL

3 0 0 3

Course Objectives

- Understand the fundamental principles and engineering trade-offs involved in designing modern parallel computers
- Develop programming skills to effectively implement parallel architecture
- Analyze complex problems with shared memory programming with openCL

Course Outcomes (COs)

1. Ability to comprehend parallel architecture and its importance in solving engineering problems
2. Analyze the type of cache design with respect to its access time
3. Design the future system and analyse the GPU with respect to different application
4. Implement the parallel computation algorithm in real word application to reduce the computation time
5. Design and implement parallel programs in modern environments such as OpenCL, etc.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2	3											
2		2	3											
3			3											1
4			3		2								1	
5			3		1									1

UNIT I **9 Hours**

INTRODUCTION TO PARALLEL COMPUTER

The need for parallelism, Forms of parallelism (SISD, SIMD, MISD, MIMD), Moore's Law and Multi-cores, Fundamentals of Parallel Computers, Communication architecture, Message passing architecture.

UNIT II **9 Hours**

CACHE DESIGN

Shared vs. Private Caches, Centralized vs. Distributed Shared Caches, Snooping-based cache coherence protocol, directory-based cache coherence protocol, Uniform Cache Access, Non-Uniform Cache Access.

UNIT III **9 Hours**

GRAPHICS PROCESSING UNIT

Architecture of a modern GPU, Evolution of Graphics Pipelines, GPGPUs, Scalable GPUs, Architectural characteristics of Future Systems, Implication of Technology and Architecture for users, Vector addition, Applications of GPU.

UNIT IV **9 Hours**

PARALLEL COMPUTATIONS

Low Level Image Processing, Mandelbrot Set, Monte Carlo Methods; Simple Data Partitioning: Sum of Numbers, Bucket Sort, Numerical Integartion, N-Body Problem; Divide-and-Conquer: Sum of Numbers, Merge Sort, Adaptive Quadrature, Barnes-Hut Algorithm; Pipelined Computations: Type 1, 2 and 3 Pipelines.

UNIT V **9 Hours**

PARALLEL PROGRAMMING LANGUAGES: OPENCL

Introduction to OpenCL- The OpenCL programming model- Host program and device kernel- OpenCL objects- Basic program: vector addition- Algorithms in OpenCL- Square matrix transpose-Square matrix multiplication - Parallel reduction algorithms-Sorting algorithms.

FOR FURTHER READING

Case studies: Image histogram in OpenCL, Sobel Edge Detection Filter, Parallelizing Dijkstra's Single-Source Shortest-Path Graph Algorithm

Total: 45 Hours

Reference(s)

1. D. E. Culler, J. P. Singh, and A. Gupta, Parallel Computer Architecture, MorganKaufmann, 2004
2. Rajeev Balasubramonian, Norman P. Jouppi, and Naveen Muralimanohar, Multi-Core Cache Hierarchies, Morgan & Claypool Publishers, 2011
3. Peter and Pach Eco, An Introduction to Parallel Programming, Elsevier, 2011
4. James R. Larus and Ravi Rajwar, Transactional Memory, Morgan & Claypool Publishers, 2007
5. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors: A Hands-on Approach, 2010
6. Barbara Chapman, F. Desprez, Gerhard R. Joubert, Alain Lichnewsky, Frans Peters Parallel Computing: From Multicores and GPU's to Petascale, 2010

18IT006 DATA COMPRESSION 3 0 0 3

Course Objectives

- Understand the important issues in data compression.
- Develop a reasonably sophisticated data compression application.
- Learn different types of compression techniques used for audio, image and video compression.

Course Outcomes (COs)

1. Understand the basic mathematical models used in data compression.
2. Implement the Lossless compression techniques to compress different raw data
3. Understand the conceptual basis for commonly used Lossy compression techniques
4. Apply various audio compression techniques over real world data
5. Analyze different types of image and video compression techniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	2	2	3											
3	1	2												
4	2	1	3	3	2									
5	1	2		2										

UNIT I **9 Hours**

INTRODUCTION

Mathematical Preliminaries, Lossy and Lossless compression, Application of compression-Huffman coding: Overview; The Huffman coding algorithm, Minimum variance Huffman codes; Application of Huffman coding for text compression

UNIT II **9 Hours**

LOSSLESS COMPRESSION

Dictionary Techniques: Overview; Introduction; Static dictionary; Adaptive dictionary; Applications: UNIX compress, GIF, PNG, V.42. Lossless image compression: Overview; Introduction; Basics; CALIC; JPEG- LS; Multiresoution approaches; Facsimile encoding: Run-length coding, T.4 and T.6

UNIT III **9 Hours**

BASICS OF LOSSY CODING

Some mathematical concepts: Introduction-Distortion criteria-Models. Scalar quantization: Overview-The quantization problem- Uniform quantizer- Adaptive quantization.

UNIT IV **9 Hours**

AUDIO COMPRESSION

High quality digital audio, frequency and temporal masking, lossy sound compression,mu-law and A-law,companding, and MP3 audio standard.

UNIT V **9 Hours**

IMAGE AND VIDEO COMPRESSION

PCM, DPCM JPEG, JPEG - LS , and JPEG 2000 standards- Intra frame coding, motion estimation and compensation, introduction to MPEG -2 H-264 encoder and decoder.

Total: 45 Hours

Reference(s)

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers, Third Edition
2. David Saloman,Data Compression: The complete reference, 3rd Edition,Springer publication
3. W.B.Pennebaker: JPEG still image compression standard, 1993

18IT007 TEXT MINING 3 0 0 3

Course Objectives

- Understand common text mining activities in contemporary organisations
- the complexities of collecting, integrating, processing and managing text data from a wide range of internal and external sources
- how various analytical techniques can be used to uncover the potential of text data to gain actionable insights and support marketing decisions

Course Outcomes (COs)

1. Collect, integrate and prepare text data with other types of data collected from various sources
2. Apply analytical techniques to analyse text and data
3. Evaluate suitable approaches for a range of analytical tasks related to text mining
4. Organize and formulate a system description algorithm for text mining
5. Apply classification and clustering algorithms for the application and generalizations for real time problems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2											
2	1	2	1											
3	1	2	2											
4	1	2	2											
5	1	2	2											

UNIT I **9 Hours**

NATURAL LANGUAGE PROCESSING

Text Mining Overview - Introduction to Natural Language Processing, Indian Languages - Grammar, Syntax, Semantics, Discourse, Synthesis, Machine Translation - Morphology, Stemmer - Regular Expressions, Spell Checkers - Text Summarization

UNIT II **9 Hours**

INFORMATION EXTRACTION

Statistical Modeling - Rule Based Extraction - Hidden Markov Model - POS Tagger - Conditional Random Field, CRF Address Parsers

UNIT III **9 Hours**

INFORMATION RETRIEVAL

Precision and Recall - Vector Space Models - Feature Identification, Feature Selection, Term Document Matrix - Principal Component Analysis - Dimension Reduction - Latent Semantic Indexing - Plagiarism Detection - Cross Language Retrieval - Query Expansion

UNIT IV **9 Hours**

ALGORITHMIC TECHNIQUES

Probabilistic Models - Aspect Models - Probabilistic Latent Semantic Indexing - Expectation Maximization Algorithm - Latent Dirichlet Allocation - Document Classification

UNIT V **9 Hours**

CLASSIFICATION AND CLUSTERING

Classification: Naive Bayes Classifier, Support Vector Machines - Neural Network - Clustering: Agglomerative Clustering, Divisive Clustering, Distance Measures, K-Means, K-Nearest Neighbor

Total: 45 Hours

Reference(s)

1. Charles.T. Meadow, Bert R Boyce, Donald H Karft, Text Information Retrieval System, 4th Edition, Emerald Group Publishing, 2013
2. David Grossman, Ophir Frieder, Information Retrieval-Algorithms and Heuristics, Springer, 2004
3. Stefan Buttcher, Charles LA Clarke, Dordon. V. Cormack, Information Retrieval, Implementing and evaluating Search Engine, MIT Press, 2010
4. Tanveer Siddiqui, Tiwari, Natural Language Processing and Information Retrieval, Oxford University Press, 2008

18IT008 COMPUTER GRAPHICS 3 0 0 3

Course Objectives

- Understand the fundamental theories and algorithms of computer graphics and apply them to develop graphics primitives.
- Design and Implement 3D graphical model algorithms using OpenGL
- Acquire knowledge of Illumination models and create an interactive animation using various techniques.

Course Outcomes (COs)

1. Understand the structure of modern computer graphics systems and primitives.
2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. Develop 3D UI computer graphics programs using OpenGL
4. Compare various algorithms used for modelling and rendering graphical 3D data.
5. Design interactive animations using various animation techniques.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2		2	1	3										
3		2	1		3									
4		1		2		3								
5			2		1				3					

UNIT I **9 Hours**

INTRODUCTION TO COMPUTER GRAPHICS AND GRAPHICS PRIMITIVES

Basic of Computer Graphics- Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards. Graphics Primitives: Points, lines,circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives: scan-linepolygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributes.

UNIT II **9 Hours**

2D TRANSFORMATION AND VIEWING

Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (cohen-sutherland, liang- bersky, NLN), polygon clipping.

UNIT III **9 Hours**

INTRODUCTION TO 3D GRAPHICS AND OPENGL

Introduction to 3D graphics: 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, Bazier curves and surfaces, B-spline curves and surfaces. OpenGL: Basic Rendering- Basic Texturing- Shader uniforms- Build-in Functions- Simulating Light- Accessing Textures.

UNIT IV **9 Hours**

3D TRANSFORMATION AND VIEWING

Visible surface detection methods: back-face detection - depth sorting- BSP tree methods. Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

UNIT V **9 Hours**

ILLUMINATION MODELS AND COMPUTER ANIMATION

Basic illumination models- Light intensities- Radiosity lighting model. Computer animation: Design of animation sequence, raster animation, computer animation languages, key frame systems, motion specifications.

FURTHER READING

Advanced rendering techniques, Modelling Techniques, Mathematics for computer graphics.

