B.E. (Computer Science and Engineering)

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, NAAC with 'A' Grade and ISO 9001:2008 Certified)

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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 VI as and when these courses are offered. A student will also be permitted to register the **one-credit courses** offered by other Departments, provided the student has fulfilled the necessary pre- requisites or the courses that may not require any pre-requisites. Under no circumstances, the same one credit course shall be repeated in subsequent semesters in any Department / Centre for the same batch of the students and a maximum batch size for a given course shall not exceed 40. In case of disciplines with multiple divisions (intake more than 60) different course(s) shall be offered to other batch(es) of students.

On successful completion of one credit courses, credits will be indicated in the grade sheet as "Additional credits earned", but will not be considered for computing the Semester Grade Point Average (SGPA)/ Cumulative Grade Point Average (CGPA).

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

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

3.9 **Industrial Training / Internship**

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

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

3.10 **Socially Relevant Projects**

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

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

4. VALUE ADDED COURSES

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

5. DURATION OF THE PROGRAMME

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

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

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

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

6. COURSE ENROLLMENT AND REGISTRATION

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

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

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

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

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

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

6.4 Flexibility to Add or Drop courses

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

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

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

6.5 Reappearance Registration

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8. FACULTY ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty member of the Department who shall function as Faculty Advisor for those students. The Faculty Advisor shall advise and guide the students in registering of courses, reappearance of courses, monitor their attendance and progress and counsel them periodically. The Faculty Advisor also discusses with or informs the parents about the progress / performance of the students concerned.

The responsibilities of the faculty advisor shall be:

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

9. COMMITTEES

9.1 Common Course Committee

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

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

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

9.2 Class Committee Meeting

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

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

10. SYSTEM OF EXAMINATION

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

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

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

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

11. PASSING REQUIREMENTS AND PROVISIONS

11.1 The Passing requirement for a student in a course is determined based on the marks obtained both in Continuous Assessment and End Semester Examinations. If the student gets <50% of marks in End Semester Examination, then the student will be awarded only RA (Reappearance) grade. A student who earns a minimum of 6 grade points in a course is declared to have successfully passed the course.

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'.

If a student fails to secure a pass in theory courses in the current semester examination, he/she is allowed to write arrear examinations for the next three consecutive semesters and their internal marks shall be carried over for the above mentioned period of three consecutive semesters. If a student fails to secure a pass in a course even after three consecutive arrear attempts, the student has to repeat the course in the semester in which it is offered along with regular students. That is, the students should have successfully completed the courses of (n minus 4)th semester to register for courses in nth semester.

Based on the above, the following prerequisites shall be followed for completing the degree programme:

i. To enter into Semester V, the student should have no arrear in Semester I. Failing which the student shall repeat the Semester I course/courses along with the regular students.

ii. To enter into Semester VI, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.

iii. To enter into Semester VII, the student should have no arrear in Semester III. Failing which the student shall redo the Semester III course/courses along with the regular students.

iv. To enter into Semester VIII, the student should have no arrear in Semester IV. Failing which the student shall redo the Semester IV course/courses along with the regular students.

v. In case, if he/she has not successfully completed all the courses of semester V at the end of semester VIII, he/she shall redo the Semester V courses along with regular students. For the subsequent semesters of VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

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

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

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

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

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

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

12. ASSESSMENT AND AWARD OF LETTER GRADES

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

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

12.3 Condition for Relative Grading

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

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

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

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

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

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

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

$$SGPA/CGPA = \frac{\sum_{1}^{n} C_i * g_i}{\sum_{1}^{n} C_i}$$

Where

C_i : Credit allotted to the course.

g_i : Grade Point secured corresponding to the course.

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

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

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

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

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

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

12.10 **Eligibility for the Award of Degree**

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

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

13. CLASSIFICATION OF THE DEGREE AWARDED

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

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

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

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

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

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

14. WITHDRAWAL FROM THE EXAMINATION

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

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

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

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

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

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

15. AUTHORIZED BREAK OF STUDY FROM A PROGRAMME

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

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

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

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

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

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

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

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

16. SCHEME OF ASSESSMENT

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

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (10)	
	Periodical Test II (10)	
	Innovative Practices (30)	
	End Semester Examination	**50**
	Total Marks	**100**
II	**THEORY COURSES WITH LAB COMPONENT**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (10)	
	Periodical Test II (10)	
	Innovative Practices (30)	
	(Laboratory Assessment & Report)	
	End Semester Examination (QP pattern as per (I))	**50**
	Total Marks	**100**
III	**LABORATORY COURSES**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Conduct of Experiment	
	i. Preparation (20)	
	ii. Experiment and Analysis of Results (20)	
	iii. Record (10)	
	Test – Cycle I (25)	
	Test – Cycle II (25)	
	Total Marks	**100**
IV	**PROJECT WORK I**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Literature Survey (5)	
	Identification of topic and Justification (5)	
	Work plan (10)	
	Review II	
	Approach & Results (15)	
	Conclusion (15)	

	End Semester Examination	**50**
	Report# (20)	
	Presentation (20)	
	Viva voce (10)	
	Total Marks	**100**
V	**PROJECT WORK II**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Progress (10)	
	Review II	
	Approach & Results (10)	
	Review III	
	Conclusion & Final Presentation (10)	
	Report (15)	
	Publication of Paper in Conferences / Journals (5)	
	End Semester Examination	
	Presentation (30)	**50**
	Viva voce (20)	
	Total Marks	**100**
VI	**LANGUAGE ELECTIVE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test 1	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Test 2	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Oral Exam	**50**
	Total Marks	**100**
VII	**ONE-CREDIT COURSE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test I	**50**
	Quiz/ Assignment	**50**
	Total Marks	**100**

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

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

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

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

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

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

17. FIELD / INDUSTRIAL VISIT / INTERNSHIP

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

18. PERSONALITY AND CHARACTER DEVELOPMENT

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

19. DISCIPLINE

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

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

20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To perform well in their professional career by acquiring knowledge in the domain of Computer Science and Engineering.

PEO2. To improve communication skills, follow professional ethics and involve in team work in their profession.

PEO3. To update with evolving technology and use it for career advancement.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **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.

PO3. **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.

PO4. **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.

PO5. **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.

PO6. **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.

PO7. **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.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **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.

PO11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and multidisciplinary environments.

PO12. **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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

PSO2. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

MAPPING OF PEOs, POs and PSOs

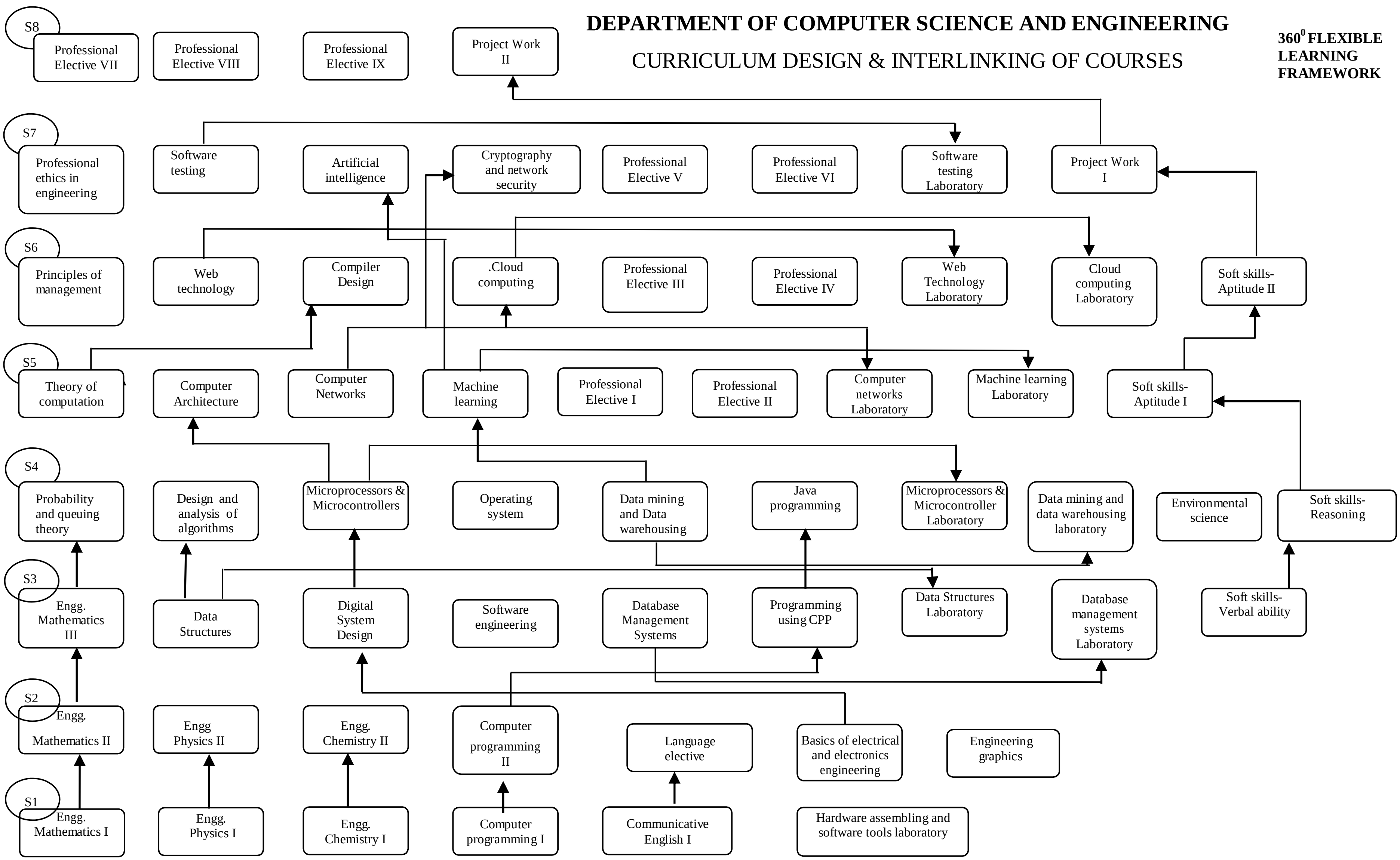
POs	a	b	c	d	e	f	g	h	i	j	k	l	PSO1m	PSO2n
PEO1	X	X	X	X	X	X	X						X	X
PEO2								X	X	X	X			
PEO3												X	X	X

CONNECTIVITY CHART

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM DESIGN & INTERLINKING OF COURSES

360^0 FLEXIBLE LEARNING FRAMEWORK



B.E. COMPUTER SCIENCE AND ENGINEERING

REGULATION 2018

Minimum Credits to be Earned : 171

I SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
18CS101	Engineering Mathematics I	3	1	0	4	4	50	50	100	BS
18CS102	Engineering Physics I	2	0	2	3	4	50	50	100	BS
18CS103	Engineering Chemistry I	2	0	2	3	4	50	50	100	BS
18CS104	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
18CS106	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	
18CS201	Engineering Mathematics II	3	1	0	4	4	50	50	100	BS
18CS202	Engineering Physics II	2	0	2	3	4	50	50	100	BS
18CS203	Engineering Chemistry II	2	0	2	3	4	50	50	100	BS
18CS204	Computer Programming II	2	0	2	3	4	50	50	100	ES
	Language Elective	1	-	2	2	3	100	0	100	HS
18CS206	Basic Electrical and Electronics Engineering	2	0	2	3	4	50	50	100	ES
18CS207	Engineering Graphics	1	0	4	3	5	100	0	100	ES
Total		**13**	**1**	**14**	**21**	**28**				**-**

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CS301	Engineering Mathematics III	3	1	0	4	4	50	50	100	BS
18CS302	Data Structures	3	0	0	3	3	50	50	100	PC
18CS303	Digital System Design	3	0	2	4	5	50	50	100	ES
18CS304	Software Engineering	3	0	0	3	3	50	50	100	PC
18CS305	Database Management Systems	3	0	0	3	3	50	50	100	PC
18CS306	Programming Using CPP	2	0	2	3	4	50	50	100	PC
18CS307	Data Structures Laboratory	0	0	4	2	4	100	0	100	PC
18CS308	Database Management Systems Laboratory	0	0	4	2	4	100	0	100	PC
18GE301	Soft Skills - Verbal Ability	2	0	0	0	2	100	0	100	EEC
Total		**19**	**1**	**12**	**24**	**32**				**-**

IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CS401	Engineering Mathematics IV	3	1	0	4	4	50	50	100	BS
18CS402	Design And Analysis of Algorithms	3	1	0	4	4	50	50	100	PC
18CS403	Microprocessors And Microcontroller	3	0	0	3	3	50	50	100	ES
18CS404	Operating System	3	0	0	3	3	50	50	100	PC
18CS405	Data Mining and Data Warehousing	3	0	0	3	3	50	50	100	PC
18CS406	Java Programming	2	0	2	3	4	50	50	100	PC
18CS407	Microprocessors and Microcontroller Laboratory	0	0	4	2	4	100	0	100	ES
18CS408	Data Mining and Data Warehousing Laboratory	0	0	4	2	4	100	0	100	PC
18HS001	Environmental Science	2	0	0	0	2	100	0	100	HSS
18GE401	Soft Skills – Reasoning	2	0	0	0	2	100	0	100	EEC
Total		**21**	**2**	**10**	**24**	**33**				**-**

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CS501	Theory of Computation	3	1	0	4	4	50	50	100	ES
18CS502	Computer Architecture	3	0	0	3	3	50	50	100	PC
18CS503	Computer Networks	3	0	0	3	3	50	50	100	PC
18CS504	Machine Learning	3	0	0	3	3	50	50	100	PC
	Professional Elective I	-	-	-	3	3	50	50	100	PE
	Professional Elective II	-	-	-	3	3	50	50	100	PE
18CS507	Computer Networks Laboratory	0	0	4	2	4	100	0	100	PC
18CS508	Machine Learning Laboratory	0	0	4	2	4	100	0	100	PC
18GE501	Soft Skills - Aptitude I	0	0	2	0	2	100	0	100	EEC
Total		**12**	**1**	**10**	**23**	**29**				**-**
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HS003	Principles of Management	2	0	0	2	2	50	50	100	HSS
18CS602	Web Technology	3	0	0	3	3	50	50	100	PC
18CS603	Compiler Design	3	1	0	4	4	50	50	100	PC
18CS604	Cloud Computing	3	0	0	3	3	50	50	100	PC
	Professional Elective III	-	-	-	3	3	50	50	100	PE
	Professional Elective IV	-	-	-	3	3	50	50	100	PE
18CS607	Web Technology Laboratory	0	0	4	2	4	100	0	100	PC
18CS608	Cloud Computing Laboratory	0	0	4	2	4	100	0	100	PC
18GE601	Soft Skills - Aptitude II	0	0	2	0	2	100	0	100	EEC
Total		**11**	**1**	**10**	**22**	**28**				**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18HS002	Professional Ethics in Engineering	2	0	0	2	2	50	50	100	HSS
18CS702	Software Testing	3	0	0	3	3	50	50	100	EEC
18CS703	Artificial Intelligence	3	0	0	3	3	50	50	100	PC
18CS704	Cryptography And Network Security	3	0	0	3	3	50	50	100	PC
	Professional Elective V	-	-	-	3	3	50	50	100	PE
	Professional Elective VI	-	-	-	3	3	50	50	100	PE
18CS707	Software Testing Laboratory	0	0	4	2	4	100	0	100	EEC
18CS708	Project Work I	0	0	6	3	6	50	50	100	EEC
Total		**11**	**0**	**10**	22	27				**-**

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
	Professional Elective VII	-	-	-	3	3	50	50	100	PE
	Professional Elective VIII	-	-	-	3	3	50	50	100	PE
	Professional Elective IX	-	-	-	3	3	50	50	100	PE
18CS804	Project Work II	0	0	18	9	18	50	50	100	EEC
Total		**0**	**0**	**18**	**18**	**27**				**-**

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
18HSC01	Chinese	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	50	50	100	BS
18GE0P2	Semiconductor Physics and Devices	3	0	0	3	3	50	50	100	BS
18GE0P3	Applied Laser Science	3	0	0	3	3	50	50	100	BS
CHEMISTRY ELECTIVES										
18GE0C1	Corrosion Science and Engineering	3	0	0	3	3	50	50	100	BS
18GE0C2	Energy Storing Devices	3	0	0	3	3	50	50	100	BS
18GE0C3	Polymer Science	3	0	0	3	3	50	50	100	BS
DISCIPLINE ELECTIVES										
18CS001	Free Open-Source Software	3	0	0	3	3	50	50	100	PE
18CS002	Data Analytics	3	0	0	3	3	50	50	100	PE
18CS003	Cyber Security	3	0	0	3	3	50	50	100	PE
18CS004	Distributed Computing	3	0	0	3	3	50	50	100	PE
18CS005	Big Data Analytics	3	0	0	3	3	50	50	100	PE
18CS006	Information Storage Management	3	0	0	3	3	50	50	100	PE
18CS007	TCP/IP	3	0	0	3	3	50	50	100	PE
18CS008	Wireless Network Technologies	3	0	0	3	3	50	50	100	PE
18CS009	Software Quality Assurance	3	0	0	3	3	50	50	100	PE
18CS010	Graphics And Multimedia	3	0	0	3	3	50	50	100	PE
18CS011	XML And Web Services	3	0	0	3	3	50	50	100	PE