Total: 45 Hours

Reference(s)

1. 1. Edward Angel, Interactive Computer Graphics: A Top-Down Approach with OpenGL, 4th edition, Addison-Wesley, 2005.
2. 2. Sumanta Guha, Computer Graphics Through OpenGL: From Theory to Experiments, 3rd edition,2018
3. 3. Fabio Ganovelli, et.al, Introduction to Computer Graphics: A Practical Learning Approach, Taylor and Francis group, 2015
4. 4. Donald Hearn, M. Pauline Baker, Computer Graphics, 2nd edition, C version, Prentice Hall, 1996
5. 5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

18IT009 SOFTWARE TESTING 3 0 0 3

Course Objectives

- Discuss the various software testing issues and solutions in types of testing
- Learn how to plan a test project, design test case, conduct testing operations, manage defects and generate testing report
- Expose the advanced software testing basics such as object oriented software testing methods
- Gain the techniques and skills on how to use modern software testing tools to support software testing projects.

Course Outcomes (COs)

1. Define the various testing terms and strategies
2. Describe the test cases suitable for a software development for different domains.
3. Identify suitable tests to be carried out and prepare test planning based on the document
4. Manage the test process and use of automatic testing strategies
5. Apply software testing techniques in commercial environment. Use practical knowledge of a variety of ways to test software.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2		3	2											
3	2		2											
4				2	1									
5				2	3									

UNIT I **9 Hours**

FUNDAMENTALS OF TESTING

Testing principles and objectives - Testing Vs Debugging - Testing axioms -Basic definitions - Software testing principles - The testers role in a software development organization-Origin of defects - Cost of defects -Defect classes - Test process - The Defect Repository and Test Design - Defect Examples-Developer/Tester Support of Developing a Defect Repository.

UNIT II **9 Hours**

TEST CASE DESIGN STRATEGIES

Black box approach to test case design - Boundary value analysis - Equivalence class partitioning- state based testing - cause effect graph - Compatibility testing - User documentation testing - Domain testing - Random Testing - Requirements based testing - Using White Box Approach to Test design - Test Adequacy Criteria - Static testing vs. structural testing -code functional testing - Coverage and Control Flow Graphs - Covering Code Logic - Paths - code complexity testing -Additional White box testing approaches - Evaluating Test Adequacy Criteria Green's theorem in a plane - Stoke's Theorem- Gauss divergence theorem - Applications of Vector calculus

UNIT III **9 Hours**

LEVELS OF TESTING

The need for Levels of Testing - Unit Test- Unit Test Planning - Designing the Unit Tests - The Test Harness -Running the Unit tests and Recording results -Integration tests - Designing Integration Tests - Integration Test Planning - Scenario testing - Defect bash elimination System Testing - Acceptance testing-Performance testing - Regression Testing - Internationalization testing- Ad-hoc testing - Alpha, Beta Tests - Testing OO systems - Usability and Accessibility testing - Configuration testing - Compatibility testing - Testing the documentation - Website testing.

UNIT IV **9 Hours**

TEST MANAGEMENT AND AUTOMATION

People and organizational issues in testing- Organization structures for testing teams - testing services - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - test management-test process -Reporting Test Results - Software test automation - skills needed for automation - scope of automation - design and architecture for automation - requirements for a test tool - challenges in automation - Test metrics and measurements - project, progress and productivity metrics.

UNIT V **9 Hours**

RECENT TRENDS

Digital transformation with Agile- Performance Engineering- Combining manual and automated testing - Shortening delivery cycle - Testing tools: Selenium, Testingwhiz, Sahi and tricentis

Total: 45 Hours

Reference(s)

1. Sanjay Mohapatra, Suman kumar kanth - Software Testing -Applicationsand Product testing,Tata McGrawHill Edition, 2012.
2. Srinivasan Desikan and Gopalaswamy Ramesh, -Software Testing - Principles and Practices, Pearson Education, 2011.
3. Paul C. Jorgensen - Software Testing A craftman's Approach, Third Edition 2010
4. Boris Beizel- Software Testing Techniques, Second Edition 2009
5. Ron Patton, -Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com
6. William E.Perry-Effective Methods for Software Testing, Third Edition Wilwy, 2007

18IT010 FUNDAMENTALS OF VIRTUALIZATION 3 0 0 3

Course Objectives

- Identify the benefits and basics of virtualization.
- Understand the basic VM constructs and implement Xen hypervisor, VMWare, VSphere,Kernel Virtual Machine (KVM), Microsoft Hyper, Virtual Box.
- Implementation of Virtualization infrastructure and automation Puppet, Chef.

Course Outcomes (COs)

1. Have knowledge of transforming traditional inflexible, complex infrastructure of individual servers, storage, and network hardware into a flexible virtual resource pool.
2. Knowing various approaches to virtualization, its relevance to the modern data center, available platforms and important features.
3. Learning the business benefits and considerations of Virtual Machines.
4. Enable to configure the VMware vSphere storage and network virtualization.
5. Analyzing the implications of virtualization on Data Center Challenges.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1		2										
2	2				2									
3	1			2										
4		2			3									
5		1			3									

UNIT I **9 Hours**

INTRODUCTION

Virtualization overview - Benefits - Need of virtualization - Limitations - Traditional vs. contemporary virtualization - Pitfalls of virtualization - Hypervisors - Virtualization considerations for Cloud Providers.

UNIT II **9 Hours**

TYPES OF HARDWARE VIRTUALIZATION

Full virtualization- Para virtualization-Desktop Virtualization - Server Virtualization- Data virtualization - OS level virtualization - Application level virtualization - Comparing Virtualization approaches - Managing heterogeneous virtualization environment - customized and modifying virtualization- advanced virtualization

UNIT III **9 Hours**

VIRTUAL MACHINE

Taxonomy of virtual machines- Life Cycle- Process and System level virtual machines- Emulation - Binary Translation techniques -Managing storage for virtual machines - Virtualizing storage- Backup and recovery virtual machine - Applications of virtual machines.

UNIT IV **9 Hours**

IMPLEMENTATION OF VIRTUAL MACHINE

Building and managing virtual machine - Xen hypervisor and its architecture - VMWare VSphere - Kernel Virtual Machine (KVM) - Microsoft Hyper- V- Virtual Box.

UNIT V **9 Hours**

AUTOMATION AND MANAGEMENT

Cloud Management reference architecture- Data Center challenges and solutions - goals of automating virtualization management -Automating the Data Center- benefits of data center autonomic service provisioning- Virtualization Management - Evaluating virtualization management solutions - Tools for automation Puppet, Chef.

Total: 45 Hours

Reference(s)

1. RajkumarBayya, James Broberg, Andrzej Goscinski, Cloud Computing Principles and Paradigms , John Wiley & Sons, 2011.
2. James E.Smith, Ravi Nair, Virtual Machines, Elsevier, 2005.
3. Matthew Portney , Virtualization Essentials , John Wiley & Sons 2012.
4. Tim cerfing, Jeff buller, Chuck Enstall, Richard Ruiz, Mastering Microsoft Virtualization, Wiley Publication, 2010.
5. VenkataJosyula, MalcolmOrr, Greg Page, Cloud Computing: Automating the virtualized Data center, Cisco Press, 2012.
6. William Von Hagen , Professional Xen Virtualization, Wiley Publication, 2008.

18IT011 MANAGEMENT INFORMATION SYSTEMS 3 0 0 3

Course Objectives

- Gain knowledge about the major types of information systems used in a business environment.
- Impart knowledge on the ethical, social, and security issues of information systems.
- Understand the processes of developing and implementing information systems

Course Outcomes (COs)

1. Understand the basics of Management Information systems.
2. Formulate solutions social and ethical issues related to information technology infrastructure.
3. Apply the knowledge on database management systems to store hybrid information in a business organization.
4. Recognize the use of security mechanisms to share business information over various types of networks.
5. Explore the new IT initiatives for enhancing knowledge management information systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1												
2			2					1						
3		2	1											
4		1												
5						1								

UNIT I **9 Hours**

INTRODUCTION TO INFORMATION SYSTEMS

Information Systems in Global Business Today: Role of Information Systems in Business Today - Perspectives of Information Systems - Approaches to Information Systems - Global E-Business and Collaboration: Business Process and Information Systems - Types of Information Systems Enterprise Systems

UNIT II **9 Hours**

INFORMATION TECHNOLOGY INFRASTRUCTURE

Information Systems, Organizations and Strategy: Organizations and Information Systems - Impact of Information Systems on organizations and Business Firms - Ethical and Social Issues in Information Systems: Understanding Ethical and Social Issues Related to Systems - Ethics in an information society - IT Infrastructure and Emerging Technologies: Infrastructure Components - Hardware Platform Trends - Software Platform Trends

UNIT III **9 Hours**

DATABASES AND INFORMATION MANAGEMENT

Organizing Data in Traditional File Environment - Database Approach to Data Management - Using Databases to improve Business Performance and Decision Making - Managing Data Resources

UNIT IV **9 Hours**

NETWORKS AND SECURITY

Telecommunications and Networking in todays Business Needs: Networking and Communication Trends - Key Digital Networking Technologies - Securing Information Systems: System Vulnerability- Business Value of Security and Control - Establishing Management Framework for Security and Control - Technologies and Tools for Protecting Information Resources.

UNIT V **9 Hours**

NEW IT INITIATIVES

Enterprise Applications: Enterprise Systems - Supply Chain Management Systems - Customer Relationship Management Systems - Electronic Commerce: Types of Electronic Commerce - Mcommerce Services and Applications - The Knowledge Management Landscape: Important Dimensions of Knowledge - The Knowledge Management Value Chain - Types of Knowledge Management Systems.

UNIT VI

FOR FURTHER READING

Porters Competitive Forces Model - The Business Value Chain Model - Management Issues - Sustaining Competitive Advantage - Aligning IT with Business Objectives - Managing Strategic Transitions

Total: 45 Hours

Reference(s)

1. Kenneth C. Laudon, Jane P. Laudon, Management Information Systems -Managing the digital firm, Pearson Education, 2012.
2. Waman S Jawadekar, Management Information Systems-Texts and Cases, the McGraw-Hill Company, 2009.
3. James O' Brien, Management Information Systems-Managing Information Technology in the Ebusiness enterprise, McGraw-Hill Higher Education, 2011.
4. Turban, McLean and Wether, Information Technology for Management-Transforming Organisations in the Digital Economy, John Wiley, 2008.
5. Raymond McLeod and Jr. George P. Schell, Management Information Systems, Pearson Education, 2008.

18IT012 MULTIMEDIA TOOLS AND APPLICATIONS 3 0 0 3

Course Objectives

- Understand the basic elements of multimedia to design text, image, audio and video.
- Comprehend the building blocks of multimedia, with emphasis on authoring, data compression, web
- Knowledge on multimedia applications with an added exposure to some of the popular tools / software.