18CS012	Internet of Things	3	0	0	3	3	50	50	100	PE
18CS013	E-Commerce	3	0	0	3	3	50	50	100	PE
18CS014	Management Information Systems	3	0	0	3	3	50	50	100	PE
18CS015	Total Quality Management	3	0	0	3	3	50	50	100	PE
18CS016	Deep Learning Techniques	3	0	0	3	3	50	50	100	PE
18CS017	Mobile Application Development	3	0	0	3	3	50	50	100	PE
18CS018	Human Computer Interaction	3	0	0	3	3	50	50	100	PE
18CS019	Virtual Reality	3	0	0	3	3	50	50	100	PE
18CS020	Digital Marketing	3	0	0	3	3	50	50	100	PE
18CS021	Social Network Analysis	3	0	0	3	3	50	50	100	PE
18CS022	Natural Language Processing	3	0	0	3	3	50	50	100	PE
18CS023	Web Services and Service Oriented Architecture	3	0	0	3	3	50	50	100	PE
18CS024	Business Analytics	3	0	0	3	3	50	50	100	PE
18CS025	Open Stack Essentials	3	0	0	3	3	50	50	100	PE
18CS026	Embedded Systems	3	0	0	3	3	50	50	100	PE
18CS027	Soft Computing	3	0	0	3	3	50	50	100	PE
18CS028	Digital Image Processing	3	0	0	3	3	50	50	100	PE
18CS029	Professional Readiness For Innovation, Employability And Entrepreneurship	3	0	0	3	3	50	50	100	PE
OPEN ELECTIVES										
18CS0YA	E-Learning Techniques	3	0	0	3	3	50	50	100	PE
18CS0YB	Software Testing and Quality Assurance	3	0	0	3	3	50	50	100	PE
18CS0YC	Java Fundamentals	3	0	0	3	3	50	50	100	PE
18CS0YD	Network Engineering and Management	3	0	0	3	3	50	50	100	PE
18CS0YE	Agent Based Intelligent Systems	3	0	0	3	3	50	50	100	PE
18CS0YF	E-Business	3	0	0	3	3	50	50	100	PE
18CS0YG	Knowledge Discovery in Databases	3	0	0	3	3	50	50	100	PE
18CS0YH	Social Network Analysis Concepts	3	0	0	3	3	50	50	100	PE

18CS0YI	Operating System Concepts	3	0	0	3	3	50	50	100	PE
18CS0YJ	Object Oriented Programming	3	0	0	3	3	50	50	100	PE
18CS0YK	Advanced Social Text and Media Analytics	3	0	0	3	3	50	50	100	PE
ONE CREDIT COURSES										
18CS0XA	3D Animations	-	-	-	1	-	100	0	100	EEC
18CS0XB	Quantum Computing	-	-	-	1	-	100	0	100	EEC
18CS0XC	Agile Programming	-	-	-	1	-	100	0	100	EEC
18CS0XD	Mobile Operating Systems	-	-	-	1	-	100	0	100	EEC
18CS0XE	Internet Marketing	-	-	-	1	-	100	0	100	EEC
18CS0XF	Scripting Languages	-	-	-	1	-	100	0	100	EEC
18CS0XG	Raspberry PI	-	-	-	1	-	100	0	100	EEC
18CS0XH	Automation Testing Using QTP	-	-	-	1	-	100	0	100	EEC
18CS0XI	Augmented Code Reality	-	-	-	1	-	100	0	100	EEC
18CS0XJ	Angular Java	-	-	-	1	-	100	0	100	EEC
18CS0XK	Tensor Flow	-	-	-	1	-	100	0	100	EEC
18CS0XL	Statistical Analysis Using R	-	-	-	1	-	100	0	100	EEC
18CS0XM	Machine Learning for Engineers	-	-	-	1	-	100	0	100	EEC
18CS0XN	Block Chain Technologies	-	-	-	1	-	100	0	100	EEC
18CS0XO	.Net Programming	-	-	-	1	-	100	0	100	EEC
18CS0XP	Go Programming	-	-	-	1	-	100	0	100	EEC
18CS0XQ	React JS	-	-	-	1	-	100	0	100	EEC
18CS0XR	Node JS	-	-	-	1	-	100	0	100	EEC
18CS0XS	PostgreSQL	-	-	-	1	-	100	0	100	EEC
18CS0XT	Embedded IoT	-	-	-	1	-	100	0	100	EEC
18CS0XU	Tableau	-	-	-	1	-	100	0	100	EEC
18CS0XV	Type Script With Jest Testing Framework	-	-	-	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
18GE0XP	FM Radio Broadcasting Technology	1	0	0	1	-	100	0	100	EEC

SUMMARY OF CREDIT DISTRIBUTION

S.No	Category	Credit 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	15%	20%
2	ES	5	9	4	5	4				27	16	15%	20%
3	HSS	2	2				2	2		8	5	5%	10%
4	PC			16	15	13	14	6		64	40	30%	40%
5	PE					6	6	6	9	27	16	15%	20%
6	EEC							8	9	17	7	7%	10%
Total		17	21	24	24	23	22	22	18	171	100	-	-

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

18CS101 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.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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	3	3												
2	3	2												
3	3	2												
4	3	2	3											
5	3	3												

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 Hospitals Rule. Area between curves, volume of a general solid by slicing and cylindrical shell methods, volume of a solid of revolution, length of plane curves, area of a surface of revolution.

UNIT V **9 Hours**

COMPLEX ANALYSIS

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

FOR FURTHER READING

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

Total: 45 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.

18CS102 ENGINEERING PHYSICS I 2 0 2 3

Course Objectives

- Illustrate the Newton's 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.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
h Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j 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 Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Illustrate the Newtons three laws of motion and apply the same to solve the real-world problems involving elevator, at wood 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	2						2	2	2			2	
2	2	2						2	2	2			2	
3	2	2						2	2	2			2	
4	2	2						2	2	2			2	
5	2	1						2	2	2			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. Applications of Newtons laws: particle in equilibrium, particle under net force - weighing a mass in an elevator, the at wood machine and acceleration of two objects connected by a cord

UNIT II **6 Hours**
OSCILLATIONS AND WAVES
Fundamentals of simple harmonic motion - energy of simple harmonic oscillator - spring mass system- time period of simple pendulum, compound pendulum and torsional pendulum- Damped oscillations. Travelling wave motion - sinusoidal waves on strings - speed of a wave - reflection and transmission - rate of energy transfer in wave motion

UNIT III **6 Hours**
ELECTRICITY AND MAGNETISM
Point charges - electric fields- Gauss law and its applications- electric potential - capacitance – energy stored in a capacitor. Concept and source of magnetic fields- Amperes theorem- determination of magnetic field due to different current distributions - Faradays law - self-induction and mutual induction - energy stored in an inductor.

UNIT IV **6 Hours**
LIGHT AND OPTICS
Nature of light- laws of reflection and refraction- refractive index and Snells law - dispersion of light - total internal reflection - image formation: concave mirrors - convex mirrors- thin lenses - compound microscope-human eye. Conditions of interference - Youngs double slit experiment - intensity distribution of interference - phase chang due to reflection - diffraction - narrow slit diffraction - single slit and two slit - intensity distribution - diffraction grating – applications.

UNIT V **6 Hours**
MODERN OPTICS
Special theory of relativity - simultaneity and time dilation - twin paradox - length contraction - Relativistic mass variation-space time graph. Black body radiation and Planck hypothesis - allowed energy levels - thermal radiation from different objects - photoelectric and Compton effect. Matter waves - de-Broglie hypothesis - wave nature of particles - Davission-Germer experiment.

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-Meldes 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 Zemanskys University Physics with Modern Physics, Pearson education, 2016.
5. R K Gaur and S L Gupta, Engineering Physics, Dhanpat Rai Publications, 2012.

18CS103 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 microprocessors in electronic devices.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j 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.
n Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet the global requirements.

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 microprocessor.

Articulation Matrix

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

UNIT I **6 Hours**

OPTICAL MATERIAL FOR SMART SCREEN

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

UNIT II **6 Hours**

CONDUCTING MATERIALS FOR SMART SCREEN

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

UNIT III **5 Hours**

MATERIALS FOR DATA STORAGE

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

UNIT IV **5 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.

1 **5 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

FOR FURTHER READING

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

Total: 60 Hours

Reference(s)

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

18CS104 COMPUTER PROGRAMMING I 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.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

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	2	2	2	3		2		2	2	2		1	1
2	2	2	2	2	3		2		2	2	2		1	1
3	2	3	2	2	3		2		2	2	2		2	2
4	2	3	3	2	3		3		2	2	2		2	2
5	2	3	3	2	3		3		2	2	2		2	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, 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.

UNIT IV **6 Hours**

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, TUPLES AND DICTIONARIES

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; 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
EXPERIMENT 4 **3 Hours**
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/O'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

18HS101 COMMUNICATIVE ENGLISH I **1 0 2 3**

Course Objectives

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

Programme Outcomes (POs)

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

Articulation Matrix

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

UNIT I **9 Hours**

GRAMMER

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

UNIT II **9 Hours**

READING

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

UNIT III **9 Hours**

WRITING

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

UNIT IV **9 Hours**

LISTENING

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

UNIT V **9 Hours**

SPEAKING

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

1.Goodbye party for Miss Pushpa T S - Nissim Ezekiel
2.Our Casuarina Tree - Toru Dutt
3.Palanquin Bearers- Sarojini Naidu
4.The Tyger - William Blake
5.Ode on a Grecian Urn - John Keats

Total: 45 Hours

Reference(s)

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

18CS106 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.

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
e. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

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	PSO2
1	3	2											2	2
2					3								2	2
3		2			3								2	2
4	3				1								2	2
5	2	2			3								2	2

1 **6 Hours**
EXPERIMENT 1

a) Study of desktop computer, motherboard and its interfacing components.

b) Install and configure computer drivers and system components.

2 **3 Hours**
EXPERIMENT 2

Disk formatting, partitioning and Disk operating system commands

3 **6 Hours**
EXPERIMENT 3

a) Install, upgrade and configure Windows/Linux operating systems.

b) Installation of Dual OS using Virtual Machine

4 **6 Hours**
EXPERIMENT 4

a) Installation Antivirus and configure the antivirus.

b) Installation of printer and scanner software.

5 **6 Hours**
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 Colour Schemes
c. Apply various animation schemes.
d. Apply Slide Show

Total: 60 Hours

18CS201 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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d 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.

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	3	2		2										
2	3	2		2										
3	3	2		2										
4	3	2		2										
5	3	3		2										

UNIT I **9 Hours**

PARTIAL DIFFERENTIATION

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

UNIT II **9 Hours**

MULTIPLE INTEGRALS

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

UNIT III

SEQUENCES AND SERIES **9 Hours**

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

UNIT IV **9 Hours**

FIRST ORDER DIFFERENTIAL EQUATIONS

Separable differential equations, homogeneous differential quations, exact differential equations, integrating factor, Bernoulli equation, applications.

UNIT V **9 Hours**

SECOND ORDER DIFFERENTIAL EQUATIONS

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

FOR FURTHER READING

Applications 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.

18CS202 ENGINEERING PHYSICS II **2 0 2 3**

Course Objectives
- Understand the applications of laser and fibre optics in the field of engineering
- Impart knowledge in crystallography and semiconductors
- Differentiate the different types of magnetic materials and their applications

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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 Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)
1. Understand the principle, characteristics, different types of lasers and apply the same for optical data storage and retrieval techniques
2. Illustrate the propagation of light through different optical fibres, applications of optical fibers in communication and sensors
3. Identify the seven crystal systems, crystal planes and the stacking sequences in metallic crystal structures
4. Analyse the characteristics of semiconducting materials interms of crystal lattice, charge carriers and energy band diagrams
5. Outline the properties of magnetic materials, domain theory of ferro magnetism 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				
2	2	1						2	2	2			2	
3	2	1						2	2	2			2	
4	2	1						2	2	2			2	
5	2	1						2	2	2				

UNIT I **7 Hours**

LASER

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

UNIT II **7 Hours**

FIBER OPTICS

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

UNIT III **5 Hours**

CRYSTAL PHYSICS

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

UNIT IV **6 Hours**

SEMICONDUCTING MATERIALS

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

UNIT V **5 Hours**

MAGNETIC MATERIALS

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

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

4 Hours

3
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

18CS203 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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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

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 optoelectronic
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						2	2	2				
2	2	2						2	2	2				
3	2	1						2	2	2				
4	2	1						2	2	2				
5	2							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 [Zinccarbon]. 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 MANAGEMENTS

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

1 **8 Hours**

EXPERIMENT 1

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

2 **4 Hours**

EXPERIMENT 2

Determination of thermal stability of copper alloys using thermo gravimetric analysis

3 **6 Hours**

EXPERIMENT 3

Determination of single electrode potential of zinc and copper electrodes.

4 **6 Hours**

EXPERIMENT 4

Preparation of cadmium nanoparticles and its characterization.

5 **6 Hours**

EXPERIMENT 5

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

Total: 60 Hours

Reference(s)

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

18CS204 COMPUTER PROGRAMMING II 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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement C programs using operators, type conversion and input-output functions
2. Develop C Programs using decision making and looping statements.
3. Develop C programs using the concepts of arrays and strings.
4. Implement C Programs using functions and pointers.
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	3	2	2	2	3		2		2	2	2		1	1
2	2	2	2	2	3		2		2	2	2		1	1
3	2	3	2	2	3		2		2	2	2		2	2
4	2	3	3	2	3		3		2	2	2		2	2
5	2	3	3	2	3		3		2	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 floatingpoint 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

EXPERIMENT 4 **3 Hours**

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, 2013
3 E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2012
4 Kernighan B W and Ritchie O M, The C programming Language. Prentice-Hall of India, 2009
5 Kelley A and I. Pohl, A Book on C : Programming in C, Pearson Education, 1998
6 Ashok.N.Kamthane,Programming in C,Pearson education,2013

18CS206 BASIC 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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

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	2	2	3											3
2	2		2											3
3	2		2											3
4	3	3	3											3
5	3	3	3											3

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 memorys, 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.

1 **6 Hours**

EXPERIMENT 1

Design of power supply system for mobile charger.

2 **3 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.

18CS207 ENGINEERING GRAPHICS **1 0 4 3**

Course Objectives

- Provide knowledge on projection of points and lines.
- Impart skill in drawing projection of simple solids.
- Build the proficiency to create two dimensional sketches using software.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
j. 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.

Course Outcomes (COs)

1. Illustrate the projection of points and lines in different quadrants
2. Construct orthographic projections of simple solid
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	2							2		2				
2	2							2		2				
3	2							2		2				
4	2							2		2				
5	2							2		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 Ã¢?? parallel, perpendicular and inclined to anyone plane.

UNIT II **12 Hours**

PROJECTION OF SOLIDS

Orthographic projection of simple solids Ã¢?? 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 simple solids.

UNIT IV **10 Hours**

CREATION OF 2D SKETCHES USING SOFTWARE

Sketch Entities Ã¢?? 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 Modelling- 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: 60 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.

18CS301 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 Combinatory 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.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Interpret the concepts of direct proof, indirect proof and proof by contradiction and verify the validity of an argument using propositional and predicate logic.
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	1	2		2									2	
3	2	2		2									2	
4	1	2		3									2	
5	2	2		3									2	

UNIT I **12 Hours**

LOGIC

Propositional Logic- Truth tables- Tautologies and Contradictions- Rules of inference- Predicate Logic.

UNIT II **10 Hours**

SET THEORY AND GRAPHS

Sets: Relations- Equivalence relations- Functions- Graphs: Graph- Isomorphism- connected graphsTrees- 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.

18CS302 DATA STRUCTURES 3 0 0 3

Course Objectives

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Critically analyze the various sorting algorithms.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement the abstract data type List using array and linked lists to solve the real-time applications
2. Apply the linear data structures stack and queue for real time applications.
3. Implement the non-linear data structure tree for real world applications.
4. Inspect abstract data types for graph data structures for problem solving.
5. Critically analyze the sorting, searching algorithms, and hashing 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	2	2	2
2	2	2	2	2	2						2	2	2	2
3	2	3	3	2	2						2	2	3	2
4	3	3	3	3	2						3	3	3	3
5	3	2	3	3	3						3	3	3	3

UNIT I **9 Hours**

LINEAR DATA STRUCTURES - LIST

Pseudo code-Algorithm efficiency -Designing recursive algorithms - Recursive examples.-Abstract Data Types (ADTs) - List ADT - array-based implementation - linked list implementation -singly linked lists- circularly linked lists- doubly-linked lists -applications of lists -Polynomial Manipulation -All operations(Insertion, Deletion, Merge, Traversal).

UNIT II **9 Hours**

LINEAR DATA STRUCTURES - STACKS, QUEUES

Stack ADT - Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT - Operations - Circular Queue - Priority Queue- deQueue - 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 - B-Tree - Heap - Applications of heap.

UNIT IV **9 Hours**

NON LINEAR DATA STRUCTURES – GRAPHS

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

UNIT V **9 Hours**

SEARCHING, SORTING AND HASHING TECHNIQUES

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

FOR FURTHER READING

Applications of list - Red-Black trees - Splay trees- Bucket hashing - Introduction to NP Completeness

Total: 45 Hours

Reference(s)

1 Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education,2016.
2 Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
3 Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
4 Reema Thareja, Data Structures Using C, Second Edition , Oxford University Press, 2011

18CS303 DIGITAL SYSTEM DESIGN 3 0 2 4

Course Objectives

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyse the basic operations used in digital systems.
2. Design and analyze combinational circuits.
3. Implement MSI devices for digital application
4. Construct state machines and flipflop in synchronous sequential circuits.
5. Analyse the basic operations in Asynchronous sequential circuits

Articulation Matrix

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

UNIT I **9 Hours**

BOOLEAN ALGEBRA AND LOGIC GATES

Number systems - Decimal, Binary, Octal and Hexadecimal - conversion from one system to another

- Representation of Negative numbers - Logic gates - Boolean Algebra - Postulates of Boolean algebra - Minterm - Maxterm - SOP and POS forms - NAND and NOR implementation - Simplification of Boolean functions: Two variable K Map - Three variable K Map - Four variable K Map - Five variable K map - Don't care conditions.