Course Outcomes (COs)

1. Identify the basic elements of multimedia and file formats
2. Conceptual knowledge to solve issues related to emerging electronic technologies and graphic design
3. Illustrate the importance of web based multimedia usage
4. Use and apply authoring tools for web and e-learning.
5. Implement various software programs used in the creation of multimedia (interactive, motion/animation, presentation, etc.)

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		3	2											
2	3		2											
3		3	2											
4		2			3									
5	1	3			2									

UNIT I **9 Hours**

BASIC ELEMENTS

Creation - Editing - Design - Usage - Tools and Hardware -File Formats for Text, Image / Graphics, Audio, Video - Multimedia data interface standards - Multimedia databases

UNIT II **9 Hours**

MULTIMEDIA FILE HANDLING

Compression and decompression - Data and file format standards - Multimedia I/O technologies - Digital voice and audio -Video image and animation - Full motion video - Storage and retrieval technologies

UNIT III **9 Hours**

MULTIMEDIA ON THE WEB

Hypertext - Hypermedia - Hypermedia Structures and Formats - Web Graphics- Web Design Guidelines - HTML5 - Plugins -Multimedia Networking.

UNIT IV **9 Hours**

AUTHORING AND TOOLS

Authoring - Story Boarding, Metaphors - Card / Page, Icon, Timeline, Tools - Adobe Dream Weaver CC, Flash, Edge Animate CC, Camatasia Studio 8, Claro, E-Learning Authoring Tools - Articulate, Elucidate

UNIT V **9 Hours**

MULTIMEDIA APPLICATIONS

Multimedia Databases - Content Based Information Retrieval, Multimedia Communications -Multimedia Information Sharing and Retrieval - Applications - Social Media Sharing, Online Social Networking - Virtual Reality - Multimedia for Portable Devices, Collaborative Multimedia Applications

FOR FURTHER READING

CBT presentation - Dynamic web pages- Publishing in Internet - User interactions using multimedia systems

Total: 45 Hours

Reference(s)

1. Ze - Nian Li, Mark S Drew and Jiangchuan LiuFundamentals of Multimedia, Second Edition, Springer, 2014.
2. ParagHavaldar and Gerard Medioni, Multimedia Systems - Algorithms, Standards and Industry Practices, Course Technology, Cengage Learning, 2010.
3. Nigel Chapman and Jenny Chapman, Digital Multimedia, Third Edition, Wiley, 2009
4. Ralf Steinmetz and KlaraNahrstedt, Multimedia Computing, Communications and Application, First Edition, Pearson, 2005.
5. www.Webstyleguide.com

18IT013 INFORMATION STORAGE MANAGEMENT 3 0 0 3

Course Objectives

- Characterize the functionalities of logical and physical components of storage
- Describe storage networking technologies and Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies and explain common storage management activities and solutions

Course Outcomes (COs)

1. Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment
2. Illustrate the usage of advanced intelligent storage systems and RAID
3. Interpret various storage networking architectures - SAN, including storage subsystems and virtualization
4. Examine the different role in providing disaster recovery and remote replication technologies
5. Infer the security needs and security measures to be employed in information storage management

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3			1									
2	1	1			2									
3	2	1			3									
4	1	3	2			2								
5	2					2								

UNIT I **9 Hours**

STORAGE SYSTEMS

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center

UNIT II **8 Hours**

INTELLIGENT STORAGE SYSTEMS AND RAID

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid state drives, RAID, Types of intelligent storage systems , Scale-up and scale-out storage architecture

UNIT III **10 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN,FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV **10 Hours**

BACKUP, ARCHIVE AND REPLICATION

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute-based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS)

UNIT V **8 Hours**

SECURING STORAGE INFRASTRUCTURE

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance

FOR FURTHER READING

Storage infrastructure management functions, Storage infrastructure management processes

Total: 45 Hours

Reference(s)

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

18IT014 DEEP LEARNING 3 0 0 3

Course Objectives

- To impart basic knowledge on Neural Networks and AI.
- To familiarize with implementation of methods and algorithms of Deep Learning techniques.
- To understand CNN and RNN models in analyzing visual imagery.

Course Outcomes (COs)

1. Understand the working of Unsupervised Learning and Supervised Learning Neural Network.
2. Apply Regression and Classification predictive models for function approximation.
3. Apply the Probability theory a mathematical framework for representing uncertain statements.
4. Analyse and Design the Convolutional Neural Network models to recognize, model, and solve problems in the analysis and design of information systems.
5. Apply the Recurrent Neural Network models to recognize, model, and solve problems in the analysis and design of information systems.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2	3										
2	1	3	2	2	1									
3		3	2	2										
4		2	1	2	1									
5		2	2	1	1							1		

UNIT I **8 Hours**

NEURAL NETWORKS

Neural Network- Multilayer neural networks-Unsupervised Learning-Supervised Learning- Boltzmann Machine- Optimization using Hopfield Network- Genetic Algorithm- Applications of Neural Networks.

UNIT II **9 Hours**

AI AND MACHINE LEARNING

Intelligent agents, Agents and environments, Structure of agents - Problem Solving - Problem solving agent-Machine Learning-Supervised and Unsupervised learning-Regression and Classification-K-Means Clustering.

UNIT III **10 Hours**

DEEP LEARNING TECHNIQUES

Introduction-History of Deep Learning-Linear Model Regression-Deep Learning Working-Perceptron-Back Propagation-Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.

UNIT IV **9 Hours**

CONVOLUTIONAL NEURAL NETWORK

Convolutional Neural Network-Architecture- Backpropagation- ConvNets for spatial localization-Object detection.

UNIT V **9 Hours**

RECURRENT NEURAL NETWORK

Recurrent Neural Networks (RNN)-Long Short Term Memory (LSTM)-RNN language models-Image captioning.

FURTHER READING

Deep Boltzmann Machines- Gradient-Based Learning- Industrial automation-Feed Forward Neural Network- FMS and Robotics-Business Intelligence

Total: 45 Hours

Reference(s)

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book (2015).
2. Mishra R B, Artificial Intelligence, PHI Learning Pvt. Ltd., New Delhi, 2011
3. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.
4. Kevin Knight, Elaine Rich and Nair, Artificial Intelligence, Tata McGraw Hill, New Delhi, 2008
5. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.
6. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Interscience. 2nd Edition. 2001.

18IT015 COMPUTER ANIMATION: ALGORITHMS AND TECHNIQUES

3 0 0 3

Course Objectives

- Understand the basic animation techniques and concepts covered in the film and video technology.
- Knowledge on algorithms of camera specifications and its renderings motion.
- Emphasis is on creative content, experimentation and critical thinking on character and facial animation

Course Outcomes (COs)

1. Identify the useful algorithms and techniques to move objects in interesting ways.
2. Develop an understanding of the hardware used for creating film and video technology.
3. Design the animation by manipulating objects, lights and cameras
4. Illustrate the important features of an animation for motion specification.
5. Apply the algorithm for complex motions used in character and facial animations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		3	2											
2	3	1												
3	2		3											
4	2				2									
5	2	3	2											

UNIT I **9 Hours**

ANIMATION AND CONCEPTS

Introduction - Overview - Perception - The Heritage of Animation - Computer Animation: Background and History - Computer Animation Software - Animation on the WEB.

UNIT II **9 Hours**

HARDWARE AND RECORDING TECHNIQUES

Real-Time Versus Single-Frame Animation - Film Technology - Video Technology - Animation Hardware - Dynamic Web Page Creation - Web advertisements - Web animations.

UNIT III **9 Hours**

DISPLAY CONSIDERATIONS

Display Pipeline and Matrix Transformations - Roundoff Error Considerations - Observer/Camera Specification

UNIT IV **9 Hours**

AIDS TO MOTION SPECIFICATION

Interpolation - Ease-In/Ease-Out and Velocity Control - Orientation Interpolation - Camera Path Following - Animation Languages - Key Frame/Track-Based Animation, Metamorphosis - Implicit Surface Animation

UNIT V **9 Hours**

ALGORITHMIC MOTION SPECIFICATION

Kinematics and Linked Appendages - Constraint Programming - Rigid Body Animation - Flexible Body Animation - Emergent Behavior: Particles and Flocks - Behavioral Animation - Character Animation: Dynamics - Facial Animation , Walking - Plant Growth

FOR FURTHER READING

Facial Animation: Human face, Facial models, Animating the face, Lip-Sync animation; Physically-based Animation.

Total: 45 Hours

Reference(s)

1. Rick Parent, Computer Animation: Algorithms & Techniques, Morgan Kaufmann Pub.
2. Watt and Watt, "Advanced Animation and Rendering," Addison-Wesley, New York, 1992.
3. Charles Solomon, "The History of Animation: Enchanted Drawings," Wings Books, New York, 1994.
4. Williams, L., "Performance-Driven Facial Animation," SIGGRAPH'90, pp. 235-242.
5. Ebert, Dave, "Design and Animation of Volume Density Functions," The Journal of Visualization and Computer Animation, Vol. 4, No. 4, 1993, pp. 213-232.
6. Korein, J., and Badler, N., "Temporal Anti-Aliasing in Computer Generated Animation," SIGGRAPH'83, pp. 377-388.

18IT016 HIGH PERFORMANCE COMPUTING 3 0 0 3

Course Objectives

- Understand the challenges in parallel and multi-threaded programming
- Acquire the knowledge about the various parallel programming paradigms, and solutions
- Acquaint the knowledge of Parallel Programming using OpenMP and MPI

Course Outcomes (COs)

1. Understand parallelization to process data in parallel in order to execute faster
2. Implement the Program for Parallel Processors
3. Implement programs using OpenMP in Shared Memory
4. Implement programs using MPI in Distributed Memory
5. Compare and contrast programming for serial processors and programming for parallel processors

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2											
2	3	2	2											
3	1	3	2											
4	1	3	2											
5	1	2	2											

UNIT I **9 Hours**

MULTI-CORE PROCESSORS

Single core to Multi-core architectures - SIMD and MIMD systems - Interconnection networks - Symmetric and Distributed Shared Memory Architectures - Cache coherence - Performance Issues - Parallel program design

UNIT II **9 Hours**

PARALLEL PROGRAM

Performance - Scalability - Synchronization and data sharing - Data races - Synchronization primitives (mutexes, locks, semaphores, barriers)- deadlocks and livelocks - communication between threads (condition variables, signals, message queues and pipes).