UNIT II **9 Hours**

COMBINATIONAL LOGIC

Combinational circuits - Analysis procedures - Design procedures - Adders - Subtractors - Binary adder - Carry Look Ahead Adder - BCD Adder - Magnitude comparator - Code Converters - Binary code - Gray code- Excess 3 code- BCD code

UNIT III **7 Hours**

DESIGN WITH MSI DEVICES

Multiplexers and Demultiplexers- Function realization using multiplexers - Decoders and encoders - Programmable Logic Devices (PLD) - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) -Implementation of combinational logic circuits using ROM, PLA, PAL

UNIT IV **10 Hours**

SYNCHRONOUS SEQUENTIAL LOGIC

Sequential circuits - Latches -Flip flops - RS, JK, D and T flipflops - Flip Flop Conversion – Analysis procedures - Design procedures - Moore and Mealy models - State reduction and state assignment – Shift Registers - Counters.

UNIT V **10 Hours**

ASYNCHRONOUS SEQUENTIAL LOGIC

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

1

EXPERIMENT 1

Implement Boolean Laws using Logic Gates **5 Hours**

2

EXPERIMENT 2

Implement adder and subtractor in combinational circuit **5 Hours**

3

EXPERIMENT 3

Construct Magnitude comparator **5 Hours**

4

EXPERIMENT 4

Demonstrate Multiplexer and Demultiplexer **5 Hours**

5
EXPERIMENT 5
Implement Encoder and Decoder **5 Hours**

6 **5 Hours**
EXPERIMENT 6
Implement shift register using sequential circuit

FOR FURTHER READING
HDL: Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and Verilog.

Total: 75 Hours

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

18CS304 SOFTWARE ENGINEERING **3 0 0 3**

Course Objectives

- Understand detailed concepts related to software engineering life cycle.
- Gain knowledge about the concepts of software designing and testing.
- Acquire knowledge about an quality management processes and methods

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the software development life cycle models for applications
2. Identify the software requirement models and cost estimations for software projects.
3. Apply the software design concepts, principles and practices to develop software.
4. Compare and contrast the testing techniques for the software projects

5. Analyze the quality of the software using software reviews and software configuration management process

Articulation Matrix

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

UNIT I **7 Hours**

SOFTWARE PROCESS MODELS

The Nature of Software-Software Process Models-Waterfall Model-Incremental Process Models- Evolutionary Process Models- Prototyping-Spiral Model-Concurrent Model-Introduction to Agile Process.

UNIT II **11 Hours**

REQUIREMENT ENGINEERING AND ESTIMATION

Requirements Engineering - Establishing the Groundwork - Eliciting Requirements - Building the Requirements Model - Requirements Analysis - Metrics in the Process and Project Domains – Software Measurements - Metrics for Software Quality - Software Project Estimation - Decomposition Techniques - Empirical Estimation Models - The Make/Buy Decision.

UNIT III **8 Hours**

DESIGN CONCEPTS AND PRINCIPLES

The Design Concepts - The Design Model - Architectural Design - User Interface Design: Interface Analysis - Interface Design Steps - Risk Management - Software Engineering Practice - Core Principles - Coding Principles and Concepts.

UNIT IV **10 Hours**

TESTING TACTICS

Software Testing Fundamentals - Internal and External Views of Testing - White-Box Testing – Basis Path Testing - Control Structure Testing - Black Box Testing - Unit Testing - Integration Testing – Validation Testing - System Testing - The Art of Debugging.

UNIT V **9 Hours**

QUALITY MANAGEMENT

Software Quality Assurance - Software Reviews - Formal Technical Reviews - Informal Reviews - Software Reliability - Software Configuration Management - The SCM Process - The Cleanroom Strategy - Software Reengineering Process Model - Reverse Engineering - Forward Engineering.

FOR FURTHER READING

Software Process Improvement - SPI Process - The CMMI - SPI Frameworks.

Total: 45 Hours

Reference(s)

1 Roger S.Pressman, Software Engineering: A Practitioners Approach, McGraw Hill International edition, Seventh edition, 2010
2 Ian Sommerville, Software Engineering, 8th Edition, Pearson Education,2008
3 Stephan Schach, Software Engineering, Tata McGraw Hill, 2007
4 Pfleeger and Lawrence Software Engineering: Theory and Practice, Pearson Education, second edition, 2001

18CS305 DATABASE MANAGEMENT SYSTEMS 3 0 0 3

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

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)
1. Design ER model with constraints to perform database design effectively.
2. Apply the SQL queries, relational models and set operations for problem solutions.
3. Write queries using normalization criteria and optimize queries.
4. Compare and contrast the indexing strategies in database systems.
5. Analyze the issues involved in transaction processing, concurrency control, deadlock and its recovery schemes.

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

UNIT I **8 Hours**

INTRODUCTION

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

UNIT II **9 Hours**

RELATIONAL MODEL AND DATABASE DESIGN

Introduction to Relational Model - Formal Relational Query Languages - Introduction to SQL: Data definition-Basic structure of SQL Queries-Additional Basic operations -Set operations-Aggregate functions Nested sub queries-Intermediate SQL: Joins-Views-Integrity Constraints.

UNIT III **8 Hours**

NORMAL FORMS

Functional Dependencies - Normal Forms Based on primary Keys-General Definition of Second and Third Normal Form - Boyce Codd Normal Form - Multi valued dependencies and Fourth Normal Form.

UNIT IV **9 Hours**

DATA STORAGE AND QUERY PROCESSING

Overview of Physical Storage Media - Magnetic Disk Flash storage -RAID-File and Record Organization - Indexing and Hashing: Ordered Indices - B+ Tree Index File-Static Hashing - Dynamic Hashing-Query Processing: Overview-measures of Query Cost.

UNIT V **11 Hours**

TRANSACTION MANAGEMENT

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

FOR FURTHER READING

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

Total: 45 Hours

Reference(s)

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

18CS306 PROGRAMMING USING CPP 2 0 2 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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Identify classes and objects from the given problem description and able to create classes and objects using C++
2. Implement the C++ program using arrays and operator overloading
3. Achieve code reusability and extensibility by means of inheritance and polymorphism.
4. Apply the concept of run time polymorphism by using virtual functions and implement the streams in C++ program
5. Implement files, templates and exception handling for a given scenario using C++

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	3	3	3	2				2	2			3	3
3	2	3	3	3	2				2	2			3	3
4	2	3	3	2	2				2	2			3	3
5	2	3	3	2	2				2	2			3	3

UNIT I **6 Hours**

CLASSES AND OBJECTS

Need for object oriented programming - Characteristics of object oriented programming -Classes and Objects: Simple Class- Data members and member functions - Access specifiers - Static Data Members and Member Functions - Constructors and Destructors - Passing and Returning Objects from Functions.

UNIT II **6 Hours**

ARRAYS AND OVERLOADING

Array Fundamentals - Arrays as Class Member Data - Arrays of Objects - String Manipulations - Method overloading - Operator overloading: Unary Operators - Binary Operators - Special Operators - Pitfalls of Operator Overloading.

UNIT III **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 IV **6 Hours**

POINTERS AND STREAMS

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

UNIT V **6 Hours**

FILES, TEMPLATES AND EXCEPTION HANDLING

File Stream Operations - File Pointers Manipulation-Templates: Class Templates - Function Templates - Overloading Function Templates - Exception Handling Mechanism: Try Throw and Catch.

1
EXPERIMENT 1 **5 Hours**
Implementation of operator overloading with class and objects.
1. Write a program to find the square and cube of a number using class and object.
2. Write a program to find the area of rectangle and circle using class and object.
3. Write a program to find whether the given number is an Armstrong number using classes and objects.

2 **5 Hours**
EXPERIMENT 2
Implementation of operator and function overloading.
1. Write a program to perform conversion from integer to complex number by operator overloading.
2. Write a program to perform from complex number to integer using operator overloading.
3. Write a program to perform addition of two numbers using function overloading.

3 **5 Hours**
EXPERIMENT 3
Implementation of types of Inheritance.
1. Write a program to generate employee payroll using inheritance.
2. Write a program to student details using multilevel inheritances.
3. Write a program to employee details using multiple inheritance.

4 **5 Hours**
EXPERIMENT 4
Implementation of two different classes for adding a private data member using friend function.
1. Write a program to multiply two matrices using static member function with friend function.
2. Write a program to perform complex number subtraction by overloading an operator using friend function.
3. Write a program to perform arithmetic operations using friend function.

5 **5 Hours**
EXPERIMENT 5
Implementation of file handling operations.
1. Write a program to reading and writing a file contents.
2. Write a program to open a file and append data to the end of file.
3. Write a program to write the class objects to a file.

6 **5 Hours**
EXPERIMENT 6
Implementation of Class templates and Function templates.
1. Write a program to perform insertion sort using class template.
2. Write a program to perform quick sort using function template.
3. Write a program to perform merge sort using template.

Total: 60 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.

18CS307 DATA STRUCTURES LABORATORY 0 0 4 2

Course Objectives

- Understand the principles of linear and nonlinear data structures.
- Build an applications using sorting and searching.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement the concept of recursion.
2. Implement the programs to demonstrate the operations on stack and queue.
3. Implement the programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths.
4. Implement the sorting and searching algorithms.
5. Implement the techniques of hashing.

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	2				2	2			2	2
3	2	3	3	2	2				2	2			3	2
4	3	3	3	3	2				3	3			3	3
5	3	2	3	3	3				3	3			3	3

1 **4 Hours**

EXPERIMENT 1

Program to Solve Tower-of-Hanoi Problem using Recursion

2 **4 Hours**

EXPERIMENT 2

a) Write a C program to implement a Stack ADT using array and write the routine for push operation which represent a function PUSH(X, S), Check for the condition whether S-full or not, if yes display the message otherwise insert the elements into the Stack. Perform POP operation which represents a function POP(S), Check for the condition whether S-Empty, if stack is empty, display the message otherwise delete an element from the Stack. Test your program with at least 5 elements and provide the output.

b) Write a C program to implement the Queue ADT using array and write the routine to enqueue an element X into queue, Check for the conditions Q-full, if yes display the message otherwise insert the data into the queue and dequeue an element from queue, check for the conditions Q-empty, if yes display the message otherwise deleting the element from the queue and display the elements from the Queue ADT. Test your program with at least 6 elements and provide the output

3 **6 Hours**

EXPERIMENT 3

Linked List Implementation of stack and queue.

4 **4 Hours**

EXPERIMENT 4

Write a function program to perform the following operations on a singly linked list
i. Create a list
ii. Insert an element to the list
iii. Delete the maximum element from the list
iv. Arrange the list as sorted order
v. Display the elements of the list
Write a main method to demonstrate the above functionalities.

5 **4 Hours**

EXPERIMENT 5

Write a function program to perform the following operations on a doubly linked list

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

6 **4 Hours**
EXPERIMENT 6
Program to sort the elements in ascending order using selection sort and bubble sort.

7 **4 Hours**
EXPERIMENT 7
Implementation of quick sort.

8 **4 Hours**
EXPERIMENT 8
Implementation of heap sort.

9 **4 Hours**
EXPERIMENT 9
Implementation of shell sort.

10 **4 Hours**
EXPERIMENT 10
Develop a program to perform linear and binary search

11 **4 Hours**
EXPERIMENT 11
Program to construct an expression tree for a given expression and perform various tree traversal methods.

12 **4 Hours**
EXPERIMENT 12
Implement Prims algorithm with the following functionalities
i. Read a set of vertices minimum of six from the keyboard
ii. Get the number of edges and form the graph
iii. Find the value of each edge by using distance formula for two points.
iv. Develop a Minimum Spanning Tree for the graph
v. Find the total length of all edges.
Write a main method to execute the above functionalities

13 **4 Hours**
EXPERIMENT 13
Implementation of hashing technique

Total: 60 Hours

18CS308 DATABASE MANAGEMENT SYSTEMS LABORATORY 0 0 4 2

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

Programme Outcomes (POs)

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

b. 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 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. 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. 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.

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

j. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

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

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

1 **4 Hours**
EXPERIMENT 1
Working with SQL commands like DDL, DML, TCL, and DCL.

2 **8 Hours**
EXPERIMENT 2
Performing Single- row functions and group functions in SQL.

3 **4 Hours**
EXPERIMENT 3
Execute simple queries using joins and Integrity constraints.

4 **8 Hours**
EXPERIMENT 4
Creation and manipulation of database objects.

5 **4 Hours**
EXPERIMENT 5
Simple programs using PL/SQL block.

6 **8 Hours**
EXPERIMENT 6
Implementation of cursor in PL/SQL block.

7 **8 Hours**
EXPERIMENT 7
Generate trigger in PL/SQL block.

8 **6 Hours**
EXPERIMENT 8
Write PL/SQL block Programs using exception handling.

9 **8 Hours**
EXPERIMENT 9
Design a PL/SQL blocks using subprograms namely functions and procedures.

Total: 60 Hours

Reference(s)

1 Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw - Hill, 2015

2 C.J.Date,An Introduction to Database system, Pearson Education, 2006

18GE301 SOFT SKILLS - VERBAL ABILITY 2 0 0 0

Course Objectives

- To help students gain adequate proficiency in vocabulary
- To read and understand unabridged text
- To help students become proficient in basic writing skills related to work place communication

Programme Outcomes (POs)

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes (COs)

1. Take up verbal ability part of the placement tests with confidence
2. Write with confidence in professional and workplace communication
3. Distinguish fact from opinion by reading passages from a text

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**

INTRODUCTION

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

UNIT II **15 Hours**

BASICS OF VERBAL APTITUDE

Sentence Formation - Paragraph Formation - Change of Voice - Change of Speech - Reading Comprehension - Sentence Equivalence - Jumbled Sentences - Spotting Errors -Homophones Homonyms - Commonly Mispronounced/Misspelt Words.

Total: 30 Hours

Reference(s)

1 Murphy, Raymond. English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English. IV Edition. United Kingdom: Cambridge University Press. 2012

2 Lewis, Norman. Word Power Made Easy. New York: Pocket Books. 1991.
3 Baron"s The Official Guide for New GMAT Review, New Jersey: John Wiley & Sons, Inc.

18CS401 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

Programme Outcomes (POs)

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

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 science/engineering problems.

Articulation Matrix

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

UNIT I 10 Hours

FOURIER ANALYSIS

Fourier series for periodic functions. Orthogonal functions. The Euler coefficients. Fourier transforms. Properties of Fourier transform. Applications of Fourier series and transform analysis

UNIT II **11 Hours**

PARTIAL DIFFERENTIAL EQUATION

Introduction to partial differential equations. One-dimensional wave equation. Method of separation of variables. D Alemberts solution of the wave equation. Heat equation. Laplace equation. Telegraph equations. Laplace transforms method of solution.

UNIT III **9 Hours**

LAPLACE TRANSFORM

Properties and theorems of Laplace transform. Shifting theorems. Convolution. Applications to ordinary differential equations. Applications to linear system analysis.

UNIT IV **8 Hours**

PROBABILITY THEORY

Probability. Random variables, probability densities and distributions, mean and variance of a distribution. Conditional probability. Bayes theorem. Binomial, Poisson and normal distributions.

UNIT V **7 Hours**

MATHEMATICAL STATISTICS

Sample mean and variance. Sampling distributions. Statistical estimation of parameters, confidence intervals. Testing of hypotheses, one-sample and two-sample inferences. Applications to statistical quality control and reliability analysis.

Total: 60 Hours

Reference(s)

1. Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993.
2. Johnson Richard A. and Bhaltacharyya Gouri K., Statistics, Principles and Methods, 3rd Edition, John Wiley, 1996.
3. O Neil Peter V, Advanced Engineering Mathematics, 4th Edition, PWS-Kent, 1995.
4. James Glyn, Advanced Modern Engineering Mathematics, Addison-Wesley, 1993.
5. 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.

18CS402 DESIGN AND ANALYSIS OF ALGORITHMS 3 1 0 4

Course Objectives

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyse the basics of Algorithmic problem solving methods based on Data structures
2. Analyze the algorithm efficiency by means of mathematical notations
3. Develop and analyze the types of sorting and searching algorithms
4. Distinguish the different techniques in the design of Graph Algorithms
5. Examine NP complete with NP hard problems based on algorithms design techniques

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

UNIT I **7 Hours**

INTRODUCTION

Introduction Fundamentals of Algorithmic Problem Solving Important Problem types: Sorting problem- searching problems - string processing - graph problems - combinatorial problems- Geometric

Problems - Numerical problems Fundamental Data structures-Trees and Graphs

UNIT II **9 Hours**

FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY

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

UNIT III **10 Hours**

ANALYSIS OF SORTING AND SEARCHING ALGORITHMS

Brute Force Strategy: Selection Sort and Bubble Sort, Sequential Search and Brute-force string matching - Divide and conquer: Merge sort, Quick Sort, Binary Search, Binary tree Traversal and Related Properties Decrease and Conquer: Insertion Sort, Depth first Search and Breadth First Search-Pair and Convex-Hull

UNIT IV **10 Hours**

ANALYSIS OF GRAPH ALGORITHMS

Transform and conquer: Presorting, Balanced Search trees AVL Trees, Heaps and Heap sort Dynamic Programming: Warshalls and Floyd Algorithm, Optimal Binary Search trees Greedy Technique: Prims Algorithm, Kruskals Algorithm, Dijkstra Algorithm Huffman trees-The Simplex Method-The Maximum- Flow Problem Ã¢?? Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

UNIT V **9 Hours**

ALGORITHM DESIGN TECHNIQUES TO NP COMPLETE AND NP HARD PROBLEMS

NP Complete problems Backtracking: n-Queens Problem Hamiltonian Circuit problem Subset-Sum problem Branch and bound: Assignment problem, Knapsack problem Traveling salesman problem- Approximation algorithms for NP hard problems: Travelling salesman and knapsack problem-Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems-Coping with the Limitations.