UNIT III **9 Hours**

SHARED MEMORY PROGRAMMING WITH OPENMP

OpenMP Execution Model - Memory Model - OpenMP Directives - Work-sharing Constructs - Library functions - Handling Data and Functional Parallelism - Handling Loops - Performance Considerations

UNIT IV **9 Hours**

DISTRIBUTED MEMORY PROGRAMMING WITH MPI

MPI program execution - MPI constructs - libraries - MPI send and receive - Point-to-point and Collective communication - MPI derived datatypes - Performance evaluation

UNIT V **9 Hours**

PARALLEL PROGRAM DEVELOPMENT

Case studies n-Body solvers Tree Search OpenMP and MPI implementations and comparison.

FURTHER READING

Parallel architecture: Inter-process communication, Synchronization, Mutual exclusion, Basics of parallel architecture, Parallel programming with message passing using MPI

Total: 45 Hours

Reference(s)

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris",Pearson, 2011 (unit 2)
3. Michael J Quinn,"Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003. Shameem Akhter and Jason Roberts, Multi-core Programming, Intel Press, 2006
4. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
5. Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd Edition, 1998
6. Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984

18IT017 SOCIAL NETWORK ANALYTICS 3 0 0 3

Course Objectives

- Understand the Strategic aspects with real time in Social Media analytics
- Formalize different types of entities and relationships and represent the information as relational data
- Conduct basic social network analysis to include centrality, subgroup analysis, social theory, and statistical analysis of networks

Course Outcomes (COs)

1. Apply best practices in web and social media analysis that can be used to process data in information technology and social science domains
2. Develop skills to use online forums for communication
3. Apply knowledge for current web development in the era of Social Web
4. Examine the tools and an algorithm for mining in social networks
5. Use appropriate information visualization technique to gain insights into large Data sets

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2			2										
2					3	2								
3	2				1	2								
4				3		2								
5		1				3				2				

UNIT I **9 Hours**

INTRODUCTION

Overview: Social network data-Formal methods- Paths and Connectivity-Graphs to represent social relations-Working with network data- Network Datasets -Strong and weak ties - Closure, Structural Holes, and Social Capital

UNIT II **9 Hours**

SOCIAL INFLUENCE

Homophily : Mechanisms Underlying Homophily, Selection and Social Influence, Affiliation, Tracking Link Formation in OnLine Data, Spatial Model of Segregation - Positive and Negative Relationships - Structural Balance - Applications of Structural Balance, Weaker Form of Structural Balance

UNIT III **9 Hours**

INFORMATION NETWORKS AND THE WORLD WIDE WEB

Structure of Web - World Wide Web- Information Networks, Hypertext, and Associative Memory- Web as a Directed Graph, Bow-Tie Structure of the Web- Link Analysis and Web Search- Searching the Web: Ranking, Link Analysis using Hubs and Authorities- Page Rank- Link Analysis in Modern Web Search, Applications, Spectral Analysis, Random Walks, and Web Search

UNIT IV **9 Hours**

SOCIAL NETWORK MINING

Clustering of Social Network graphs: Betweenness, Girvan newman algorithm-Discovery of communities-Cliques and Bipartite graphs-Graph partitioning methods-Matrices-Eigen values- Simrank

UNIT V **9 Hours**

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Graph Theory-Centrality-Clustering -Node-Edge Diagrams,Matrix representation, Visualizing Online Social Networks,Visualizing Social Networks with Matrix-Based Representations-Matrix Node- Link Diagrams, Hybrid Representations -Applications -Covert Networks-Community Welfare -Collaboration Networks -Co-Citation Networks
Case Study : Social Networking Service Twitter

Total: 45 Hours

Reference(s)

1. Easley, Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected world",3rd Edition,Cambridge Univ Press, 2010
2. Jure Leskovec, Anand Rajaraman, Milliway Labs, Jeffrey D. Ullman, "Mining of Massive Datasets",2nd Edition,Cambridge University Press,2014
3. Borgatti,Everett MG, Johnson J, "Analyzing social networks",1st Edition, SAGE Publications Ltd, 2013
4. John Scott,"Social Network Analysis: A Handbook",3rd Edition, SAGE Publications Ltd,2013
5. Robert A Hanneman, Mark Riddle, "Introduction to social network methods", University of California, 2008
6. Nilanjan Dey, Samarjeet Borah, Rosalina Babo, Amira S. Ashour, " Social Network Analytics : Computational Research Methods and Techniques " , 1st Edition, Elsevier - (Academic Press), 2018.

18IT018 LINUX ADMINISTRATION 3 0 0 3

Course Objectives

- Understand essential tools to access a shell prompt and issue commands with correct syntax
- Operate running systems by identifying CPU/memory intensive processes, adjust process priority with renice, and kill processes
- Configure systems, web server to mount file systems at boot by Universally Unique ID

Course Outcomes (COs)

1. Understand open source and apply file processing using command line
2. Configure file systems and analyze the scheduling of tasks and cloning
3. Configure local storage and create the partitions and logical volumes for given development environment
4. Configure Firewall, Domain Name System and MariaDB for development environment
5. Manage web server using Apache and email configuration using postfix for given development environment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2		2									
2	1				2									
3	1		2		3									
4	1	2	2											
5	1		2		3									

UNIT I **9 Hours**

BASIC SYSTEM CONFIGURATION

Introduction to Open Sources - Need of Open Sources- Overview of Kernel Mode and User Mode - Accessing command line - Creating, Viewing and Editing Text Files - Managing Files from command line - Using Regular Expressions with grep - Getting help - Configure date and time

UNIT II **9 Hours**

INFRASTRUCTURE SERVICE

Manage Local users and groups in Linux - Controlling Access to Files with Linux File-system Permissions - Monitoring and Managing Linux Processes with priority - Scheduling Future Linux Tasks using at and cron - Controlling Access to Files with Access Control Lists (ACL) - Cloning

UNIT III **9 Hours**

STORAGE MANAGEMENT

Adding Disks, Partitions, and File Systems to a Linux System - Managing Logical Volume Management (LVM) Storage - Accessing Network Attached Storage with Network File System - Accessing Network Storage with SMB

UNIT IV **9 Hours**

SERVER CONFIGURATION

Configure OpenSSH - Firewall Configuration - Managing DNS for Servers - ISCSI Target - Configuring MariaDB Databases

UNIT V **9 Hours**

SERVER MANAGEMENT

Web Server: Apache Web Server - Configuring and working with Apache Web Server - Setting up Email Servers using postfix

Total: 45 Hours

Reference(s)

1. Marie, Maxim Svistunov: Development, Configuration, and Administrator on Linux 7, Redhat PRESS, 2015
2. Remy Card, Eric Dumas and Frank Mevel, The Linux Kernel Book, Wiley Publications, 2003
3. M.N Rao, Fundamentals of Open Source Software, PHI Learning, 2015
4. Wale Soyinka, Red Hat Linux Administration: A Beginner's Guide, McGraw-Hill Osborne Media, Sixth Edition, 2012
5. Terry Collings, Kurt Wall, Red Hat Linux Networking and System Administration, Redhat PRESS, Third Edition, 2005
6. Wale Soyinka, Red Hat Linux Administration: A Beginner's Guide, McGraw-Hill Osborne Media, Sixth Edition, 2012

18IT019 STREAMING ANALYTICS 3 0 0 3

Course Objectives

- Gain knowledge about the Streaming Data and Static Data used in a business environment.
- Impart knowledge on the Data flows, processing & storing streaming data.
- Understand the knowledge on streaming metrics.

Course Outcomes (COs)

1. Understand the need for stream computing
2. Comprehend the architecture of stream analytics
3. Explore the new initiatives for enhancing data flow management pipelines for streams.
4. Recognize the Processing streaming data
5. Apply the knowledge of streaming metrics for delivery of the results.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		2		1										
2		2		1										
3		2		1										
4		2		1										
5			1	2										

UNIT I **9 Hours**

INTRODUCTION TO STREAM COMPUTING

Streaming Data - Sources - Difference between Streaming Data and Static Data. Overview of Large Scale Stream Processing Engines - Issues in Stream Processing.

UNIT II **9 Hours**

STREAMING ANALYTICS ARCHITECTURE

Phases in Streaming Analytics Architecture - Vital Attributes - High Availability - Low Latency - Horizontal Scalability-Fault Tolerance - Service Configuration and Management - Apache ZooKeeper.

UNIT III **9 Hours**

DATA FLOW MANAGEMENT

Distributed Data Flows - At Least One Delivery - Apache Kafka - Apache Flume - Zero MQ - Messages, Events, Tasks & File Passing.

UNIT IV **9 Hours**

PROCESSING

Distributed Stream Data Processing: Co-ordination, Partition and Merges, Transactions. Duplication Detection using Bloom Filters - Apache Spark Streaming Examples Choosing a storage system - NoSQL Storage Systems.

UNIT V **9 Hours**

DELIVERING STREAMING METRICS

Visualizing Data - Mobile Streaming Apps -Times Counting and Summation - Stochastic Optimization - Delivering Time Series Data.

Total: 45 Hours

Reference(s)

1. Byron Ellis, Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data, Wiley, 2014.
2. Sherif Sakr, Large Scale and Big Data: Processing and Management, CRC Press, 2014.
3. Bill Franks, Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics, Wiley, 2012.
4. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Mining of Massive Datasets, Cambridge University Press, 2014.
5. Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos , Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw-Hill, 2011.