Total: 60 Hours

Reference(s)

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

18CS403 MICROPROCESSORS AND MICROCONTROLLER 3 0 0 3

Course Objectives

- Understand the architecture and software aspects of 8085, 8086 microprocessors and 8051 microcontroller
- Implement assembly language programs for various applications using the instructions of 8085, 8086 microprocessors and 8051 microcontroller
- Impart knowledge on the methods of interfacing 8085 and 8086 microprocessors with various peripheral devices

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the programming techniques and instruction set of 8085 microprocessor.
2. Analyze the instruction set and addressing modes of 8086 microprocessor
3. Develop assembly language programs using 8086 microprocessor instructions
4. Analyze the operating modes of I/O interface devices
5. Design and implement 8051 microcontroller based systems.

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

UNIT I **8 Hours**

THE 8085 MICROPROCESSOR

Microprocessor Architecture and its Operations - The 8085 MPU - 8085 Instruction Set – Programming Techniques with Additional Instructions of 8085 microprocessor - The 8085 Interrupt Process – 8085 Vectored Interrupts

UNIT II **11 Hours**

THE 8086 MICROPROCESSOR

Register Organisation of 8086 - Architecture - Signal Descriptions of 8086 - Physical memory organization - General bus Operation - I/O Addressing Capability - Special Processor Activities - Minimum Mode 8086 Architecture - Read/Write Cycle Timing Diagram for Minimum mode - Maximum Mode 8086 Architecture - Read/Write Cycle Timing Diagram for Maximum Mode - Addressing Modes of 8086 - Instruction set of 8086

UNIT III **7 Hours**

8086 SYSTEM DESIGN AND RECENT ADVANCES IN MICROPROCESSOR ARCHITECTURES

The Art of Assembly Language Programming with 8086: A few Machine Level Programs – Programming with an Assembler - Special Architecture Features and Related Programming: Introduction to stack - Stack Structure of 8086 - Interrupt and Interrupt Service Routines - Non-Maskable Interrupt – Maskable interrupt - Interrupt programming - Macros. Intel Pentium 80586 architecture-Branch prediction-Instruction set of Pentium-MMX-Architecture-Data types and Instruction set.

UNIT IV **10 Hours**

PERIPHERAL DEVICES AND I/O INTERFACING

Programmable Interrupt Controller 8259A: Architecture and Signal Descriptions of 8259A – Command Words of 8259A - Operating modes of 8259A - The Keyboard/Display Controller 8279: Architecture and Signal Descriptions of 8279 - Modes of Operation of 8279 - DMA Controller 8257: Internal Architecture and Signal Descriptions of 8257 - DMA Transfers and Operations.

UNIT V **9 Hours**

8051 MICROCONTROLLER

Architecture of 8051 - Signal Descriptions of 8051 - Register Set of 8051 - Memory Addressing - External I/O Interfacing - Addressing modes of 8051 - Instruction Set of 8051.

FOR FURTHER READING

Introduction to PIC Microcontrollers - Architecture of PIC Microcontrollers - Instruction Set of PIC Microcontroller - I/O Port Configuration - PIC Programming.

Total: 45 Hours

Reference(s)

1. Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International publishing private limited, 2013
2. A.K.Ray and K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing, Tata McGraw Hill Education Private Limited, 2013
3. Douglas V.Hall, Microprocessors and Interfacing: Programming and Hardware, TMH, 2010
4. Yu-cheng Liu and Glenn A. Gibson, Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design, PHI, 2011

5 Mohamed Ali Mazidi, Janice Gillispie Mazidi, The 8051 microcontroller and embedded systems, Pearson education, 2009.

18CS404 OPERATING SYSTEM **3 0 0 3**

Course Objectives

- To make the students to learn different types of operating systems along with the components and services provided.
- To understand the concept of process management and implementation of process scheduling in a multi-programming environment using scheduling algorithms.
- To provide knowledge on the structure and operations of memory management and storage management.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Analyze the evolution of operating system, components and the usage of system calls & programs
2. Analyze the operation of processes and CPU scheduling algorithms in process management
3. Analyze the activities involved in process synchronization and deadlock mechanism
4. Apply the techniques to allocate and manage the memory for a specific system
5. Apply the mechanisms of disk scheduling to manage files on a secondary storage structure

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	
2	2	2	2	2								2	2	
3	2	3	2	2								3	3	
4	2	3	3	2								3	3	
5	2	3	3	2								3	3	

UNIT I **10 Hours**

INTRODUCTION

Components of Computer System - Evolution of operating System. Operating System Components & Services: Process management -Memory Management- Storage Management - Protection &

Security - Operating System Services. Computing Environments-Open source operating systems - System Calls & System programs

UNIT II **9 Hours**

PROCESS MANAGEMENT

Process Concepts: The process - Process State - Process Control Block. Process Scheduling: Scheduling Queues -Scheduler - Context Switch. Operations on Processes - Process creation - Process Termination - Cooperating Processes. Interprocess Communication. CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms.

UNIT III **9 Hours**

PROCESS SYNCHRONIZATION AND DEADLOCK

Process Synchronization: The Critical-Section Problem - Synchronization Hardware - Semaphores - Classic problems of Synchronization. Deadlock: System Model - Deadlock Characterization - methods for handling Deadlocks –Deadlock Prevention - Deadlock avoidance - Deadlock detection - Recovery from Deadlocks.

UNIT IV **9 Hours**

MEMORY MANAGEMENT

Address Binding - Logical Versus Physical Address Space - Swapping- Contiguous Memory allocation – Fragmentation- Paging - Segmentation. Virtual Memory: Demand Paging - Page Replacement Algorithms - Allocation of frames-Thrashing.

UNIT V **8 Hours**

STORAGE MANAGEMENT

File Management: File Concept - Access Methods - Directory and Disk Structure - File System Mounting- File Sharing. File System Implementation: File system structure - Directory implementation- Allocation Methods - Free-space Management. Secondary Storage Structure: Disk Structure - Disk Scheduling - Disk Management.

FOR FURTHER READING

Case Studies: The Linux System, Windows 7, Influential Operating Systems

Total: 45 Hours

Reference(s)

1 Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons Pvt. Ltd, 2015
2 Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall of India Pvt. td, 2014
3 William Stallings, Operating System, Seventh Edition Prentice Hall of India, 2012
4 Harvey M. DeitelM ,Operating Systems, Pearson Education Pvt. Ltd, 2007

18CS405 DATA WAREHOUSING AND DATA MINING 3 0 0 3

Course Objectives

- Understand the basic concepts of data mining.
- Apply the data mining functionalities
- Assess the strengths and weaknesses of various data mining techniques

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Design the data warehouse architecture and schemas and implement the OLAP operations.
2. Classify the functionalities, patterns, tasks and issues of data mining.
3. Apply the data pre-processing techniques in the KDD process
4. Identify the association rules using frequent itemset mining algorithms and advanced pattern mining in multi-level and multi-dimensional space
5. Apply the classification and clustering algorithms to mine the patterns

Articulation Matrix

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

UNIT I **7 Hours**

DATA WAREHOUSING

Data Warehouse: Basic Concepts, Differences between Operational Database Systems and Data Warehouses- A Multitiered Architecture - Data Warehouse Models : Extraction, Transformation and Loading - Metadata Repository -Data Cube and OLAP -Data Warehouse Design and Usage - Data warehouse implementation

UNIT II **9 Hours**

INTRODUCTION TO DATA MINING

Introduction - The evolution of database system technology - Steps in knowledge discovery from database process - Architecture of a data mining systems - Data mining on different kinds of data - Different kinds of pattern - Technologies used - Applications - Major issues in data mining - Classification of data mining systems - Data mining task primitives - Integration of a data mining system with a database or datawarehouse system

UNIT III **10 Hours**

DATA PREPROCESSING

Data Objects and attribute types - Basic statistical description of data - Data visualization – Measuring data similarity and dissimilarity - Data cleaning - Integration - Data reduction - Data transformation and data discretization

UNIT IV **9 Hours**

ASSOCIATION RULE MINING

Basic concepts - Frequent itemset mining methods - Apriori algorithm, APattern growth approach for mining frequent itemsets, Mining frequent itemsets using vertical data format, Mining closed and max patterns - Pattern mining in multilevel and multidimensional space – Constraint based Frequent pattern mining - Mining High-Dimensional Data and Colossal Patterns

UNIT V **10 Hours**

CLASSIFICATION AND CLUSTERING

Classification: Basic concepts - Decision tree induction - Bayes classification Methods-Rule Based Classification- Model Evaluation and Selection - Techniques to Improve Classification Accuracy - Bayesian Belief Networks - Classification by Backpropagation - Cluster Analysis – Partitioning methods - Hierarchical methods

FOR FURTHER READING

Applications of data Mining-Social impacts of data Mining-Tools

Total: 45 Hours

Reference(s)

1 Jiawei Han, Micheline Kamber and Jian Pai, Data Mining: Concepts and Techniques, Morgan Kauffman, 2013
2 Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Mcgraw- Hill,2008
3 David Hand, Heikki Manila, PadhraicSymth, Principles of Data Mining, MIT Press, 2004
4 Margaret H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education 2008

18CS406 JAVA PROGRAMMING **2 0 2 4**

Course Objectives

- Understand the basic features of OOP in Java
- Summarize the types of Inheritance supported by Java
- Recognize the multithreading process supported by Java.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Analyze the basic statements in Java program
2. Analyze various types of inheritance and packages under different accessibility
3. Analyze the concept of interfaces, exceptions and multithreading nature of Java
4. Develop applications in Java with files and Strings handling
5. Design desktop based java applications using Java Applet, AWT and its components

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

UNIT I **6 Hours**

JAVA BASICS

The Genesis of Java - Overview of Java - Data Types, Variables, and Arrays - Operators – Control Statements - Introducing Classes - Methods and Classes. I/O Basics - Reading Console Input –Writing Console output.

UNIT II **6 Hours**

INHERITANCE AND PACKAGES

Inheritance: Basics - Using Super - Creating a Multilevel Hierarchy - Method overriding - Using Abstract Classes - Packages and Interfaces: Packages - Access Protection - Importing Packages

UNIT III **6 Hours**

INTERFACES, EXCEPTIONS AND THREAD

Interfaces Definitions and Implementations - Exception Handling: Types - Try and Catch - Throw - Multi-threaded Programming: Creating Threads - Inter Thread Communication

UNIT IV **6 Hours**

INTERFACES, EXCEPTIONS AND THREAD

File - The Byte Streams - The Character Streams - Using Stream I/ O - Serialization. String Handling: Special String operations and Methods - String Buffer - Exploring java.lang: Simple type Wrappers - System - Math - Utility Classes: String Tokenizer - Date and Time - Collection Interfaces –Collection Classes

UNIT V **6 Hours**

APPLETS, EVENT HANDLING AND AWT

Applet Basics - Applet Architecture - Applet Display Methods - Event Handling Mechanisms – Event Classes - Event Listener - Working with Windows , Graphics , Colors and Fonts - AWT Controls - Layout Managers and Menus - JDBC Concepts

1 **3 Hours**

EXPERIMENT 1

Program on Classes and Method

2 **2 Hours**

EXPERIMENT 2

Implementation of Inheritance

3 **3 Hours**
EXPERIMENT 3
Implementation of Interfaces and Packages

4 **3 Hours**
EXPERIMENT 4
Implementation of Multithreaded Programming

5 **2 Hours**
EXPERIMENT 5
Develop a program to implement String Handling Methods

6 **2 Hours**
EXPERIMENT 6
Implementation of Exception handling mechanisms

7 **3 Hours**
EXPERIMENT 7
Implementation of Collections Interfaces and Classes

8 **2 Hours**
EXPERIMENT 8
Implementation of I/O Streams

9 **2 Hours**
EXPERIMENT 9
Implementation of Applet Programs

10 **3 Hours**
EXPERIMENT 10
Implementation of AWT controls

11 **2 Hours**
EXPERIMENT 11
Write a program to implement Event classes implementation of JDBC concepts

12 **3 Hours**
EXPERIMENT 12
Implementation of JDBC concepts

Total: 60 Hours

FOR FURTHER READING
Spring framework - Container concepts - DAO Support and JDBC Framework - An introduction to Hibernate 3.5 - Integrating and configuring Hibernate - Building a Sample Application

Reference(s)

1 Herbert Schildt, Java 2-Complete Reference, Tata Mc Graw Hill, 2015
2 Deitel & Deitel, Java How to Program, Prentice Hall of India, 2010
3 Gary Cornell and Cay S.Horstmann, Core Java Vol.1 and Vol.2, Sun Microsystems Press, 2008
4 Jeff Linwood and Dave Minter, Beginning Hibernate Second Edition, Apress 2010
5 Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas Risberg, Colin Sampaleanu, Java Development with the Spring Framework, Wiley-India, 2012

18CS407 MICROPROCESSORS AND MICROCONTROLLER LABORATORY **0 0 4 2**

Course Objectives

- Understand the working of 85x86 microprocessors and 8051 microcontroller
- Develop ability in assembly language programming using 85x86 microprocessors and 8051 microcontroller.
- Work with I/O interfacing devices

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet the global requirements.

Course Outcomes (COs)

1. Develop assembly language programs using 8085/86 microprocessors and 8051 microcontroller
2. Implement interface between 8085 microprocessor and peripheral devices
3. Design an interface between LED and 8051 microcontroller.

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				3
2	2	2	3	2					2	2				2
3	2	2	3	3			3		2	2				3

1 **3 Hours**

EXPERIMENT 1

8085-Arithmetic operations

2 **3 Hours**
EXPERIMENT 2
8085-Code conversions

3 **3 Hours**
EXPERIMENT 3
8085-Matrix Multiplication

4 **6 Hours**
EXPERIMENT 4
8086-Arithmetic operations

5 **3 Hours**
EXPERIMENT 5
8086-String Manipulation

6 **6 Hours**
EXPERIMENT 6
Stepper motor interfacing with 8086

7 **6 Hours**
EXPERIMENT 7
Counters and time delay using 8086

8 **6 Hours**
EXPERIMENT 8
Interfcaing 8085 with 8255

9 **6 Hours**
EXPERIMENT 9
Interfcaing 8085 with 8279

10 **6 Hours**
EXPERIMENT 10
8051-Arithmetic operations

11 **3 Hours**
EXPERIMENT 11
8051-Fibonacci series and square of a number

12 **3 Hours**
EXPERIMENT 12
Unpacked BCD to ASCII

13 **6 Hours**

EXPERIMENT 13

Interfacing LED with 8051

Total: 60 Hours

Reference(s)

1 Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International publishing private limited, 2013
2 K.Ray and K.M.Bhurchandi, Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing, Tata McGraw Hill Education Private Limited, 2013
3 Douglas V.Hall, Microprocessors and Interfacing: Programming and Hardware, TMH, 2010
4 Yu-cheng Liu and Glenn A. Gibson, Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design, PHI 2011
5 Mohamed Ali Mazidi, Janice Gillispie Mazidi, The 8051 microcontroller and embedded systems, Pearson education, 2009

18CS408 DATA MINING AND DATA WAREHOUSING LABORATORY 0 0 4 2

Course Objectives

- Understand the basic concepts of data mining.
- Apply the data mining functionalities
- Assess the strengths and weaknesses of various data mining techniques

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement the data warehouse architecture
2. Explain the functionalities of data mining
3. Explore the different data preprocessing techniques
4. Identify the association rules using frequent itemset mining algorithms

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
2	2	2	2	2	2	2	2	2	2	2		2	2	2
3	2	3	3	2	3	3	2	2	2	2		2	3	2
4	2	3	3	2	3	3	2	2	2	2		2	3	3

1 **8 Hours**
EXPERIMENT 1
Working with attributes and filters

2 **8 Hours**
EXPERIMENT 2
Associating - Apriori algorithm and FP-Growth
  a. Learning Associations

3 **8 Hours**
EXPERIMENT 3
Classification - Bayesian, Decision tree, SVM
a. Selecting Classifier,
b. Test Options,
c. Training a Classifier,
d. Classifier Output,
e. Result list

4 **8 Hours**
EXPERIMENT 4
Clustering - K-means clustering, Agglomerative clustering
a. Selecting a Cluster
b. Cluster Modes
c. Ignoring Attributes
d. Working with Filters
e. Learning Clusters

5 **8 Hours**
EXPERIMENT 5
Visualizing methods in data mining

6 **10 Hours**
EXPERIMENT 6
Applications of classification for web mining

7 **10 Hours**

EXPERIMENT 7

Case Study on Text Mining or any commercial application

Total: 60 Hours

Reference(s)

1 Jiawei Han, Micheline Kamber and Jian Pai, Data Mining: Concepts and Techniques, Morgan Kauffman, 2013
2 Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Mcgraw- Hill,2008
3 David Hand, Heikki Manila, PadhraicSymth, Principles of Data Mining, MIT Press, 2004
4 Margaret H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education 2008

18HS001 ENVIRONMENTAL SCIENCE **2 0 0 2**

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
g. 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. 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 problems related 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

18GE401 SOFT SKILLS-BUSINESS ENGLISH 2 0 0 2

Course Objectives

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

Programme Outcomes (POs)

i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. 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.

Course Outcomes (COs)

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

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**

LISTENING AND READING

Listening for writing short answers - filling gaps in sentences - identifying topic, context and function -identify different functions of language in business situations - identify prompts -identify paraphrases of required information Scanning - reading for gist - understanding sentence structure - error identification - identify paraphrases -cohesive words and phrases - understand the importance of analysing the distractors - identify grammatical and semantic relationships

UNIT II **15 Hours**

WRITING AND SPEAKING

Business emails - notes - memos to colleagues or friends - giving instructions - explaining a development- asking for comments - requesting information - agreeing to requests - explaining - apologising - reassuring - complaining - describing - summarising - recommending - persuading turn - taking - sustaining interaction - initiating - responding - giving personal information - talking about present circumstances, past experiences and future plans - expressing opinion - speculating - organising a larger unit of discourse - giving information - expressing and justifying opinions - speculating - comparing and contrasting - agreeing and disagreeing

Total: 30 Hours

18CS501 THEORY OF COMPUTATION **3 1 0 4**

Course Objectives

- Understand the mathematical models of computation and design grammars and recognizer for different formal languages
- Identify the relation among regular language, context free language and the corresponding recognizers
- Determine the decidability and intractability of computational problems

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Classify the proofing techniques and construct finite automata
2. Construct finite automata for any given regular expression
3. Apply context free grammars and languages
4. Construct Push down Automata and Turing machine
5. Analyze the undecidability of languages

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	3									2	
3	2	2	3	3									2	
4	3	3	3	3									2	
5	3	3	3	3									2	

UNIT I **9 Hours**

AUTOMATA

Introduction to formal proof - Additional forms of proof - Inductive proofs - Finite Automata (FA) -Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) - Finite Automata with Epsilon transitions.

UNIT II **9 Hours**

REGULAR EXPRESSIONS AND LANGUAGES

Regular Expression - FA and Regular Expressions - Arden's theorem - Applications of Regular Expression - Algebraic Laws for Regular Expression - Proving languages not to be regular - Closure properties of regular languages.

UNIT III **9 Hours**

CONTEXT-FREE GRAMMAR AND LANGUAGES

Grammar Introduction- Types of Grammar - Context-Free Grammar (CFG) - Parse Trees – Applications of Context-Free Grammar -Ambiguity in grammars and languages - Normal forms for CFG – Pumping Lemma for CFL - Closure Properties of CFL.

UNIT IV **9 Hours**

PUSH DOWN AUTOMATA AND TURING MACHINES

Definition of the Pushdown automata - Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG. Turing Machines (TM)- Programming Techniques for TM - Storage in finite control - Multiple tracks - Checking off symbols – Subroutines.

UNIT V **9 Hours**

UNDECIDABILITY

A language that is not Recursively Enumerable (RE) - An undecidable problem that is RE – Undecidable problems about Turing Machine - Post's Correspondence Problem - Rice Theorem.

FOR FURTHER READING

Application of Finite Automata - Text Search Decision Properties of Regular Languages – Ambiguity Resolution in YACC- Extensions to the Basic Turing Machine Introduction to classes- P and NP- completeness.

Total: 60 Hours

Reference(s)

1 John E.Hopcroft, Rajeev Motwani and Jeffrey.D Ullman, Introduction to Automata Theory, Languages and Computations, Pearson Education, Third Edition, 2014
2 Harry R.Lewis and Christos.H. Papadimitriou, Elements of The theory of Computation, Pearson Education/PHI, 2007
3 C.Martin, Introduction to Languages and the Theory of Computation, TMH, 2007
4 Micheal Sipser, Introduction of the Theory and Computation, Thomson Brokecole, 2005

18CS502 COMPUTER ARCHITECTURE 3 0 0 3

Course Objectives

- Understand of the basic structure and operation of a digital computer
- Impart knowledge about the operation of the arithmetic unit including the algorithms & implementation addition, subtraction, multiplication & division.
- Acquire knowledge about the diverse ways of communicating with I/O devices and standard I/O Interfaces

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
b. 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 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.
c. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Classify the basic operational concepts of a digital computer, instruction sets with addressing modes
2. Design the arithmetic operations addition, subtraction, multiplication and division of signed numbers
3. Analyze the execution of instruction, Bus organization, pipelining and hazards
4. Illustrate the standard I/O devices and interfaces
5. Analyze the primary and secondary memories and their performance consideration

Articulation Matrix

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

UNIT I **9 Hours**

STRUCTURE OF COMPUTERS

Functional units-Basic operational concepts- Bus structures - Software-performance-Memory locations and addresses- Memory operations- Instruction and instruction sequencing- Addressing modes- Basic I/O operations.

UNIT II **9 Hours**

ARITHMETIC OPERATIONS

Addition and subtraction of signed numbers- Design of fast adders- Multiplication of positive numbers- Signed operand multiplication and fast multiplication-Integer division

UNIT III **11 Hours**

BASIC PROCESSING UNIT

Fundamental concepts-Execution of a complete instruction-Multiple bus organization-Hardwired control -Microprogrammed control -Pipelining: Basic concepts -Data hazards -Instruction hazards -Influence on Instruction sets -Data path and control consideration-Superscalar operation

UNIT IV **8 Hours**

INPUT/OUTPUT ORGANIZATION

Accessing I/O devices -Interrupts-Direct Interfaces (PCI, SCSI, USB)

UNIT V **8 Hours**

MEMORY UNIT

Basic concepts- Semiconductor RAMs-ROM's-Speed-size and cost-Cache memories -Performance consideration-Virtual memory-Memory Management requirements-Secondary storage.

FOR FURTHER READING

Categories of Instruction Set Architectures (ISA)- Multistage pipelines with variable latencies-branch prediction- Very large Instruction Word (VLIW) architectures- Instruction Level Parallelism (ILP)-Examples of modern processors- Hyper threading (HT)- Simultaneous Multithreading (SMT)- Multicore chips (Chip Multiprocessing).

Total: 45 Hours

Reference(s)

1 CarlHamacher, Zvonko Vranesicand Safwat Zaky, Computer Organization, McGraw-Hill,Third Reprint2015
2 WilliamStallings,Computer Organization and Architecture Designing for Performance,Pearson Education,2003
3 DavidA, PattersonandJohnL, Hennessy,Computer Organization and Design:The hardware/software interface, MorganKaufmann,4th edition, 2014.
4 John P.Hayes, Computer Architecture and Organization, McGraw Hill,3rd edition, 2002.

18CS503 COMPUTER NETWORKS 3 0 0 3

Course Objectives

- Understand the state-of-the-art in network protocols, architectures and applications
- Gain knowledge about the functions of different network layers
- Familiarize in the various aspects of computer networks

Programme Outcomes (POs)

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

b. 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 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. 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. 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.

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

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

l. 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.

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Classify the network models OSI and TCP/IP, Transmission media and circuit and packet switching
2. Apply framing, error and flow control techniques
3. Analyze and design the routing algorithms
4. Illustrate the process-to-process delivery, congestion control and quality of services
5. Interpret the working of application layer protocols

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	3		2
2	2	2	2	2			2				2	3		2
3	3	2	2	2	3		3				3	3		2
4	3	3	3	3	3		3				3	3		2
5	3	3	3	3	3		3				3	3		2

UNIT I **10 Hours**

INTRODUCTION

Data Communications - Data Flow - Networks - The Internet - Protocols and Standards – Network Models: Layered Tasks - The OSI Model - TCP/IP Protocol Suite - Addressing - Transmission Media - Connecting LANs, Backbone Networks, and Virtual LANs: Connecting Devices-Circuit Switching and Packet Switching

UNIT II **10 Hours**

DATA LINK LAYER

Introduction - Block Coding - Cyclic codes - Checksum -Data Link Control: Framing - Flow and Error Control - Noiseless Channels - Noisy Channels - HDLC -Multiple Access: Random Access - Channelization -Wired LANs: IEEE Standards- Standard Ethernet - Encoding (NRZ, NRZI, Manchester,4B/5B- WiMax.

UNIT III **9 Hours**

NETWORK LAYER

IPv4 Addresses- IPv6 Addresses - Internetworking - IPv4 - IPv6 - Transition from IPv4 to IPv6 - Network Layer: Delivery, Forwarding, and Routing: Address Mapping - Internet Control Message Protocol (ICMP) - Internet Group Management Protocol (IGMP) - Network Layer: Delivery, Forwarding, and Routing.

UNIT IV **9 Hours**

TRANSPORT LAYER

Process-to-Process Delivery - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) -Stream Control Transmission Protocol (SCTP) - Congestion Control and Quality of Service: Data Traffic - Congestion Control - Quality of Services (QoS)-POP3- IMAP.

UNIT V **7 Hours**

APPLICATION LAYER

Domain Name System (DNS): Domain Name Space - Distribution of Name Space - DNS in the Internet World Wide Web and HTTP - Simple Mail Transfer Protocol - File Transfer Protocol -Secure Shell (SSH)- TELNET - PGP - Firewalls.

FOR FURTHER READING

Network Management: Simple Network Management Protocol (SNMP) - Symmetric key cryptography - Security services - PGP - Firewalls.

Total: 45 Hours

Reference(s)

1 Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill,2014
2 James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3 Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4 Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008
5 William Stallings, Data and Computer Communication, Pearson Education, 2007
6 Douglas E.Comer and M.S.Narayanan, Computer Networks and Internets, Pearson Education,2008

18CS504 MACHINE LEARNING 3 0 0 3

Course Objectives

- Define machine learning and problems relevant to machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Apply neural networks, Bayes classifier and k nearest neighbor, for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Programme Outcomes (POs)

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

b. 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 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. 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. 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.

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

l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Identify the perspective and issues of machine learning and comprehend concept learning
2. Apply the decision tree on a dataset and find the issues in decision tree algorithm
3. Implement perceptron and back propagation neutal networks
4. Classify Bayes, Bayesian network and EM classifiers
5. Apply the Instance based and Reinforcement learning for solving 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	2							2	3		
2	2	3	3	2	3						3	3	3	
3	2	3	3	2	3						3	3	3	
4	3	3	3	3	3						3	3	3	
5	3	3	3	3	3						3	3	3	

UNIT I **9 Hours**

INTRODUCTION

Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

UNIT II **9 Hours**

DECISION TREE LEARNING

Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT III **9 Hours**

ARTIFICIAL NEURAL NETWORKS

Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm.

UNIT IV **9 Hours**

BAYESIAN LEARNING

Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm.

UNIT V **9 Hours**

HYPOTHESIS, INSTANCE BASED AND REINFORCEMENT LEARNING

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning.Reinforcement Learning: Introduction, Learning Task, Q Learning.

Total: 45 Hours

Reference(s)

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

2 Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3 Ethem Alpayd, Introduction to machine learning, second edition, MIT press.

18CS507 COMPUTER NETWORKS LABORATORY 0 0 4 2

Course Objectives

- Understand the concepts of computer networks and to study the functions of different layers.
- Familiarize with different protocols and network components.
- Familiarize in the various aspects of computer networks.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement the client server communication using socket connection.
2. Implement data link layer protocols
3. Design network routing protocols
4. Configure a Network topology using Packet tracer software.

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	2	3	3		3
2	2	3	2	2	3		2		2	2	3	3		3
3	2	3	3	2	3		3		2	2	3	3		3
4	3	3	3	3	3		3		2	2	3	3		3

1 **4 Hours**
EXPERIMENT 1
Study of Color coding Jack RJ45 and do the following Cabling works in a network
a. Cable Crimping
b. Standard Cabling
c. Cross Cabling and
d. Establish a LAN connection using three systems using any topology.

2 **4 Hours**
EXPERIMENT 2
Configure IP Address in a system in LAN (TCP/IP Configuration) and implement the client server communication using socket connection.

3 **6 Hours**
EXPERIMENT 3
Write a program for transferring a file between nodes in a network.

4 **4 Hours**
EXPERIMENT 4
Perform Bit Stuffing and CRC computation.

5 **4 Hours**
EXPERIMENT 5
By varying the no of frames, design the Sliding Window Protocol.

6 **6 Hours**
EXPERIMENT 6
Simulation of ARP/RARP

7 **4 Hours**
EXPERIMENT 7
Display the routing table for the nodes in a network using Distance Vector Routing (DVR) algorithm.

8 **4 Hours**
EXPERIMENT 8
Find the minimum cost in the node to node communication by Open Shortest Path First (OSPF) protocol.

9 **6 Hours**

EXPERIMENT 9
Write a program for downloading a file from HTTP server.

10 **6 Hours**
EXPERIMENT 10
Develop a client that contacts a given DNS server to resolve a given host name.

11 **6 Hours**
EXPERIMENT 11
Configure a Network topology using Packet tracer software.

12 **6 Hours**
EXPERIMENT 12
Study of Network simulator (NS) and Simulation of any one of routing protocol using NS2.

Total: 60 Hours

Reference(s)
1. Behrouz A.Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill,2014
2. James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education, 2005
3. Larry L.Peterson and Bruce S.Davie, Computer Networks, Elsevier, 2009
4. Andrew S.Tanenbaum, Computer Networks, Pearson Education, 2008

18CS508 MACHINE LEARNING LABORATORY 0 0 4 2

Course Objectives

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Consider a set of training data examples and implement algorithms to find the most specific hypothesis and set of all hypotheses that are consistent with the training examples.
2. Apply decision tree model, bayesian learning, instance based learning and reinforcement learning for approximation of classification, clustering, prediction algorithms to get the desired output.
3. Apply neural networks for approximation of classification, clustering, prediction algorithms to get the desired output.

Articulation Matrix

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

1 **6 Hours**

EXPERIMENT 1

Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file.

2 **6 Hours**

EXPERIMENT 2

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3 **6 Hours**

EXPERIMENT 3

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4 **6 Hours**

EXPERIMENT 4

Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5 **6 Hours**

EXPERIMENT 5

Write a program to implement the naive Bayesian classifier for a sample training data set stored as a.CSV file. Compute the accuracy of the classifier, considering few test data sets.

6 **6 Hours**

EXPERIMENT 6

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

7 **6 Hours**

EXPERIMENT 7

Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8 **6 Hours**

EXPERIMENT 8

Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9 **6 Hours**

EXPERIMENT 9

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

10 **6 Hours**

EXPERIMENT 10

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

Total: 60 Hours

18GE501 SOFT SKILLS - APTITUDE I **0 0 2 0**

Course Objectives

- Expose the undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values. It will provide a lot of activities and examples for a student to learn and develop these life skills.

Course Outcomes (COs)

1. Explain various concepts of number systems and their techniques in solving the percentage, average and age problems.
2. Analyse the profit and loss of real time situations and the relation between ratio, proportion and variation.
3. Apply different techniques to find the distance, speed and time of various moving objects.
4. Understand the concepts of coding, sequences and series, data interpretation and critical reasoning to solve real time logical reasoning problems.

1 **2 Hours**

NUMBER SYSTEMS

Introduction - Definition - Classification on Numbers- Power cycles and remainders - Short cut process- Concept of Highest Common Factor-Concept of Least Common Multiple- Divisibility- Number of zeros in an expression

2 **2 Hours**

PERCENTAGE

Introduction - Definition and Utility of Percentage - Importance of base/denominator for percentage calculations-Concept of percentage values through additions-Fraction to percentage conversion table.

3 **3 Hours**

AVERAGES AND AGES

Introduction-Average of different groups-Addition or removal of items and change in average-Replacement of some of the items.

4 **3 Hours**

RATIO, PROPORTIONS AND VARIATION

Introduction- Ratio- Properties-Dividing a given number in the given ratio-Comparison of ratios-Proportions-Useful results on proportion- Continued proportion-Relation among the quantities more than two-Variation

5 **2 Hours**

PROFIT AND LOSS

Gain/Loss and percentage gain or percentage loss-Multiplying equivalents to find sale price-Relation among cost price, sale price, gain/loss and percentage gain or percentage loss-An article sold at two different selling price-Two different articles sold at same selling price-Percentage gain or percentage loss on selling price-Percentage gain or percentage loss on whole property.

6 **2 Hours**

TIME AND WORK

Introduction-Basic concepts-Concepts on working with different efficiencies-Pipes and Cisterns-Work Equivalence (Man Days) -Alternative approach.

7 **2 Hours**

TIME, SPEED AND DISTANCE

Definition-Basics of Time, Speed and Distance - Relative speed-Problems based on Trains-Problems based on Boats and Streams-Problems based on Races-Time taken with two difference modes of transport-Time and distance between two moving bodies.

8 **3 Hours**

CODING AND DECODING

Introduction-Description of Coding method-Coding patterns - Concepts of Coding and Decoding-Problems involving Coding and Decoding methods.

9 **2 Hours**

SEQUENCE AND SERIES

Introduction-Sequences of real numbers - Number and Alphabet series-Description of Number and Alphabet series-Analogy-Odd man out-Power series.

10 **3 Hours**

DATA SUFFICIENCY

Introduction to Data Sufficiency - Overview of the wide variety of Data Sufficiency problems - Basic introduction on how to determine what information is sufficient to solve a given problem - Common pitfalls to avoid.

11 **3 Hours**

DIRECTION

Introduction to Direction - sense test - Overview of the wide variety of Direction problems-Direction-Plotting diagrams.

12 **3 Hours**

CRITICAL REASONING

Introduction-Basic concept of critical reasoning- Weaken the argument-Strengthen the argument-Flaw in the argument-Evaluate the conclusion.

Total: 30 Hours

Reference(s)

1 Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Mc Graw Hill Publications.
2 U. Mohan Rao, Quantitative Aptitude for Competitive Examinations, Scitech Publications Pvt Ltd, India.
3 Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Third Edition, Pearson Education Pvt Ltd, India, 2016.

4 Dr. R S Aggarwal, A Modern Approach to Verbal and NonVerbal Reasoning, Revised Edition, S Chand Publications.
5 Arun Sharma, How to prepare for Logical Reasoning for CAT & other Management Exams, Fifth Edition, Mc Graw Hill Publications.
6 Jaikishan and Premkishan, How to Crack Test of Reasoning in all Competitive Examinations, Revised Edition, Arihant Publications

18HS003 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.

Programme Outcomes (POs)

c. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.