18IT020 PERVASIVE COMPUTING 3 0 0 3

Course Objectives

- discover the characteristics of pervasive computing applications including the major system components and architectures of the systems
- analyze the strengths and limitations of the tools and devices for development of pervasive computing systems
- explore the characteristics of different types of mobile networks on the performance of a pervasive computing system

Course Outcomes (COs)

1. Understand the fundamental elements of pervasive computing.
2. Learn the design process of Pervasive Computing Environments and its solutions
3. Familiarize hardware, software and the aspects involved in pervasive computing.
4. Compare protocols, languages, models & technologies involved
5. Learn WAP and voice technology.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		3	2										
2	3	2												
3	3		2	3	3									
4	3	3												
5	3	2	2											

UNIT I **9 Hours**

INTRODUCTION

Pervasive Computing: Past, Present and Future Pervasive Computing, Pervasive Computing Market, m-Business Application examples: Retail, Airline check-in and booking, Healthcare Tracking, Car information system, Sales Force Automation, Email access via WAP and voice Device Technology: Hardware, Human-machine interface Biometrics, Operating systems Java for pervasive devices

UNIT II **9 Hours**

DEVICE CONNECTIVITY

Device connectivity : Protocols: wireless, mobile phone technologies, mobile internet protocol Synchronization and replication protocol, distributed services and message and transaction protocols Security Device Management Web Application Concepts: WWW Architecture and Protocols Transcoding, Client Authentication via the Internet

UNIT III **9 Hours**

WAP

WAP and Beyond: Introduction, Components of the WAP architecture WAP infrastructure, WAP security issues Wireless Markup Language, WAP push Products,i-Mode voice technology: Basics of Speech recognition, Voice Standards Speech Applications, Speech and Pervasive Computing, security

UNIT IV **9 Hours**

PERVASIVE ARCHITECTURE

Device Categories, PDA operation Systems Device Characteristics, SoftwareComponents Standards, Mobile Applications, PDA Browsers Pervasive web application architecture: Background, Scalability and availability, Development of Pervasive Computing web applications Pervasive application architecture

UNIT V **9 Hours**

APPLICATION IN PERVASIVE COMPUTING

User Interface Issues in Pervasive Computing, Architecture Smart Card- based Authentication via internet and ordering goods- Access from WAP -Access from personal digital assistants-Access via voice

FOR FURTHER READING

Applications in Data mining, Graphics and Machine learning

Total: 45 Hours

Reference(s)

1. JochenBurkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, Pervasive Computing, Technology and Architecture of Mobile Internet Applications, Pearson Education, 2012. ISBN-13: 978-0201722154
2. UweHansmann, L. Merk, M. Nicklous, T. Stober, U. Hansmann, PervasiveComputing (Springer Professional Computing) , 2003, Springer Verlag,ISBN:3540002189.
3. Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, McGraw Hill edition, 2006. ISBN-13: 978-0071412377

18IT021 STORAGE MANAGEMENT ESSENTIALS 3 0 0 3

Course Objectives

- Explore the various terminologies, principles and applications of data storage management
- Understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization.
- Introduce the broad perceptive of cloud architecture and model
- Create application by utilizing cloud platforms such as MongoDB, Hadoop, Google app Engine and Amazon Web Services (AWS)

Course Outcomes (COs)

1. Explain and identify the techniques of big data analysis in cloud.
2. Identify how Hadoop solves Big Data problems, Hadoop Ecosystem, Hadoop Architecture,HDFS, Anatomy of File Read and Write & how MapReduce works.
3. Recognize OpenStack architecture, service components, and its installation procedures with automated tools.
4. Describe Dynamic Cluster Management and Erasure Coding using CEPH distributed storage system.
5. Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real-world cloud computing problems

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	1	1									
2	3	1	2	2	1									
3	2	2	1	2	2									
4	2	1	2	2	3									
5	2	1	2	2	2									

UNIT I **9 Hours**

STORAGE FUNDAMENTALS

Introduction - File Systems -Storage components - Direct Attached Storage - Network Attached Storage - Storage Area Network - Storage management

UNIT II **9 Hours**

HADOOP STORAGE

Hadoop overview - HDFS Architecture: Name Nodes, Data Nodes, File System Namespace, Data Replication, Persistency, Communication Protocols, Data Organization and accessibility, space Reclamation - SAN for Hadoop Storage - Replication - DFS for Hadoop - Hadoop on cloud object storage

UNIT III **9 Hours**

OPENSTACK STORAGE

Object storage overview - Swift architecture - Components of object storage - Rings - Installation and Configuration - object storage deployment - Block storage - Architecture - Components of Block Storage - Block Storage Deployment - Attaching Blocks to VM instances - java api integration

UNIT IV **9 Hours**

CEPH STORAGE

Introduction - ceph architecture: Ceph storage cluster, Scalability and HA, Dynamic Cluster Management, Erasure Coding, Cache Tiering - configuring ceph - ceph filesystem - ceph protocol - ceph clients - Ceph Manager Daemon, Ceph Object Gateway

UNIT V **9 Hours**

CASE STUDY

MongoDB - Data Model, Query Model, Data Consistency, Data Management, Big data storage options for hadoop - cloud object storage - SNIA Certification

FOR FURTHER READING

Google Storage Architecture, Amazon Storage services

Total: 45 Hours

Reference(s)

1. Greg Schulz, Cloud and Virtual Data Storage Networking, CRC Press, Taylor & Francis Group, 2012
2. Amar Kapadia, Sreedhar Varma, Kris Rajana, Implementing Cloud Storage with OpenStack Swift.PACKT Publishing, 2014
3. Nigel poulton, Data Storage Networking: Real World Skills for the CompTIA Storage+ Certification and Beyond, SyBEX (A wiley brand),2014
4. Greg Schulz, Software Defined Data Infrastructure Essentials, CRC press, 2017

18IT0YA DATABASE MANAGEMENT SYSTEMS 3 0 0 3

Course Objectives

- Understand the concepts of database
- Design a good Relational Database using SQL
- Create and manipulate database tables using basic and advanced SQL Queries

Course Outcomes (COs)

1. Design a table from ER diagram and normalize to reduce the redundancy.
2. Construct a table and provide privileges to perform operations on the table.
3. Develop a query to retrieve data from more than one table and display the required data.
4. Apply SQL queries on Stored Procedures, Functions and Triggers in Relational Database.
5. Identify the Roles and Responsibilities of Database Administrator.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		3		2									
2	1		2	2	3									
3	1		2	2	3									
4	1		3	3										
5	1		3	1										

UNIT I **8 Hours**

DATABASE DESIGN CONCEPTS

Fundamentals of Database - ER Diagrams- Keys - Features of Good Relational Design - Normalization - 1NF -2NF-3NF-BCNF- ACID Properties.

UNIT II **9 Hours**

BASIC QUERIES

DDL (Data Definition Language) - Create - Alter -Drop - Truncate - Comment - Rename - Constraints - Primary Key - Foreign Key - Unique Key - Not NULL - Check - DML (Data Manipulation Language) - Insert -Update -Delete - Merge - Select- DCL (Data Control Language)- Grant - Revoke - TCL (Transaction Control Language)-Commit - Savepoint - Rollback.

UNIT III **10 Hours**

ADVANCED QUERIES I

Select - Where - Distinct - Like- Order By - Group By - Having - Joins - Cartesian Product - Inner Join - Natural Join - Left Outer - Right Outer - Full Outer Join.

UNIT IV **10 Hours**

ADVANCED QUERIES II

Case - When - And - Or - Not - Between - Null - Subqueries - In - Any - All - PL/SQL - Functions-Stored Procedures - Triggers - Cursors.

UNIT V **8 Hours**

DATABASE ADMINISTRATION

Database Users - DBA Roles and Responsibilities - Types of DBA - Privileges - Database Backup - DB Mirroring - Database Recovery - Data Tuning.

Total: 45 Hours

Reference(s)

1. Silberchatz, Korth, Sudarsan, Database System and Concept, sixth edition, Mcgraw, 2013
2. Dr. P.S. Deshpande, SQL & PL/SQL for oracle 10G Black book, Second edition, Wiley, 2010
3. Santhosh Kumar K, JDBC, Servlets, and JSP Black book, Third Edition, Wiley, 2008.

18IT0YB DATA STRUCTURES AND ALGORITHMS 3 0 0 3

Course Objectives

- To understand node creation and perform linked lists operations like insertion, deletion and displaying the linked list data.
- To apply insertion and deletion operations of Stack and Queue data structures
- To apply Tree data structure and hashing techniques to accelerate data searching
- To apply graph traversals and algorithms to solve real world problems
- To analyze the algorithmic complexity of simple and non-recursive problems

Course Outcomes (COs)

1. Apply linked list linear data structures operations using dynamic memory allocation
2. Apply stack and Queue data structure operations to solve computational problems
3. Design tree data structures and hashing techniques for effective searching of data
4. Build algorithms for solving real world problems using Graph data structure
5. Analyze the performances of the sorting algorithms using divide and conquer techniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2		2									
2	3	3	2		2		2							
3	3	3	2		2		2							
4	3	3	2		2		2							
5	3	3	2		2		2							

UNIT I **9 Hours**

LINEAR DATA STRUCTURES: LIST

Abstract Data Types - List ADT - Array-based implementation - Linked list implementation - Singly linked lists - Circularly linked lists - Doubly-linked lists - Applications of lists - Polynomial Manipulationusing linked list.

UNIT II **9 Hours**

LINEAR DATA STRUCTURES: STACKS, QUEUES

Stack ADT Operations - Applications of Stack - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT Operations - Circular Queue - Priority Queue - Applications of queues.

UNIT III **9 Hours**

NON LINEAR DATA STRUCTURES: TREES

Tree ADT - tree traversals - Binary Tree ADT - Expression trees - Applications of trees - Binary Search tree ADT - AVL Trees - Hashing - Separate chaining - Open addressing - Linear probing.

UNIT IV **9 Hours**

NON LINEAR DATA STRUCTURES - GRAPHS

Graphs : Definitions, Topological sort, Graph Traversals: Breadth-first traversal, Depth-first traversal, Shortest-path algorithms, Minimum spanning tree, Prim's and Kruskal's algorithms, Applications ofgraphs.

UNIT V **9 Hours**

ALGORITHM DESIGN AND ANALYSIS

Algorithm Design: Greedy algorithm - Divide and conquer - Dynamic programming - Backtracking - Branch and bound - Algorithm Analysis: Asymptotic notations - Recurrences - NP complete problems.