Course Outcomes (COs)

1. Understand the basic concepts of Management.
2. Ability to have 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			2			2	2							
2			2		2	2	2							
3								2	3					
4			2						2	2				
5			2						2	2				

UNIT I **9 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

UNIT II **9 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 **9 Hours**

ORGANISING

Nature and purpose-Formal and informal organization-Organization chart-Organization Structure-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 **9 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 **9 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: 45 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

18CS602 WEB TECHNOLOGY 3 0 0 3

Course Objectives

- Understand the scripting languages XHTML, JavaScript and PHP.
- Familiar with the different server technologies.
- Gain knowledge in the concepts of web services.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
k. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Demonstrate the technologies used to create web pages
2. Design dynamic and interactive web pages by embedding Java Script in XHTML
3. Implement server side programming and build web applications using PHP
4. Develop interactive web applications using ASP.Net
5. Interpret web services and its technologies

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

UNIT I **10 Hours**

INTRODUCTION TO WEB AND XHTML

Introduction - Blogging - Social Networking - Socialmedia - Tagging - Software developmen - Introduction to XHTML and Editing XHTML Headings - Linking - Images - Special characters and Horizon rules - Lists - Tables - Forms -Internal Linking- Meta Elements - Cascading Style Sheets.

UNIT II **10 Hours**

JAVASCRIPT

Introduction to scripting - Control statements I, II - Functions: Definition - Random Number Generation -Global function - Recursion - Arrays: Declaring and allocating arrays Multidimensional arrays - Objects: Math object - String object - Date object - Boolean, Number object - Document object - Window object - Events.

UNIT III **8 Hours**

INTERNET APPLICATION SERVER TECHNOLOGIES

Web server (IIS and Apache): Multitier Architecture - Client/ Serverside scripting - Accessing web services - Microsoft IIS - Apache HTTP server - Database: Relational database - SQL - PHP: Basics - String and Form Processing - connecting to database.

UNIT IV **9 Hours**

ASP .NET AND JSP WEB APPLICATIONS

Introduction - creating and running a simple web form - Web controls - session tracking - case study: Connecting to a database in ASP.NET. - Introduction to AJAX- AJAX XML Http request- AJAX Events- Java web technologies(Servlets, JSP)-creating and running a simple application in Netbeans-JSF components.

UNIT V **8 Hours**

WEB SERVICES

Introduction - Java web services Basics - Creating Publishing, Testing and describing web service - Consuming web service - SOAP - Session Tracking in web services - Consuming a Database driven web service from a web application - Passing an object of a User defined type to a web service.

FOR FURTHER READING

Introduction - Java web technologies - Creating and running a simple application in Netbeans – JSF components - Session tracking: cookies.

Total: 45 Hours

Reference(s)

1 P.J. Deitel and H.M. Deitel, Internet and World Wide Web - How to Program, Pearson Education,2009.
2 Deitel, Deitel and Nieto, Internet and World Wide Web How to Program, Pearson Education,2002.
3 Uttam K.Roy, Web Technologies, Oxford University Press, 2010.
4 Rajkamal, Web Technology, Tata McGraw-Hill, 2009.
5 www.w3schools.com/ajax.

18CS603 COMPILER DESIGN 3 1 0 4

Course Objectives

- Acquire knowledge in different phases of a Compiler and its applications.
- Understand the categorization of tokens using lexical analyzer and pattern recognition using parsers.
- Familiar with the code generation schemes and optimization methods.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Analyze the output generated in each phase of the compiler
2. Construct finite automata for regular expression and apply state minimization techniques
3 Construct Top down and Bottom up parser for context free grammars
4. Generate intermediate code for programming constructs
5. Apply optimization techniques in code generation and analyze the issues in code generation.

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	3									2	
3	2	2	3	3									2	
4	3	3	3	3									2	
5	3	3	3	3									2	

UNIT I **8 Hours**

INTRODUCTION TO COMPILER

Language processors - Structure of a compiler - Grouping of phases into passes- Compiler construction tools - Applications of compiler technology: Implementation of high-level programming languages - Optimizations for computer architectures-Design of new computer architecture - Program Translations-Software productivity tools.

UNIT II **9 Hours**

LEXICAL ANALYSIS

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Lexical Errors - Specification of tokens - Recognition of Tokens - Finite automata - Regular expression to finite automation- Optimization of DFA based Pattern Matchers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III **11 Hours**

SYNTAX ANALYSIS

Introduction-Role of the parser - Context-Free Grammars -Writing a Grammar-TopDown parsing -Recursive Descent Parsing - Nonrecursive Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing- LR Parsers: Simple LR Parser - Canonical LR Parser - LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.

UNIT IV **8 Hours**

SEMANTIC ANALYSIS

Syntax Directed Translation - Construction of Syntax Tree - Variants of Syntax Trees -Three-Address Code - Types and Declarations - Translation of Expressions - Control Flow - Backpatching - Switch- Statements - Intermediate Code for Procedures.

UNIT V **9 Hours**

CODE OPTIMIZATION

Principal Sources of Optimization-DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Issues in Design of a Code Generator - A Simple Code Generator Algorithm.

FOR FURTHER READING

The evolution of programming languages-The science of building a compiler - Run time Environments -Storage Organization - Stack Allocation of Space- Heap Management.

Total: 60 Hours

Reference(s)

1 Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman Compilers: Principles, Techniques and Tools ,2nd Edition, Pearson, 2012.
2 D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, Modern Compiler Design, Wiley, 2008.
3 Kennath C. Louden, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2003.
4 Allen I. Holub, Compiler Design in C, Prentice Hall of India, 2003.

18CS604 CLOUD COMPUTING 3 0 0 3

Course Objectives

- Understand the architecture and features of different cloud models
- Be familiar with the underlying principles of virtualization, cloud applications and cloud storage
- Gain knowledge on security issues and risk management

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the types of cloud model suitable for building an efficient cloud computing environment
2. Analyze the virtualization technologies and capacity planning techniques to create shared resource pools
3. Illustrate the cloud based applications and the cloud storages using CDMI and OCCI
4. Analyze the basics of information security in cloud computing
5. Examine the risks involved in virtualization security management

Articulation Matrix

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

UNIT I **9 Hours**
INTRODUCTION

Defining Cloud Computing-Cloud Types: The NIST Model-The Cloud Cube Model -Deployment Models-Service Models-Essential Characteristics of Cloud Computing-Benefits of Cloud Computing-Measuring the Cloud's Value: Measuring Cloud Computing Costs-Understanding Services and

Applications by Type: Defining IaaS-Defining PaaS-Defining SaaS.

UNIT II **8 Hours**

VIRTUALIZATION AND CAPACITY PLANNING

Using Virtualization Technologies-Load Balancing and Virtualization-Advanced Load Balancing-Understanding Hypervisors: Virtual Machine Types-VMware vSphere-Capacity Planning: Defining Baseline and Metrics-Network Capacity.

UNIT III **10 Hours**

CLOUD APPLICATIONS AND CLOUD STORAGE

Moving Applications to the Cloud: Applications in the Cloud-Functionality Mapping-Application Attributes-Cloud Service Attributes-System Abstraction-Cloud Bursting-Cloud APIs-Working with Cloud-Based Storage: Cloud Storage Definition-Provisioning Cloud Storage-Cloud Backup Types-Cloud Backup Features-Cloud Data Management Interface (CDMI)-Open Cloud Computing Interface (OCCI).

UNIT IV **10 Hours**

CLOUD SECURITY FUNDAMENTALS

Cloud Information Security Objectives-Cloud Security Services-Cloud Security Design Principles-Secure Cloud Software Requirements: Secure Development Practices-Approaches to Cloud Secure Software Requirements Engineering-Cloud Computing and Business Continuity Planning/Disaster Recovery.

UNIT V **8 Hours**

CLOUD RISK MANAGEMENT

Cloud Computing Risk Issues: The CIA Triad-Threats to Infrastructure, Data and Access Control-Cloud Service Provider Risks-Cloud Computing Security Challenges: Security Policy Implementation- Virtualization Security Management.

FOR FURTHER READING

Cloud evolution- Data center requirements- vmware virtualization- Google Infrastructure- Google Cloud Security.

Total: 45 Hours

Reference(s)

1 Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014.
2 Ronald L.Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2013.
3 Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2009.

18CS607 WEB TECHNOLOGY LABORATORY 0 0 4 2

Course Objectives

- Understand and apply the role of scripting languages like XHTML, CSS, JavaScript, ASP, JSP and PHP for designing interactive web applications.
- Familiar with the different types of server technologies.
- Gain knowledge about the concepts of web services.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Implement with presentation effects in XHTML and CSS
2. Create dynamic webpages using java script and PHP in XHTML
3. Design the interactive web applications by connecting SQL with ASP.Net
4. Develop SOAP based web services for real time applications

Articulation Matrix

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

1 **6 Hours**
EXPERIMENT 1
Create a XHTML document for the college website with Text styling, Linking, Images, Lists, Table by highlighting the facilities in the department.

2 **6 Hours**
EXPERIMENT 2
Create an XHTML document for an online Bookstore that has a Registration form with text box, Radio Button, Selection box, Checkbox, Submit and reset buttons.

3 **6 Hours**
EXPERIMENT 3
Design a web page using CSS which includes the following:
a) Use different font styles
b) Set background image for both the page and single elements on page.
c) Control the repetition of image with background-repeat property
d) Define style for links as a: link, a: active, a: hover, a: visited

4 **6 Hours**
EXPERIMENT 4
Write a java script to validate the following fields in a registration page
a) Name (should contains alphabets and the length should not be less than 6 characters)
b) Password (should not be less than 6 characters)
c) E-mail (should not contain invalid addresses)

5 **6 Hours**
EXPERIMENT 5
Write a JavaScript function to get nth largest element from an unsorted array.

6 **6 Hours**
EXPERIMENT 6
Create a web page with real time clock using Java script event handling mechanism.

7 **6 Hours**
EXPERIMENT 7
Write a JSP code to retrieve the xhtml form values and print those values in JSP pages.

8 **6 Hours**
EXPERIMENT 8
Write a program with ASP .net by connecting with SQL
a. Create login form to enter into website
b. Building web form that displays data from a database

9 **6 Hours**
EXPERIMENT 9
Write a PHP program for an web application that

a. takes a name as input and on submit it shows a hello page where is taken from the request
b. shows a start time at the right top corner of the page and
c. provides the logout button on clicking this button it should show a logout page with thank you message along with the duration of usage session

10 **6 Hours**

EXPERIMENT 10

Create a SOAP based web service for a simple Java Calculator class with operations add and subtract then create a web service client which then consumes the web service and displays the result of the invoked web service.

Total: 60 Hours

18CS608 CLOUD COMPUTING LABORATORY 0 0 4 2

Course Objectives

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- To learn to implement and use parallel programming using Hadoop

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Configure various virtualization tools such as Virtual Box, VMware workstation.
2. Design and deploy a web application in a PaaS environment.
3. Learn how to simulate a cloud environment to implement new schedulers.
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment

Articulation Matrix

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

1 **8 Hours**
EXPERIMENT 1
Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

2 **8 Hours**
EXPERIMENT 2
Install a C compiler in the virtual machine created using virtual box and execute Simple Programs

3 **8 Hours**
EXPERIMENT 3
Install Google App Engine. Create hello world app and other simple web applications using python/java.

4 **7 Hours**
EXPERIMENT 4
Use GAE launcher to launch the web applications.

5 **7 Hours**
EXPERIMENT 5
Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

6 **7 Hours**
EXPERIMENT 6
Find a procedure to transfer the files from one virtual machine to another virtual machine.

7 **7 Hours**
EXPERIMENT 7
Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

8 **8 Hours**
EXPERIMENT 8
Install Hadoop single node cluster and run simple applications like wordcount.

Total: 80 Hours

Reference(s)

1 Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2009.
2 Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, Cloud Computing for Dummies, Wiley India, 2009.
3 Barrie Sosinsky, Cloud Computing Bible,Wiley-India,2014

18GE601 SOFT SKILLS-APTITUDE II **0 0 2 0**

Course Objectives

- Expose the undergraduate students to such methods and practices that help, develop and nurture qualities such as character, effective communication, aptitude and holding ethical values. It will provide a lot of activities and examples for a student to learn and develop these life skills.

Course Outcomes (COs)

1. Apply the concepts of probability, Sets, Permutation and Combinations in estimating data for real time problems.
2. Understand the concept of logarithms, progressions and Simple and Compound interest to solve various practical problems.
3. Analyse objects involving cubes and cuboids in determining the number of sides colored.
4. Interpret various data from graphs and tables to determine ratio, percentage and averages.
5. Apply the logical reasoning skills for identifying age, relations, visual relations and puzzles.

1 **2 Hours**

PERMUTATION AND COMBINATION

Definition-Fundamental rules-Theorems on Permutation-Theorems on Combination.

2 **2 Hours**

PROBABILITY

Concept and Importance of Probability-Underlying factors for real Life estimation of probability-Basic facts about probability-Some important consideration while defining event.

3 **3 Hours**

SYLLOGISM AND VENN DIAGRAM

Concepts on Syllogisms-Venn diagram-Interpretation-Venn diagram-solving.

4 **3 Hours**

SIMPLE INTEREST AND COMPOUND INTEREST

Introduction-Definition - Effect of change of P, R, T on simple interest-Amount-Amount becomes N times the principle-Repayment of debt in equal installments-Rate and time are numerically equal-Compound Interest-Conversion period-Basic formula-Special cases-To find the principle / Time /Rate-Difference between Compound Interest and Simple Interest-Equal annual installment to pay the borrowed amount.

5 **2 Hours**

MIXTURES AND ALLIGATION

Definition-Alligation rule-Mean value (cost price) of the mixture-Some typical situations where allegation can be used.

6 **2 Hours**

CUBE AND LOGARITHM

Introduction-Basic Concepts of Cube and Cuboid-Problems involving cubes and cuboids of various dimensions-Problems involving coloured cubes and cuboids - Basic concepts of Logarithm-Laws of

Logarithms including change of base-Common logarithm (base 10) - Properties of Logarithms to solve equations involving logarithmic expressions.

7 **2 Hours**

DATA INTERPRETATION

Introduction-Ratio-Percentage-Average-Tables - Graphs and Charts.

8 **3 Hours**

PROGRESSION AND LOGICAL REASONING

Arithmetic progression-Geometric progression -Harmonic progression -Theorems related with progressions.

9 **2 Hours**

PROBLEM ON AGES

Introduction-Basic concept-Usage of Percentage and Averages -Applications

10 **2 Hours**

ANALYTICAL REASONING

Introduction-Basic concept-Non verbal Analytical Reasoning -Arrangements.

11 **2 Hours**

BLOOD RELATION

Introduction-Basic concept-Kinds of relation-Tree diagram -Relations.

12 **3 Hours**

VISUAL REASONING

Introduction-Basic concepts-Odd man out-Next series-Mirror image and water image

13 **2 Hours**

SIMPLIFICATIONS

Introduction-Basic concepts-Arithmetic operations-Equation solving methods-Puzzles.

Total: 30 Hours

Reference(s)

1 Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Mc Graw Hill Publications.
2 U. Mohan Rao, Quantitative Aptitude for Competitive Examinations, Scitech Publications Pvt Ltd, India.
3 Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Third Edition, Pearson Education Pvt Ltd, India, 2016.
4 Dr. R S Aggarwal, A Modern Approach to Verbal and NonVerbal Reasoning, Revised Edition, S Chand Publications.
5 Arun Sharma, How to prepare for Logical Reasoning for CAT & other Management Exams, Fifth Edition, Mc Graw Hill Publications.
6 Jaikishan and Premkishan, How to Crack Test of Reasoning in all Competitive Examinations, Revised Edition, Arihant Publications.

18HS002 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)

b. 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 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. 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. 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.
e. 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.
f. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
g. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
h. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
i. 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.
j. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
k. 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. Articulate engineering ethics theory with sustained lifelong learning.
2. Analyse the scope of engineering ethics in professionalism
3. Apply the social experimentation process for solving real world problems.
4. Analyze the rights and responsibilites of employees in creating safe and healthy workplace
5. Differentiate the global issues encountered in multinational corporation and environmental context.

Articulation Matrix

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

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 Gilligan""s 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

18CS702 SOFTWARE TESTING 3 0 0 3

Course Objectives

- Familiarize with the various test design strategies.
- Understand the levels of testing and defect classes.
- Impart knowledge on the testing and debugging policies with the types of review.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
f. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the testing principles involved in ensuring the software quality
2. Analyze the testing design strategies in software testing
3. Compare the software testing level with respect to System design and coding
4. Examine the testing activities to deliver high quality software applications.
5. Implement the testing and debugging policies with the types of review.

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

UNIT I 8 Hours

SOFTWARE TESTING FUNDAMENTALS

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process- The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of Defects- Defect Classes the Defect Repository

UNIT II **8 Hours**

TESTING DESIGN STRATEGIES

Introduction to Testing Design Strategies - The Smarter Tester - Test Case Design Strategies - Black Box testing - Random Testing - Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing - Error Guessing - Black-box testing and COTS - White-Box testing -Test Adequacy Criteria - Coverage and Control Flow Graphs.

UNIT III **9 Hours**

LEVELS OF TESTING

The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests. The Class as a Testable Unit - The Test Harness - Running the Unit tests and Recording results- Integration tests- Designing Integration Tests - Integration Test Planning - System Test - Types-of system testing - Regression Testing.

UNIT IV **10 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 - The role of three groups in Test Planning and Policy Development - Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group.

UNIT V **10 Hours**

TEST MEASUREMENTS AND REVIEWS

Defining Terms - Measurements and Milestones for Controlling and Monitoring- Status Meetings- Reports and Control Issues - Criteria for Test Completion- SCM - Types of reviews - developing a review program - Components of Review Plans- Reporting review results. Testing Tools-Case Selenium, Autoit

FOR FURTHER READING

Software test automation, skills needed for automation scope of automation, design and architecture for automation, requirements for a test tool challenges in automation.

Total: 45 Hours

Reference(s)

1 S Limaye, Software Testing Principles, Techniques and Tools, McGraw Hill, 2009.
2 Ilene Burnstein, Practical Software Testing, Springer International, 2003.
3 Boris Beiser, Software Testing Techniques, Dreamtech press, New Delhi, 2009.
4 Aditya P.Mathur, Foundations of Software Testing, Pearson Education,2008.
5 Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing, Principles and Practices, pearson Education,2008.

18CS703 ARTIFICIAL INTELLIGENCE 3 0 0 3

Course Objectives

- Understand the fundamental concepts of artificial intelligence
- Impart the different paradigms in knowledge representation and reasoning
- Determine the problems to solve using artificial intelligence and machine learning

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Analyse the intelligent agents and uninformed search strategies for problem solving
2. Analyse the informed search stratgies for problem solving
3. Apply the first order logic for knowledge representation
4. Apply planning methods to solve decision making problems
5. Apply different forms of learning for problem solving

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

UNIT I **9 Hours**

INTRODUCTION

Intelligent Agents - Agents and environments - Good behavior - The nature of environments - Structure of agents - Problem Solving - Problem solving agents- Uniformed search strategies - Avoiding repeated states-Searching with partial information.

UNIT II **9 Hours**

SEARCHING TECHNIQUES

Informed search and exploration - Informed search strategies - heuristic function - Local search algorithms and optimization problems- Local search in continuous spaces - Online search agents and unknown environments -Constraint satisfaction problems (CSP)-Backtracking search and Local search for CSP

UNIT III **9 Hours**

KNOWLEDGE REPRESENTATION

First order logic - Representation revisited - Syntax and semantics for first order logic - Using first order logic -Knowledge engineering in first order logic - Inference in First order logic - Prepositional versus first order logic - Unification and lifting - Forward chaining - Backward chaining-Ontological Engineering

UNIT IV **9 Hours**

PLANNING

Planning problem- Planning with state space search - Partial order planning - Planning graphs – Planning with proportional logic - Time, Schedules, and Resources - Hierarchical task Planning – Conditional Planning - Execution monitoring and re planning-Continuous planning

UNIT V **9 Hours**

LEARNING

Learning from observations - forms of learning - Inductive learning - Learning decision trees – Ensemble learning - Knowledge in learning - Logical formulation of learning - Explanation based learning - Learning using relevant information-Statistical Learning Methods

FOR FURTHER READING

Language Models - Text Classification - Information Retrieval - Information Extraction - speech recognition.

Total: 45 Hours

Reference(s)

1 Stuart Russell and Peter Norvig, Artificial Intelligence - A Modern Approach, Prentice Hall India,2012
2 Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Tata Mcgraw- Hill, 1997.
3 Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill, 2010.
4 M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publisher, 2010.
5 Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi agent Systems with JADE, John Wiley and Sons Ltd, 2007.

18CS704 CRYPTOGRAPHY AND NETWORK SECURITY **3 0 0 3**

Course Objectives

- Understand the principles and methods of conventional and advanced encryption algorithms.
- Learn the techniques used for message authentication and confidentiality maintenance.
- Understand the network security tools and applications.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
l. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Classify the encryption techniques and number theory in computer security
2. Apply Data Encryption Standard and Advanced Encryption Standard to enhance the data security
3. Apply public key cryptographic algorithms to improve the management of cryptosystem
4. Apply the hashing techniques for cryptographic data integrity
5. Analyze the issues in network and internet security

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Computer Security Concepts - OSI Security Architecture - Security Attacks Services Mechanisms - Model for Network Security - Classical Encryption Techniques - Symmetric Cipher Model – Substitution - Transposition Techniques - Basic Concepts in Number Theory and Finite Fields - Divisibility and Division Algorithm - Euclidean Algorithm - Modular Arithmetic - Polynomial Arithmetic.

UNIT II **9 Hours**

SYMMETRIC CIPHERS

Block Cipher Principles - Data Encryption Standard (DES) - DES Example - Strength of DES - Differential and Linear Cryptanalysis - Block Cipher Design Principles - Advanced Encryption Standard(AES)- Structure - Round Functions - Key Expansion - AES Example – Pseudo random Number Generation and Stream Ciphers - RC4.

UNIT III **9 Hours**

ASYMMETRIC CIPHERS AND KEY MANAGEMENT

Prime Numbers - Fermat's and Euler's Theorems - Testing for Primality - Discrete Logarithms - Public-Key Cryptography and RSA - Diffie-Hellman Key Exchange - Key Management and Distribution - Symmetric Key Distribution Using Asymmetric Encryption - Distribution of Public Keys - X.509 Certificates - Public Key Infrastructure.

UNIT IV

Cryptographic Hash Functions - Applications - Two Simple Hash Functions - Requirements and Security Hash Functions based on Cipher Block Chaining - Secure Hash Algorithm (SHA) - SHA-3 - Message Authentication Codes - Requirements Ã¢?? Functions - Security of MACs - MACs based on Hash Functions: HMAC - Digital Signatures - Digital Signature Standard (DSS) - Kerberos.

UNIT V **9 Hours**

NETWORK AND INTERNET SECURITY

Transport Level Security - Web Security Issues - Secure Sockets Layer (SSL) - Transport Layer Security(TLS)- HTTPS - Secure Shell (SSH) - Electronic Mail Security - Pretty Good Privacy (PGP) - S/MIME - IP Security - Firewalls.

FOR FURTHER READING

Digital Watermarking and Steganography-International Data Encryption Algorithm (IDEA)- Chinese reminder theorem -Electronic Commerce Security-Viruses and worms

Total: 45 Hours

Reference(s)

1 William Stallings, Cryptography and Network security Principles and Practices, 5th edition, Pearson Education, 2010
2 William Stallings, Network security essentials application and standards, Prentice Hall of India , 2010
3 Charles P.Fleeger, Shari Lawrence P.Fleeger, Security in computing, Prentice Hall of India, 2009
4 W. Mao, Modern Cryptography Ã¢?? Theory and Practice, Pearson Education, 2007
5 Wade Trappe, Lawrence C Washington, Introduction to Cryptography with coding theory, Pearson Education, 2007

18CS707 SOFTWARE TESTING LABORATORY 0 0 4 2

Course Objectives

- Analyse the requirements for the given problem statement
- Design and implement various solutions for the given problem
- Employ various design strategies for problem solving.
- Construct control flow graphs for the solution that is implemented
- Create appropriate document for the software artefact

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Apply boundary value testing and equivalence class value testing for the given test cases.
2. Apply decision table, data flow and basis path testing for the given test cases.
3. Apply basis path testing on sorting and searching algorithms

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		2	3	2	2		3
2	2	2	2	2	3	3	2		2	3	2	2		3
3	2	3	2	2	3	3	2		2	3	2	2		3

1 **5 Hours**

EXPERIMENT 1

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results.

2 **5 Hours**

EXPERIMENT 2

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

3 **5 Hours**

EXPERIMENT 3

Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

4 **5 Hours**

EXPERIMENT 4

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.

5 **5 Hours**

EXPERIMENT 5

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.

6 **5 Hours**

EXPERIMENT 6

Design, develop, code and run the program in any suitable language to implement the Next Date function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results

7 **5 Hours**

EXPERIMENT 7

Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.

8 **5 Hours**

EXPERIMENT 8

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.

9 **5 Hours**

EXPERIMENT 9

Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.

10 **5 Hours**

EXPERIMENT 10

Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

11 **5 Hours**

EXPERIMENT 11

Design, develop, code and run the program in any suitable language to implement the quicksort algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

12 **5 Hours**

EXPERIMENT 12

Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

Total: 60 Hours

Reference(s)

1 William E Perry, Effective Methods for Software Testing, John Wiley & Sons, USA,Third Edition 2014.

LANGUAGE ELECTIVES
18HSC01 CHINESE **1 0 2 2**

Course Objectives
- To help students appear for HSK Level 1 Exam
- To help students acquire the basics of Chinese language
- To teach the students how to converse in Chinese in various situations

Programme Outcomes (POs)

j. 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.

Course Outcomes (COs)
1. Listen and identify individual sounds of Chinese
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														
5										2				

UNIT I **9 Hours**

Hello 1Initials and Finals of Chinese b,p,m,f,d,,n,l,g,k,h,j,q,x 2. Tones Four 3Chinese Syllables 4.Tone S

UNIT II **9 Hours**

Thank you Initials and Finals of Chinese The Neutral Tone Rules of Tone Marking and Abbreviation

UNIT III **9 Hours**

What'"s your name - In the school; -In the classroom; -In the school The Interrogative Pronoun 2 The Sentence 3 Interrogative Sentences with

UNIT IV **9 Hours**

She is my Chinese teacher In the library The Interrogative Pronouns The Structural Particle The interrogative Particle

UNIT V **9 Hours**

Her daughter is 20 years old this year 1.The Interrogative Pronoun | 2. Numbers below 100 | 3.Indicating a Change | The Interrogative Phrase

Total: 45 Hours

18HSF01 FRENCH 3 0 0 3

Course Objectives

- To prepare the students for DELF A1 Examination
- To teach them to converse fluently in French in day-to-day scenarios

Programme Outcomes (POs)

j. 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.

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				

9 Hours

UNIT I

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 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

18HSG01 GERMAN **3 0 0 3**

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

Programme Outcomes (POs)

j. 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.

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.

18HSH01 HINDI **3 0 0 3**

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

Programme Outcomes (POs)

j. 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.

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										3				
4										2				
5										3				

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

18HSJ01 JAPANESE 3 0 0 3

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

Programme Outcomes (POs)

j. 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.

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 - VMasendeshita 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 nohouga 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 (30Numbers)

Total: 45 Hours

Reference(s)

1 Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

18HS201 COMMUNICATIVE ENGLISH II **3 0 0 3**

Course Objectives
- Read and understand ideas of complex text on both concrete and abstract topics
- Listen and understand technical discussions in his/her field of specialisation
- Produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various option
- Interact with a degree of fluency and spontaneity that makes regular interaction without strain

Programme Outcomes (POs)
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
j. 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

Course Outcomes (COs)
1. Use appropriate grammar & vocabulary that is expected at the BEC Vantage exam level.
2. Understand the general meaning of non-routine letters, and of a report of predictable unpredictable topic
3. Write simple reports of factual nature and factual non-routine letters
4. Ask for factual information and understand the answer; and take/pass on workplace messages
5. Express opinions and present arguments to a limited extent; and give simple, prepared presentations on familiar topics

Articulation Matrix

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

UNIT I **9 Hours**
GRAMMAR3
Tenses - Future continuous, Future perfect, Future perfect continuous, Past perfect, Past perfect continuous - Adjectives and adverbs - Mixed conditionals - Modals - can't have, needn't have - Modals of deduction and speculation - Narrative tenses - Passives - Phrasal verbs, extended - Relative clauses -Reported speech - Will and going to, for prediction - Wish - Would expressing habits, in the past.

UNIT II **9 Hours**
READING
Scanning and reading for gist - Understanding text structure - Reading for gist and specific information -Vocabulary and structure - Understanding sentence structure and error identification

UNIT III **9 Hours**
WRITING
A message, memo or email, giving instructions, explaining a development, asking for comments, requesting information, agreeing to requests - Business correspondence: explaining, apologising, reassuring, complaining, short report: describing, summarising - proposal: describing, summarising, recommending, persuading.

UNIT IV **9 Hours**
LISTENING
Listening for and noting specific information - Listening to identify topic, context, Function – Following the main points and retrieving specific information from the text.

UNIT V **9 Hours**
SPEAKING
Giving personal information: Talking about present circumstances, past experiences and future plans, expressing opinions, speculating - Organising a larger unit of discourse: Giving information and expressing and justifying opinions - Turn-taking: negotiating, collaborating, exchanging information, expressing and justifying opinions, agreeing/disagreeing, suggesting, speculating, comparing and contrasting, and decision-making.

1.A Horse and Two Goats-R K Narayan
2.My Lord the Baby - Rabindranath Tagore
3.Twist in the Tale-Jeffery Archer
4.The Third and Final Continent – Jhumpa Lahiri
5.The Gift of the Magi - O Henry

Total: 45 Hours

Reference(s)
1 Guy Brook-Hart, "BEC Vantage: Business Benchmark Upper-Intermediate- Student's Books" 1st Edition, Cambridge University Press, New Delhi, 2006.
2 Ian Wood, Paul Sanderson, Anne Williams with Marjorie Rosenberg, "Pass Cambridge BEC Vantage- Student's Book" 2nd Edition, Cengage Learning, New Delhi, 2014
3 Michael Handford, Martin Lisboa, Almut Koester, Angela Pitt, "Business Advantage - Student's Book Upper-Intermediate" Cambridge University Press, New Delhi, 2014.
4 Cambridge Examination Publishing, "Cambridge BEC VANTAGE - Self-study Edition", Cambridge University Press, UK, 2005

PHYSICS ELECTIVES
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

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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. 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	1	1												
2	2	2												
3	3	1												
4	1	1												
5	2	3												

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

Micro-electromechanical 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

Programme Outcomes (POs)

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

b. 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. 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	1	2												
3	1	1												
4	1	1												
5	2	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

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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	1	1												
2	1	2												
3	2	1												
4	1	1												
5	1	2												

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.

CHEMISTRY ELECTIVES
18GE0C1 COROSSION 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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
g. 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. 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.html

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

Programme Outcomes (POs)

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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 flameretardant 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

18CS001 FREE OPEN SOURCE SOFTWARE **3 0 0 3**

Course Objectives

- Understand the basics of open source software.
- Gain the knowledge of working with Linux platform and database.
- Familiar with different programming concepts in Linux.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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
l. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the components of Linux operating system with the basic commands that are used to perform operations with the terminal in Linux.
2. Apply the steps to install Linux in a system and explore the softwares to be used with the Linux system.
3. Implement networking in Linux for user account management and user account protection.
4. Demonstrate how to compile C and C++ programs in Linux using GNU Debugger on consideration with make files.
5. Develop programs using ruby, python and GTK for working with Linux and explore the architecture of X Windows in Linux.

Articulation Matrix

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

UNIT I **8 Hours**

INTRODUCTION

Introduction to Linux Operating System - Basic UNIX Commands - File Filters: File Related Commands - Piping -Joining, awk and backup Commands - Processes in Linux: User Process and Terminal Handling.

UNIT II **10 Hours**

CONFIGURING LINUX SERVICES

Debian Linux Installation - Installing Apache: The Web Server - Samba Installation and Configuration: File Sharing -Compiling from Sources -Installing - NFS - Installing SMTP Mail Server – Installing Common Unix printing System.

UNIT III **10 Hours**

NETWORKS IN LINUX

Installing Squid Proxy and Firewalls - Users and Account Management: Configuration - Creating - Testing - Removing - Allocating - System Logging: Logging - Accounting - Graphical Tools.

UNIT IV **8 Hours**

COMPILING AND DEBUGGING

Compiling C and C++ Programs under Linux - GNU Debugger: Debugger using GDB - Make: Syntax of makefiles - Automake and Autoconf.

UNIT V **9 Hours**

PROGRAMMING IN LINUX

Introduction to Python - Ruby - OOPS through Ruby - Calling UNIX System Calls from Ruby – X Windows Architecture and GUI Programming: GTK Programming.

FOR FURTHER READING

Qt Programming - Create Interface - Accessing - Connecting - Merging.

Total: 45 Hours

Reference(s)

1 N. B. Venkateshwarlu, Introduction to Linux: Installation and Programming, B S Publishers; 2014. (An NRCFOSS Publication).
2 Steve Suchring, MySQL Bible, John Wiley, 2015
3 Wesley J. Chun, Core Python Programming, Prentice Hall, 2010.
4 Martin C. Brown, Perl: The Complete Reference, 2nd Edition, Tata McGrawHill Publishing Company Limited, Indian Reprint 2009.
5 Steven Holzner, PHP: The Complete Reference, 2nd Edition, Tata McGrawHill Publishing Company Limited, Indian Reprint 2009.

18CS002 DATA ANALYTICS 3 0 0 3

Course Objectives

- Analyze large sets of data to gain useful business information.
- Understand the data mining functionalities, technologies and steps in preprocessing the data.
- Apply data mining algorithms, methods and tools.

Programme Outcomes (POs)

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

b. 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 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. 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. 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.

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

l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Interpret the data using standard data analysis and visualization methods.
2. Analyze the statistics of data using R.
3. Apply statistical models for data analysis using R.
4. Implement clustering and association rule mining algorithms using R.
5. Implement classification algorithms using R.

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					2	3	3
2	2	2	2	2	3		2					3	3	3
3	2	2	2	3	3		3					3	3	3
4	2	3	3	3	3		3					3	3	3
5	2	3	3	3	3		3					3	3	3

UNIT I **9 Hours**

DATA DEFINITIONS AND ANALYSIS TECHNIQUES

Elements, Variables, and Data categorization - Levels of Measurement - Data management and indexing - Introduction to statistical learning and R-Programming - Basic syntax- R as a calculator - R Libraries- Importing Data - Getting help and loading packages - Data entry and exporting data - Vectors - Matrices - Data Frames - Lists.

UNIT II **9 Hours**

DESCRIPTIVE STATISTICS AND DATA VISUALIZATION

Measures of central tendency - Measures of location of dispersions - Summary statistics - Validating &Exploring Data - Manipulating Data - Summarizing - Sorting - Sub-setting - Merging - Basic plotting - 3D plotting- Histograms- Multi-panel plotting - Boxplots - ggplot2.

UNIT III **9 Hours**

BASIC ANALYSIS AND STANDARD STATISTICAL DATA ANALYSIS TECHNIQUES

Basic analysis techniques - Statistical hypothesis generation and testing - Chi-Square test - t-Test - Analysis of variance - Correlation analysis - Maximum likelihood test - Univariate Analysis - Multivariate Analysis - Linear & Nonlinear Models - Logistic Regression - Principal Components Analysis (PCA) - ANOVA.

UNIT IV **9 Hours**

CLUSTERING AND ASSOCIATION RULE MINING

Clustering: Introduction to Clustering - Partitioning methods - Hierarchical methods - Outlier detection methods- Association Rule Mining: Market Basket Analysis- Frequent item set - Frequent item set mining methods.