Total: 45 Hours

Reference(s)

1. 1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 2015.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, Introduction to Algorithms, Second Edition, MIT Press, 2014.
3. AA Puntambekar, Data Structures And Algorithms, Technical Publications, 2009.
4. R F Gilberg, B A Forouzan, Data Structures, Second Edition, Thomson India Edition, 2005.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
6. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983

18IT0YC DATA SCIENCES AND ANALYTICS 3 0 0 3

Course Objectives

- Familiarize with the fundamentals of data science and related concepts
- Acquaint the students with the knowledge to construct complex statistical models, assess the fit of such models to the data, and apply the models in real-world contexts
- Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques

Course Outcomes (COs)

1. Implement data science fundamentals and apply them to day-to-day business and industrial needs
2. Perform appropriate probability and statistical tests using R
3. Apply supervised and unsupervised algorithms in the data analysis process
4. Design the mathematical models for data analysis and also perform mining in text data
5. Construct the visualization models using Tableau and d3.js tools

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	2											
2	1	2	2		3									
3	2	3	3	2										
4	1	2	2	3										
5	1	2	3	2	3									

UNIT I **7 Hours**

INTRODUCTION TO DATA SCIENCE

Data Science Fundamentals, Exploring data engineering pipelines, Applying data science and data warehousing to business and industry

UNIT II **9 Hours**

INTRODUCTION TO PROBABILITY AND R

Introduction to Probability, Conditional Probability, Random Variable, Statistical Modelling, Probability Distribution, R Introduction, Data Structures in R, Working with Data in R

UNIT III **10 Hours**

SUPERVISED AND UNSUPERVISED LEARNING

Linear Regressions, Classification- Decision Tree, Naive Bayes, K-Nearest Neighbors, Clustering-Identifying Clusters, K-Means Clustering, Hierarchical Clustering

UNIT IV **10 Hours**

MATHEMATICAL MODELLING

Association Rule Mining, Time Series Analysis, Dimensionality Reduction, Principal Component Analysis, Linear Discriminant Analysis, Sentiment Analysis on text data

UNIT V **9 Hours**

VISUALIZATION TOOLS

Introduction to Visualization - Types of visualizations, Working with Tableau, Creating views in Tableau, using d3.js for data visualization

FOR FURTHER READING

Data Analysis using Python, Natural Language Processing, Google Charts.

Total: 45 Hours

Reference(s)

1. Lillian Pierson, Data Science for Dummies, John Wiley,2015
2. Garrett Grolemund, Hadley Wickham, R for Data Science, O Reilly in January 2017.
3. Andrie de Vries, Joris Meys, R For Dummies, John Wiley and Sons, 2012
4. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier Inc., 2012.
5. David Baldwin , Mastering Tableau, Packt Publishing, 2016.

18IT0YD OBJECT ORIENTED PROGRAMMING 3 0 0 3

Course Objectives

- Understand the features of Object oriented programming.
- Recognize the need of the concepts inheritance and polymorphism.
- Develop C++ applications using OOP concepts, files, templates and exceptions.

Course Outcomes (COs)

1. Interpret the features of object oriented programming and basic structure of C++ program.
2. Design Object Oriented programming principles using object and class properties.
3. Implement method re-usability techniques and operator overloading using C++.
4. Determine the usage of pointers and method overriding in C++ applications.
5. Develop applications with advanced concepts like files, templates and exceptions.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	2	1									
2	1	2	1		1									
3	2	2	2		1									
4	2	2	2		1									
5	1	2	2		1									

UNIT I **8 Hours**

INTRODUCTION

Object-Oriented Programming - Procedural Languages vs. Object oriented approach - Characteristics of OOPs - Introduction of C++ - The Need for C++ - Basic Program Construction - Output using Cout - Input with Cin - Basic Data Types in C++ - Variables - Operators - Control Statements - Functions

UNIT II **9 Hours**

OBJECT AND CLASSES

Introduction to Classes - Class Definition - Classes and Objects - Access specifiers - Private, Public and Protected members - Member Functions of a Class - Constructor and Destructor - Passing and Returning Objects

UNIT III **10 Hours**

OVERLOADING AND INHERITANCE

Need for Function Overloading - Operator Overloading - Defining operator overloading - Unary Operator over loading - Binary Operator overloading - Inheritance - Derived and Base Class - Types of Inheritance

UNIT IV **10 Hours**

VIRTUAL FUNCTION AND POINTER

Virtual Function - Virtual Base Classes - Abstract Classes - Virtual Functions - Pure Virtual Functions - Pointer - The Pointer Operators - Assign a value and address to a Function Pointer - Calling a Function using a Function Pointer - Pass a Function Pointer as an Argument

UNIT V **8 Hours**

FILE STREAMS, TEMPLATES AND EXCEPTION HANDLING

File streams - Streams - String I/O - Character I/O - Function templates - Class templates - Exception Handling - Multiple exceptions

FOR FURTHER READING

Array of Objects - Inline functions - Friend function - Static Function - this Pointer

Total: 45 Hours

Reference(s)

1. Robert Lafore, "Object Oriented Programming in C++", Galgotia Publication, 2010.
2. E.Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill Publishing, New Delhi, 2011.
3. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2010.
4. H.M Deitel and P.J Deitel, "C++ How to Program", Seventh Edition, Prentice Hall, 2010.
5. Herbert Schildt, "C++: The Complete Reference", Fourth Edition, Tata McGraw-Hill, 2010.
6. K.R. Venugopal, Rajkumar and T.Ravishankar, "Mastering C++", Tata McGraw Hill Publishing, New Delhi, 2010.

18IT0YE ARTIFICIAL INTELLIGENCE 3 0 0 3

Course Objectives

- To understand and explain the basics of Artificial Intelligence.
- To improve problem solving techniques, knowledge representation and reasoning systems capability.
- To gain knowledge for developing Expert systems.

Course Outcomes (COs)

1. Solve various practical problems using Artificial Intelligence techniques.
2. Apply AI problem solving techniques, knowledge representation, and reasoning methods in Knowledge based systems.
3. Identify the appropriate solution/decision under uncertainties.
4. Develop simple intelligent system using available tools and techniques of AI to analyze and interpret domain knowledge
5. Develop expert system for various applications.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		2		1								
2		3	2	2		2								
3		2	3	3		2								
4		2	3	2	2						2			
5		3	2	3	2	1					2			

UNIT I **11 Hours**

INTRODUCTION

Introduction - Foundation and history of AI. AI Problems and techniques - AI programming languages- Introduction to LISP and PROLOG-Problem spaces and searches -Blind search strategies; Breadth first - Depth first-Heuristic search techniques Hill climbing - Best first-A* algorithm AO* algorithm - game trees Minimax algorithm - Game playing -Alpha beta pruning.

UNIT II **8 Hours**

KNOWLEDGE REPRESENTATION

Knowledge representation issues-Predicate logic-logic programming-Sematic nets - Frames andinheritance - constraint propagation-Representing Knowledge using rules- Rules based deduction system.

UNIT III **9 Hours**

REASONING UNDER UNCERTAINTY

Introduction to uncertain knowledge review of probability- Baye's Probabilistic inferences and Dempster Shafer theory-Heuristic methods-Symbolic reasoning under uncertainty- Statistical reasoning-Fuzzy reasoning-Temporal reasoning- Non monotonic reasoning.

UNIT IV **9 Hours**

PLANNING AND LEARNING

Planning - Introduction, Planning in situational calculus - Representation for planning-Partial orderplanning algorithm- Learning from examples- Discovery as learning-Learning by analogy-Explanation based learning-Introduction to Neural nets-Genetic Algorithms.

UNIT V **8 Hours**

APPLICATIONS

Principles of Natural Language Processing Rule Based Systems Architecture - Expert systems- Knowledge acquisition concepts -AI application to robotics -Current trends in Intelligent Systems.

FOR FURTHER READING

Ant colony Optimization, Particle Swam Optimization, Artificial Neural Network.

Total: 45 Hours

Reference(s)

1. Patrick Henry Winston,Artificial Intelligence, Addison Wesley, Third edition, 2000.
2. George F Luger, Artificial Intelligence, Pearson Education, 6th edition, 2009.
3. Engene Charniak and Drew Mc Dermott,Introduction to Artificial intelligence, Addison Wesley 2000.
4. Nils J. Nilsson,Principles of Artificial Intelligence, Narosa Publishing House, 2000.

18GE0XA ETYMOLOGY 1 0 0 1

Course Objectives

- To increase vocabulary and enhance use, knowledge, and understanding of the English language.
- To stimulate an appreciation for the English language, including how it developed, how new wordsenter the language, and how it continues to be dynamic.
- To demonstrate the importance of a broad-based vocabulary for effective oral and written communication.

Programme Outcomes (POs)
Course Outcomes (COs)

1. Examine prefixes, roots, and suffixes of Latin, Greek, Germanic, and Anglo-Saxon origin.
2. Explore the historical aspects of language, including the infusion of Indo-European languages, semantic changes, and the influence of world events.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2					
2									2					

UNIT I **7 Hours**

CONVENTIONS

Acronyms, Abbreviations, Initialises, Jargon Neologisms - Idiomatic Expressions, Euphemisms Spoonerisms Malapropisms ; Mondegreens - Words Derived from Latin - Words Derived from Greek - Words Derived from - Germanic/Anglo-Saxon - Abstract word Acronym - Affix Analogy - Antonym Apheresis - Blend word Assimilation - Colloquial language Clipped word

UNIT II **8 Hours**

WORD ANALYSIS

Concrete word Derivative - Dialect Diminutive suffix - Dissimilation Doublet - Etymology Euphemism - Figurative word Homonym - Hybrid word Inflection - Informal language Infusion - Jargon Linguistics - Loan words Metathesis ; Modify - Philology Onomatopoeia - Romance language Prefix - Semantics - Root-base word - Suffix Slang - Word component Synonym

Total: 15 Hours

Reference(s)

1. Norman, Lewis. Word Power Made Easy, Goyal Publisher. Edition 2. 2014.
2. C T Onions. The Oxford Dictionary of English Etymology, Volume 11, Issue 1.70, Wynford Drive, Don Mills, Ont, Oxford University Press.1965.
3. Nurnberg W, Maxwell and Rosenblum, Morris, How to build a better Vocabulary, Completely Revised and Updated, Popular Library. 1961.

18GE0XB GENERAL PSYCHOLOGY 1 0 0 1

Course Objectives

- To provide a basic understanding of psychology.
- Defining Psychology and the subject matter of psychology.
- To provide an awareness of various methods and branches of psychology.
- To explain social and work psychology of people and the need for mental health.

Course Outcomes (COs)

1. Understand the basics of human behavior in the workplace and society at large.
2. Understand the different fields of psychology and its uses.
3. Deal people effectively in their personal and social life.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									1	1				
2									2			2		
3										2				

UNIT I **15 Hours**

GENERAL PSYCOLOGY

Psychology - Introduction - Mind body relationship - Methods and Scope of Psychology -Motivation- Types of Needs- Motivational Cycle- Intelligence: Concept of Intelligence and IQ- measurement - Social psychology: individual behavior and group behavior - Group dynamics- group formation- social influence- social cognition, stereotypes- prejudice- discrimination - Definitions, formation of attitude, factors of attitude formation-change of attitude.

Total: 15 Hours

Reference(s)

1. Atkinson & Atkinson, Introduction to Psychology, 6th Ed McGraw-Hill Publications. 1975
2. Mishra, B. K, Psychology: The study of human behavior, 2nd Ed New Delhi: Prentice Hall of India Learning Pvt. Ltd. 2016.
3. Baron, R.A., Branscombe. N.R, Social Psychology, 14th Ed. New Delhi; Pearson Education. 2016
4. Morgan, C.T., King, R.A., Weisz, J.R., & Schopler, J. Introduction to Psychology, 7th Ed. New Delhi: Tata McGraw Hill. 1993

18GE0XC NEURO BEHAVIORAL SCIENCE 1 0 0 1

Course Objectives

- To provide an introduction to the Cognitive Neuro Science of languages.
- To provide an understanding of the Cognitive processes.

Course Outcomes (COs)

1. Identify the psychological problems that will impact mental health.
2. Value ethical conduct in professional and personal life.
3. Recognize the need for rationale and evidence in decision-making.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									1					
2									2					
3									3					

UNIT I **15 Hours**

NEURO BEHAVIOURAL SCIENCE

Introduction to physiology - Anatomy - Neuro Biology - Psycho Neuro Science Behaviour and Hormones - Behaviour Modifications - Relaxation Therapy - Psycho Education for minds

Total: 15 Hours

Reference(s)

1. Beck, Robert. Handbook of Physiology. Vol I. Oxford University Press March 15,1996
2. Horon C Philip. Sexology and Mind. Academic Press. 1993
3. Blatteis M.Clark and Melvin J. Fregly. Handbook of Physiology Sect 4, Oxford University Press. March 15, 1996

18GE0XD VISUAL MEDIA AND FILM MAKING 1 0 0 1

Course Objectives

- To acquire fundamental knowledge on development of filmmaking as an art
- To provide students a basic understanding of the techniques and nuances of visual medium
- To inculcate an ability to plan and produce a short film

Course Outcomes (COs)

1. Understand the significance and techniques of visual medium
2. Analyse and produce visual clippings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1												
2						2								

UNIT I **15 Hours**

ART OF FILMMAKING

History of Cinema (Origin and Narrative) Cinema as a visual medium -Significance of Editing Styles of Editing Editing as a methodology (Hollywood s Invisible Editing) Technical Aspects of Editing (Final Cut Pro (FCP), AVID and Premire Pro) - Basics of video production (pre-production to post-production) Different types of shots and angles - Film style and Narrative (Italian Neo-realism, Avant Garde, Russain Formalism, Alternative Cinema etc.,) Regional Cinema to National Cinema Basics of Script Writing (Double and Single Column) Basics of Video Production (script to screen) Final submission of a script for five minutes short film

Total: 15 Hours

Reference(s)

1. Monaco, James, How to Read a Film: Movies, Media, and Beyond. Auckland: OUP, 2009.
2. Belavadi, Vasuki, Video Production. India: OUP, 2013.

18GE0XE YOGA FOR HUMAN EXCELLENCE 1 0 0 1

Course Objectives

- To know about the history and schools of yoga
- To know the difference between supreme consciousness and individual consciousness
- To apply the knowledge by the way of practice and introspection

Programme Outcomes (POs)

Course Outcomes (COs)

1. Understand the historical aspects and schools of yoga
2. Ensure their physical & mental wellness through yoga practice
3. Develop the power to concentrate and have stress free mind

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									1					
2									2					
3									2					

UNIT I **15 Hours**

YOGA FOR HUMAN EXCELLENCE

What is Yoga , History of Yoga - Yoga in todays scenario- Schools of Yoga - Eight Limbs of Yoga - Sathvic, Rajasic, Tamasic Foods and Thoughts - Science of Yoga Loosening Exercises - Yogasanas & Benefits - Super Brain Yoga - Surya Namaskar Standing Asanas - Sitting Asanas - Prone Asanas - Supine Asanas - MudrasRelaxation - Pranayama - Meditation

Total: 15 Hours

Reference(s)

1. Vethathiri Publications, Yoga Practices-2, Erode, 2012.
2. Iyengar B.K.S. Yoga: Wisdom & Practice, B.K.S. Iyengar, 2009.
3. Ramesh Partani, The Complete Secret, Ru Education, 2013.
4. http://www.sarvyoga.com/
5. http://www.wikihow.com/Do-Superbrain-Yoga

18GE0XF VEDIC MATHEMATICS 1 0 0 1

Course Objectives

- To improve their calculation speed, analytical thinking and numerical skills

Programme Outcomes (POs)
Course Outcomes (COs)

1. Solve problems creatively in mathematics and its applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2													

UNIT I **15 Hours**

VEDIC MATHEMATICS

Addition- Subtraction- System of Multiplication- Squaring numbers- Cube roots- Square roots- Solution of simultaneous equations- Solutions of Quadratic equations

Total: 15 Hours

Reference(s)

1. Dhaval Bathia, Vedic Mathematics, JAICO Publishing House, 29th Edition, Mumbai, 2014
2. Jagadguru Swami Sri Bharathi Krsna Tirthaji Maharaja, Vedic Mathematics, Motilal Banarsidass Publishers Private Limited, New Delhi, 1997

18GE0XG HEALTH AND FITNESS 1 0 0 1

Course Objectives

- To understand the fundamental concepts about physical fitness & its types, training and assessment of physical fitness

Course Outcomes (COs)

1. Acquire the knowledge and training of the individual physical, mental and social concepts
2. Understand the fundamental concepts of yogic practice and physical fitness
3. To acquire the knowledge about nutrition and health consciousness

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1												1		
2												2		
3												2		

UNIT I **5 Hours**

FITNESS

Meaning & Definition, Need & importance of Physical fitness, Types Physical fitness - Exercise, Training and Conditioning and it is important

UNIT II **5 Hours**

YOGA AND MEDITATION

Meaning and definition; Principles of practicing;Basic Asana and it important; Pranayama and Meditation - Relaxation Techniques

UNIT III **5 Hours**

NUTRITION AND BALANCE DIET

Nutrition and Balance Diet: Needs and Important, Significant of Nutritional Food - Tips for balance diet. Common Diseases for IT professionals: Common diseases - cause prevention-First aid for common sports injuries.

Total: 15 Hours

Reference(s)

1. Anderson, Bob., Pearl, Bill.,&Burke, Edmund R., (2001). Getting in Shape Workout Programs for Men&Women. Mumbai: Jaico Publishing House
2. Baechle, Thomas. R, & Earle, Roger. W., (2000). Essentials of Strength Training and Conditioning. Champaign: Human Kinetics
3. Iyengar, BKS., (2003). The Art of Yoga. New Delhi: Harper Collins Publishers
4. Singh, Hardayal, (1995). Science of Sports training. New Delhi: D.V.S. Publications
5. Begum, Raheena. M., (2002). A Textbook of Foods, Nutrition and Dietetics. New Delhi: Sterling Publishers Private Limited

18GE0XH CONCEPT, METHODOLOGY AND APPLICATIONS OF VERMICOMPOSTING

1 0 0 1

Course Objectives

- To understand the importance of safe methods of treating solid wastes generated through various human activities
- To appreciate the skills / devices / practices associated with the compact proceedures of biodegradation of unwanted solid residues

Course Outcomes (COs)

1. Understand the role of recycling of garbage leading to the sustenance of our healthand environment.
2. Recognize the organic farming practices and production of healthy food products.
3. Prepare and maintain tips for small scale compost units and thereby becoming more environmentally conscious

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1														
2														
3														

UNIT I **15 Hours**

VERMICOMPOSTING TECHNOLOGY

Ecological roles and economic importance of earthworms - need for earthworm culture, scope and importance of vermiculture , limiting factors - types of worm culturing and the relative benefits Small scale and commercial methods: process & advantages , Vermicomposting equipments, devices, Design and maintenance of vermi bed - Products from vermiculture (matter & humus cycle), vermicastings in organic farming/horticulture - Marketing the products of vermiculture quality control, market research, marketing techniques , Applied vermiculture: use of urban solids & farm/ industrial residues for vermicomposting - Constraints of vermiculture and its future perspectives Artificial Earthworm as a standalone biodegradation assembly.

Total: 15 Hours

Reference(s)

1. Sultan Ahmed Ismail, 2005. The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.4
2. Vermiculture Technology; Earthworms, Organic Wastes and Environmental Management, 2011, Edited by Clive A Edwards, Norman Q Arancon & Rhonda Sherman, CRC Press
3. www.organicgrowingwithworms.com.au
4. New York Times , Scientists Hope to Cultivate and Immune System for Crops

18GE0XI BLOG WRITING 1 0 0 1

Course Objectives

- To sharpen and improve writing skills, including draft writing, voice, and format.
- To develop general and global knowledge.
- To experiment with non-written forms of online communications, including images, audio and video.
- To be able to add content to your website without the assistance of a web designer.

Course Outcomes (COs)

1. Understand the flow of language in natural manner.
2. Understand the elements of a blog and be able to use them effectively.
3. Find a niche for a long-term blog.
4. Gain insight into the strategies, methods and writing of successful bloggers.
5. Develop their creative thinking.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										1				
2										1				
3						2								
4							2							
5														

UNIT I **7 Hours**

UNIT I

Concept: What is blog writing? Types of blog posts -personal experience, opinion, reviews, advice, news/updates. Focusing your blog - concept, audience, uniqueness, posts. Company blogs. Structure: Types of structure - inverted pyramid, feature article, list, story, other options. Creating effective openings. Planning a post.

UNIT II **8 Hours**

UNIT II

Voice: Defining and achieving voice. Exploring various voices. Stylistic tipsÃƒÂ¢??rhythm, verbs, interesting words, senses, emphasis. Smartness and sarcasm. Reliability - accuracy, provability, specificity. Transparency about payments. Sample Blogs and Activities

Total: 15 Hours

Reference(s)

1. The Elements of Blogging: Expanding the Conversation of Journalism, by Mark Leccese and Jerry Lanson. (Taylor & Francis, 2015) ISBN: 978-1-13-802154-9. $29.95 paperback.
2. Blogging Heroes, by Michael Banks. Choose 15 of the 30 interviews/profile segments to read, be sure to include the segments on Chris Anderson and Brian Lam.
3. Complete Guide to Blogging, Huffinghton Post

18GE0XJ INTERPERSONAL SKILLS 1 0 0 1

Course Objectives

- To communicate and work effectively, both individually and in groups
- To be able to understand and manage ones own and others emotions
- To define and solve problems by making decisions about the best course of action

Course Outcomes (COs)

1. Express themselves clearly and confidently
2. Listen to others completely and with empathy
3. Assert an opinion without diminishing others opinion
4. Be responsible and timely with a willingness to collaborate
5. Develop innate personality traits to handle certain social situations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										1				
2										2				
3										2				
4										2				
5												2		

UNIT I **7 Hours**
INTRODUCTION
Conversational Skills - Active Listening - Team working Empathy - Emotional Intelligence

UNIT II **8 Hours**
SKILLS
Conflict Resolution and Mediation skills - Decision making and Problem Solving - Negotiation and Persuasion skills

Total: 15 Hours

Reference(s)

1. Stephen P. Robbins, Phillip L. Hunsaker, Training in Interpersonal Skills, Pearson, 2015
2. Robert B. Cialdini, Influence: The Psychology of Persuasion, Harper Business; Revised Edition, 2006
3. Suzanne C De Janasz, Karen O Dowo & Beth Z Schneder, Interpersonal Skills in Organisations, McGraw-Hill Education; 5th Edition, 2014

18GE0XK NEW AGE INNOVATION AND ENTREPRENEURSHIP

1 0 0 1

Course Objectives

- Understand the role of National Service Scheme in community
- Identify the needs and problems of the community and involve in problem solving
- Develop competence required for group living and acquire leadership qualities

Course Outcomes (COs)

1. understand the community in which they work and render their service
2. develop among themselves a sense of social and civic responsibility

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2					
2											2			

UNIT I **15 Hours**

COMMUNITY SERVICE AND LEADERSHIP DEVELOPMENT

Introduction and Basic Concepts of NSS: History-philosophy-aims & objectives of NSS- Emblem, flag, motto, song, badge- Organizational structure Ã¢?? roles and responsibilities functionaries. NSS Programmes and Activities: Concept of regular activities, special camping, DayCamps-Basisofadoption of village/slums-Methodology of conducting Survey -Financial pattern ofthescheme -Coordination withdifferent agencies-Maintenance oftheDiary. Community Mobilization: Mapping of community stakeholders-Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization-Youth-adult partnership.Health, Hygiene & Sanitation: Definition, needs and scope of health education- Food and Nutrition - Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan). Entrepreneurship Development: Definition & Meaning - Qualities of good entrepreneur - Steps/ways in opening an enterprise -Role of financial and support service Institutions.

Total: 15 Hours

Reference(s)

1. A Hand book on National Service Scheme, Anna University, Chennai, 2012
2. http://nss.nic.in/intro.asp
3. Delgado-Gaitn and Concha, The Power of Community: Mobilizing for Family and SchoolingNew York: Rowman & Littlefield Publishing, Inc. 2001
4. James Bailey,Guide to Hygiene and Sanitation in Aviation, World health organization, 2nd edition. 1980
5. AnuradhaBasu, Mark Casson, Nigel wadeson and Bernard Yeung, The oxford hand book of entrepreneurship, Oxford Press. 2009

18GE0XL NATIONAL CADET CORPS 1 0 0 1

Course Objectives

- To understand the importance of NCC and its organization.
- To realize the skills in the applications of drill and weapon training.
- To analyze the factors in National unity
- To identify the utility of smart materials in engineering applications.

Course Outcomes (COs)

1. Recall the motto and aim of NCC.
2. Implement synergy in disaster management.
3. Execute an example patriotic leader to serve nation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1							2		2					
2							1		2					
3							1		2					

UNIT I **7 Hours**

NCC STRUCTURE AND TRAINING

NCC ORGANIZATION

National Cadet Corps: Aim and Objectives - Administrative and Organizational pattern - NCC flag and NCC song - Duties, Responsibilities and Conduct by NCC Cadets - Badges of ranks in NCC and Armed forces- Types of NCC camps - Eligibility conditions for writing B and C certificate examinations. Cadet welfare society and Career opportunities for NCC cadets.

DRILL AND WEAPON TRAINING

Drill: Aims of drill - Types of drill - Foot drill, Arms drill and Ceremonial drill. Word of commands, Guard of honour. Weapon training - Rifles used in NCC: Parts and Characteristics of 0.22 and INSAS - Stripping, Assembling and Cleaning of weapons.

NATIONAL INTEGRATION AND SOCIAL AWARENESS

National Integration: Introduction - Constitution of India- Importance and Necessity - Factors affecting National integration - Role of NCC in National integration. Social service and its need - Rural development programs - NGOs role and Contribution - Social Security schemes.

UNIT II **8 Hours**

PERSONALITY DEVELOPMENT AND LEADERSHIP

PERSONALITY DEVELOPMENT AND LEADERSHIP

Personality Development: Introduction - Factor influences in personality development. Leadership: Leadership traits and Skills - Indicator of good leader - Honour code concept - Type of leaders - Case studies of effective leader.

DISASTER MANAGEMENT AND FIRST AID

Disaster types - Natural and Manmade disasters. Role of NCC cadets in disaster management. Civil defence: Civil defence measures - Civil defence services. First aid: First aid kits and Equipments - First aid for snake bite, Sun stroke and Drowning - Respiration -Types of respiration.

Total: 15 Hours

Reference(s)

1. Cadets Hand book Common subject, DG NCC, New Delhi.
2. Cadets Hand book Special subject, DG NCC, New Delhi
3. Misra R.C and Sanjaykumar Mishra, A HAND BOOK OF NCC(English), Kanti Prakashan, 2016
4. Gupta R. K, NCC: Handbook of NCC Cadets for A, B and C Certificate Examinations (English) RPH Editorial Board, 2018.

18GE0XM COMMUNITY SERVICE AND LEADERSHIP DEVELOPMENT

1 0 0 1

Course Objectives

- To make the participants understand as to how to get along with the task of setting independent business units and on the various facets of running a business
- To get the budding young entrepreneurs to appreciate the structured knowledge of the dynamics of operationalizing a business opportunity

Course Outcomes (COs)

1. Understanding entrepreneurship as an important career option
2. Concept and methodology of idea translation to viable start-ups
3. Events to occur in the building of a technology based venture for students or working professionals or women
4. Overview of Indian trends in the start-up scene

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1											1			
2										2				
3		2												
4											2			

UNIT I **15 Hours**

NEW AGE INNOVATION AND ENTREPRENEURSHIP

Introduction to Entrepreneurship - Opportunity Identification ideation -MVPPositioning as an Entrepreneur Starting own Business - Developing Effective Business Model - Industry and Competitor Analysis - Building Business PlanMentoring Session with Investors- Legal and Ethical Foundation for Startup. Types of startups and licensing systems - MSME -Evaluating the Financial Strength of a New Venture/Project - Getting Funding - Types of Sources VCs, Angel funding, PE etc. -Marketing Strategies for New Ventures - IT Systems - IPR - Strategies for New Venture Growth - Talent Acquisition and Management for New Ventures - Valuation Challenge in Entrepreneurship - Intrapreneurship Sustainability - Exit strategies and Start-up trends in India.

Total: 15 Hours

Reference(s)

1. Kathleen R. Allen, Launching New Ventures, South-WesternCengage Learning, 6th Edition, 2012
2. Alex Osterwalder and Yves Pigneur, Business Model Generation, publishedby the authors, 2010
3. Branson. R. Business stripped bareNew York, Penguin books, 2011
4. Moris MH, Kuratko DF and Covin JG, Corporate entrepreneurship and innovation, 3 edition, Mason, Oh; CENGAGE/SOUTH WESTERN publisher, 2011

18GE0XN DISRUPTIVE INNOVATION BASED STARTUP ACTIVITIES

1 0 0 1

Course Objectives

- To make the participants understand as to how to get along with the task disruption led innovations.
- To get the budding young entrepreneurs to appreciate the structured knowledge of the dynamics of operationalizing creativity based disruption strategy

Course Outcomes (COs)

1. Understanding contemporary entrepreneurship as an important career option
2. Concept and methodology of creative disruption to viable start-ups
3. Events to occur in the building of a technology based venture for students or working professionals or women with disruptive technology option
4. Overview of Indian trends with reference to disruptive innovation based start-ups

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1										1				
2											1			
3												2		
4												2		

UNIT I **15 Hours**

DISRUPTIVE INNOVATION

Creativity linked innovation Ã¢?? Differences between Disruptive & incremental Innovations - Historical, theoretical, and practical evolution of disruptive innovation (DI). - Idea generation & communication of creativity leading to DI. Innovation management concepts in DI based entrepreneur generation - How do firms bring in new business models and get new products and services to the market? Investor preferences in core versus new or disruptive business models - disruptors and the disrupted frameworks for assessing company"s capabilities and rethinking product, market and strategy - Right customers for DI: strategy in a world that is changing so rapidly Application of disruptive theories to complex problems and opportunities.

Total: 15 Hours

Reference(s)

1. https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1540-5885.2005.00177.
2. http://www.brinq.com/workshop/archives/2005/01/08/what-is-disruptive-innovation
3. https://hbr.org/2006/12/disruptive-innovation-for-social-change

18GE0XO SOCIAL PSYCHOLOGY 1 0 0 1

Course Objectives

- To provide a basic understanding of social psychology.
- Defining psychological & physical changes during puberty age.
- To provide an awareness of various psychological problems and social problems.
- To explain social and work psychology of people and the need for mental health.

Course Outcomes (COs)

1. Understand the basics of human behavior in the workplace and society at large
2. Understand the various psychological, physical, social problems and management skills.
3. Deal people effectively in their personal and social life.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1									2					
2									2					
3									3					

UNIT I **7 Hours**

INTRODUCTION

Introduction - Ice breaker - Time Line - Tasks and Challenges of the age(Erik Erikson)Physical changes - Introduction to Reproductive Health - Reproductive Organs - Menstruation - Changes during Puberty - Abortions - Contraception - Difference between Sex and Gender - Introduction to the origins of Patriarchy - Gender.

UNIT II **8 Hours**

PSYCHOLOGY

Developmental changes - Attraction - Friendship - Differences and Similarities - Images of Beauty and Body Image -Introduction to Media-Feedback - Sexuality - Boundaries Relationships - Marriage - Love - Emotional Health - Sexual Abuse and Safety - Role of Media - Abortions, Contraception, Wrapping up the Course.

Total: 15 Hours

Reference(s)

1. Baron, R. A.,Branscombe.N.R.(2016).Social Psychology,14th Ed. New Delhi;Pearson Education
2. Morgan,C.T., King,R.A.,Weisz,J.R.,&Schopler,J.(1993). Introduction to Psychology,7th Ed.New Dehi:Tata McGraw Hill.