UNIT V **9 Hours**

CLASSIFICATION

Classification: Decision Tree Induction - Naive Bayes classification - Rule based classification - Classification by Back propagation - Support Vector machine - K- Nearest Neighbour - Random Forest - neural Networks - Deep Learning.

FOR FURTHER READING

Machine learning - Predictive Analysis - Prescriptive Analysis - Case studies.

Total: 45 Hours

Reference(s)

1 Jared P Lander R for Everyone, Kindle Edition, 2014.
2 James, G., D. Witten, T. Hastie, and R. Tibshirani, An Introduction to Statistical learning with Application to R, Springer, New York. 2013.
3 Mark Gardener Beginning R: The Statistical Programming Language, 2013.
4 John M. Chambers, Software for Data Analysis: Programming with R (Statistics and Computing), Springer, 2008.
5 Seema Acharya, Data Analytics using R, Mc Graw Hill, 2018.

18CS003 CYBER SECURITY **3 0 0 3**

Course Objectives
- To introduce the basic concepts and challenges in cyber security.
- To illustrate the use of modern tools to resolve the security issues.
- To implement the cyber security principles and methods in organization.

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Course Outcomes (COs)
1. Describe the concept of cybercrime in mobile devices
2. Illustrate the cyber security challenges in the modern devices.
3. Analyze the working principle of cyber security tools and methods.
4. Apply the concept of cyber forensics to set a cyber-forensics laboratory.
5. Implement the process of cyber security systems in the organizations.

Articulation Matrix

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

UNIT I **9 Hours**
INTRODUCTION TO CYBERCRIME
Cybercrime- definition and origins of the world- Cybercrime and information security Classifications of cybercrime - Cybercrime and the Indian ITA 2000 - A Global Perspective on cybercrimes - Cloud Computing - Proliferation of Mobile and Wireless Devices - Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era.

UNIT II **9 Hours**

CYBER SECURITY CHALLENGES IN MODERN DEVICES

Security Challenges Posed by Mobile Devices- Registry Settings for Mobile Devices Authentication Service Security - Attacks on Mobile/Cell Phones, Mobile Devices, - Security Implications for Organizations- Organizational Measures for Handling Mobile-Devices-Related Security Issues Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT III **9 Hours**

TOOLS AND METHODS

Tools and Methods Used in Cyber line Proxy Servers and Anonymizers- Phishing - Password Cracking, Key loggers and Spywares, - Virus and Worms, Steganography - DoSDDoS Attacks - SQL Injection, Buffer Over Flow - Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) - The Legal Perspectives - Cyberlaw: The Indian Context - The Indian IT Act.

UNIT IV **9 Hours**

CYBER FORENSICS

Understanding Computer Forensics - Historical Background of Cyber forensics - Digital Forensics Science - The Need for Computer Forensics -Cyber forensics and Digital Evidence - Forensics Analysis of Email - Digital Forensics Lifecycle - Chain of Custody Concept - Network Forensics - Approaching a Computer Forensics Investigation - Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography.

UNIT V **9 Hours**

ORGANIZATIONS IMPLICATIONS

Organizational Implications Cost of Cybercrimes and IPR Issues: - Lesson for Organizations Web Treats for Organizations: The Evils and Perils - Security and Privacy Implications from Cloud Computing - Social Media Marketing: Security Risk and Perils for Organization - Social Computing and the Associated Challenges for Organizations - Protecting People- Privacy in the Organization, Organizational Guidelines for Internet Usage - Safe Computing Guidelines and Computer Usage Policy.

FOR FURTHER READING

Impact of security breaches Secure operating systems

Total: 45 Hours

Reference(s)

1 Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi 2012.
2 Harish Chander, cyber laws & IT protection, PHI learning pvt.ltd, 2012.
3 Dhiren R Patel, Information security theory &practice,PHI learning pvt ltd,2010
4 MS.M.K.Geetha&Ms.SwapneRaman Cyber Crimes and Fraud Management, MACMILLAN,2012.
5 Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.
VivekSood, Cyber Law Simplified, TMH, 2012.

18CS004 DISTRIBUTED COMPUTING 3 0 0 3

Course Objectives

- Understand the basic client server communication.
- Design and implement a distributed system over other networks.
- Diagnose the cause of defects in the deadlocks.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Apply the various distributed computing system strategies
2. Implement the inter-process communication and communication between distributed objects.
3. Analyze the concept of distributed transactions and concurrency control.
4. Implement the resource management techniques in distributed system.
5. Analyze the concept of distributed file system, name services and multimedia systems.

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	2	2	2									2	
3	2	3	2	2									2	
4	2	3	2	2									2	
5	2	3	2	2									2	

UNIT I **8 Hours**

BASIC CONCEPTS

Characterization of Distributed Systems - Examples - Resource Sharing and the Web - Challenges -System Models - Architectural and Fundamental Models - Networking and Internetworking - Types of Networks - Network Principles-Internet Protocols.

UNIT II **10 Hours**

INTERPROCESS COMMUNICATION AND DISTRIBUTED OBJECTS

Interprocess Communication - The API for the Internet Protocols - External Data

Representation and Marshalling - Client - Server Communication - Group Communication - Case Study - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call - Events and Notifications.

UNIT III **9 Hours**
DISTRIBUTED TRANSACTIONS AND CONCURRENCY CONTROL
Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested - Distributed Transactions - Atomic Commit Protocols - Concurrency Control in Distributed Transactions - Distributed Deadlocks - Transaction Recovery.

UNIT IV **9 Hours**
RESOURCE MANAGEMENT
Time and Global States-Introduction - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Global states-Distributed debugging - Coordination and Agreement- Introduction - Distributed mutual exclusion - Elections Algorithm - Multicast communication -Consensus and related problems.

UNIT V **9 Hours**
DISTRIBUTED FILE SYSTEM AND NAME SERVICES
Distributed File Systems - Introduction - File service architecture - Network File System- Name Services and the Domain Name System - Directory Services. Distributed multimedia systems-characteristics - Quality of service management - Resource management.

FOR FURTHER READING
Ethernet and WiFi - Interprocess Communication in UNIX and Java RMI - Transactions with Replicated Data - Amoeba- Mach - Sun Network File System - Global Name Service.

Total: 45 Hours

Reference(s)

1 George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 2012.
2 Andrew S. Tanenbaum, Maartenvan Steen, Distibuted Systems, Principles and Paradigms, Pearson Education, 2007.
3 Mugesh Singhal, Niranjan G Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Edition, 2008.
4 M. L. Liu, Distributed Computing Principles and Applications, Pearson Education, 2004.

18CS005 BIG DATA ANALYTICS 3 0 0 3

Course Objectives

- Understand the basic ideas of Big Data
- Analyze the data analytics life cycle and methodology.
- Design unstructured data analytics

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Analyze the risks involved in traditional computing and big data applications.
2. Illustrate the concepts of NoSQL for management of BigData.
3. Analyse the HDFS file system using Hadoop I/O.
4. Apply map reduce concepts for desired applications.
5. Inspect the big data using programming tools like Pig and Hive.

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					2	3	3
2	2	2	2	2	3		2					3	3	3
3	2	2	2	3	3		3					3	3	3
4	2	3	3	3	3		3					3	3	3
5	2	3	3	3	3		3					3	3	3

UNIT I **10 Hours**

UNDERSTANDING BIG DATA

Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing- unstructured data - industry examples of big data- web analytics- big data and marketing -fraud and big data - risk and big data - credit risk management- big data and algorithmic trading - big data and healthcare - big data in medicine- advertising and big data - big data technologies -introduction to Hadoop - open source technologies.

UNIT II **7 Hours**

NOSQL DATA MANAGEMENT

Introduction to NoSQL- aggregate data models- aggregates -key-value and document data models - relationships- graph databases-schema less databases-materialized views-distribution models - sharding - version - Map reduce- partitioning and combining -composing map-reduce calculations

UNIT III **8 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

UNIT IV **10 Hours**

MAP REDUCE APPLICATIONS

MapReduce workflows - unit tests with MR Unit -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 V **10 Hours**

HADOOP RELATED TOOLS

Hbase- data model and implementations- Hbase clients - Hbase examples -praxis. Cassandra- cassandra data model- cassandra examples- cassandra clients -Hadoop integration. Pig - Grunt - pigdata model- Pig Latin -developing and testing Pig Latin scripts. Hive - data types and file formats -HiveQL data definition- HiveQL data manipulation -HiveQL queries

FOR FURTHER READING

Cloud and big data - mobile business intelligence - Crowd sourcing analytics - inter and Trans firewall
analytics

Total: 45 Hours

Reference(s)

1 Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2 Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3 Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013
4 E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5 Alan Gates, "Programming Pig", O'Reilley, 2011.

18CS006 INFORMATION STORAGE MANAGEMENT 3 0 0 3

Course Objectives

- Understand the challenges in information storage and management.
- Describe the core elements in a data center.
- Understand RAID and its various levels for data backup.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
g. 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. Illustrate physical and logical components of a storage infrastructure including storage subsystems, RAID and intelligent storage systems
2. Describe storage networking technologies such as FC-SAN, IP-SAN, FCoE, NAS and object-based and unified storage
3. Illustrate and articulate business continuity solutions, backup and replications, along with archive
   for managing fixed content
4. Identify key characteristics, services, deployment models, and infrastructure components for a cloud computing
5. Implement the concept of security storage infrastructure management

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	3										
3	2	3	3	3										
4	2	3	3	2			3							
5	2	2	3	3			2							

UNIT I **9 Hours**

STORAGE SYSTEM

Introduction to information storage, Virtualization and cloud computing, Key data center elements,Compute, application, and storage virtualization, Disk dive & flash drive components and performance, RAID, Intelligent storage system and storage provisioning (including virtual provisioning).

UNIT II **9 Hours**

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION

Fibre Channel SAN components, FC protocol and operations, Block level storage virtualization, iSCL and FCIP as an IP-SAN solutions, Converged networking option FcoE, Network Attached Storage (NAS) components, protocol and operations, File level storage virtualization, Object based storage and unified storage platform.

UNIT III **9 Hours**

BACKUP, ARCHIVE AND REPLICATION

Business continuity terminologies, planning and solutions, Clustering and multipathing to avoid single points of failure, Backup and recovery methods, targets and topologies, data deduplication and backup in virtualized environment, fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three-site remote replication and continuous data protection.

UNIT IV **9 Hours**

CLOUD COMPUTING CHARACTERISTICS AND BENEFITS

Cloud Enabling Technologies - Characteristics of Cloud Computing- Benefits of Cloud Computing-Cloud Service Models Cloud deployment models- Cloud Computing Infrastructure- Cloud Challenges, Cloud migration considerations.

UNIT V **9 Hours**

SECURING AND MANAGING STORAGE INFRASTRUCTURE

Security threats, and countermeasures in various domains, Security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, Information lifecycle Management (ILM) and storage tiering.

FOR FURTHER READING

EMC Infrastructure Management Tools-Parallel SCSI-SAN Design Exercises-Network Technologies for Remote Replication-Information Availability.

Total: 45 Hours

Reference(s)

1 Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments, 2nd Edition, EMC Educations Services, Wiley, May 2012.

2 Information Storage and Management: Storing, Managing, and Protecting Digital Information, EMC Education Services, Wiley, January 2010.

3 Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, 2nd Edition, Wiley, July 2009.

18CS007 TCP/IP **3 0 0 3**

Course Objectives

- Impart knowledge about the basic concepts of internetworking, internet addressing and forwarding.
- Understand the routing architecture and the protocols routers use to exchange routing information.
- Discuss application level services available in the internet.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Interpret the basic concepts of internetworking, protocol layering and internet addressing in TCP/IP
2. Identify the mapping of physical and internet addresses, error and control messages and reliable stream transport service
3. Analyze the protocols and algorithms used for exchanging routing information
4. Analyze the interaction between client-server using sockets API.
5. Illustrate the application layer protocols and the framework used for IP security and firewalls

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

The TCP/IP internet-Internet Services- Internetworking Concept and Architectural Model- TCP/IP 5- Layer Reference Model - Protocol layering Principle - IP datagram -IP Forwarding algorithm - Internet addresses: Classful Addressing and Classless Addressing.

UNIT II **11 Hours**

TCP/IP PROTOCOLS

ARP message format and Implementation - RARP - The ICMP message formats - User Datagram protocol (UDP) -Reliable Stream Transport Service (TCP): Segment format, Establishing and closing TCP connections- TCP state machine- Silly window syndrome - Karn's algorithm and Timer Backoff.

UNIT III **8 Hours**

IP ROUTING

Routing Architecture: Cores, Peers, and Algorithms - Routing between Peers (BGP): Characteristics, Message header, Functionality and Message types- Routing within an Autonomous System (RIP, OSPF): RIP message format(IPv4 and IPv6)-OSPF message format-IGMP.

UNIT IV **8 Hours**

SOCKET INTERFACE

Virtual Private Networks -Network Address Translation -Client-Server Model -The Socket API: Socket operations -Bootstrap and Auto configuration (DHCP) -The Domain Name System: Name Syntax and type- Mapping domain names to addresses- Domain name Resolution- Message format.

UNIT V **9 Hours**

PROTOCOLS AND FIREWALL DESIGN

Electronic Mail (SMTP, POP, IMAP, MIME) -World Wide Web HTTP) -Voice and Video Over IP(RTP, RSVP, QoS) -Network Management(SNMP): Message format- Encoded SNMP message- Security in SNMP3- IP Security- Firewalls.

FOR FURTHER READING

Internet of Things- Software Defined Networking- Multicast Routing Protocols-Other Remote Access Technologies- Proposed IPv6 Address Space Assignment.

Total: 45 Hours

Reference(s)

1. Douglas E.Comer, Internetworking with TCP/IP Principles, Protocols and Architecture, Sixth Edition Vol.1 PHI, 2014.
2. Behrouz A.Forouzan, TCP/IP protocol suite, Fourth edition,TMH, 2010.
3. Kevin R.Fall, W. Richard Stevens, TCP/IP Illustrated, Volume 1: The Protocols, 2/EPearson Education, 2011.
4. Dr.Sidnie Feit, TCP/IP, 2/Education,TMH, 2008.

18CS008 WIRELESS NETWORK TECHNOLOGIES 3 0 0 3

Course Objectives
- To impart the fundamental concepts of wireless networks.
- To understand Ad Hoc Wireless Networks and WWAN.
- To learn about 4G networks and its applications.

Programme Outcomes (POs)

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

b. 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 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. 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.

f. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)
1. Explain the fundamentals of wireless communication.
2. Describe the technologies used Wireless LAN.
3. Implement the Ad Hoc wireless Networks concepts.
4. Explore the concepts of Wireless WAN.
5. Evolution of 4G Networks, its architecture and applications

Articulation Matrix

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

UNIT I **8 Hours**

WIRELESS COMMUNICATION PRINCIPLES AND FUNDAMENTALS

Wireless propagation characteristics and modeling-Voice coding-Multiple access for wireless system- FDMA, TDMA, CDMA, CSMA-Performance increasing techniques-Adhoc and semi adhoc concept- wireless services: circuit and packet mode.

UNIT II **9 Hours**

WIRELESS LAN

Wireless LAN application- concerns- Topologies- Physical layer-MAC layer- HYPER LAN 1 MAC sublayer, IEEE 802.11 MAC sub layer-IEEE 802.11a/ 802.11 b / 802.11g-Wireless ATM architecture.

UNIT III **9 Hours**

AD HOC WIRELESS NETWORKS

Cellular And Adhoc Wireless networks -Applications- Issues in adhoc wireless networks-medium access scheme, Routing, multicasting, QoS, Security, Energy management- Challenges in designing routing protocol for adhoc networks.

UNIT IV **10 Hours**

WIRELESS WAN

Mechanism to support a mobile environment, Communication in the infrastructure, IS-95 CDMA forward channel, IS 95 CDMA reverse channel, Pallert and frame formats in IS 95, IMT 2000; forward channel in W-CDMA and CDMA 2000, reverse channels in W-CDMA and CDMA-2000, GPRS and higher data rates.

UNIT V **9 Hours**

4G NETWORKS

Introduction- 4G Vision - 4G Features And Challenges - Applications Of 4G - 4G Technologies:Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation And Coding With Time Slot Scheduler, Cognitive Radio.

FOR FURTHER READING

Data delivery approach- HYPER LAN 2: an ATM compatible WLAN- On demand routing protocol-

Short messaging service in GPRS mobile application protocols- Geolocation standards for E.911 service.

Total: 45 Hours

Reference(s)

1. P. Nicopolitidis, M.S.Obaidat, G.I.Papadimitriou, A.S. Pomportsis, Wireless Networks, Wiley &Sons, 2011.
2. Jochen Schiller, Mobile Communications, Person Education 2011, 2nd Edn.
3. X.Wang and H.V.Poor, Wireless Communication Systems, Pearson education, 2011.
4. C. Siva Ram Murthy and B.S. Manoj, Adhoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2014.
5. M.Mallick, Mobile and Wireless design essentials, Wiley Publishing Inc. 2011.

6 Kaveh Pahlavan, Prashant Krishnamoorthy, Principles of Wireless Networks, - A united approach Pearson Education, 2010. Vijay Garg , Wireless Communications And Networking, First Edition, Elsevier 2007.(Unit V)

18CS009 SOFTWARE QUALITY ASSURANCE 3 0 0 3

Course Objectives

- Understand the standards and components of software quality assurance.
- Understand software quality assurance activities with tools and techniques
- Study the metrics for software quality assurance.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. 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.
f. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Course Outcomes (COs)

1. Illustrate the componenets of software quality assurance system and its challenges
2. Identify the SQA components and the quality activities in the project life cycle
3. Analyze the procedures required to ensure software quality
4. Illustrate the project process control and its metrics in software quality assurance
5. Examine the standards and certifications of software quality assurance

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	2	3		2		2	2							
3	2	3		2		2	2	2						
4	2	3		2		2	2	2						
5	2	3		2		2	2	2						

UNIT I **7 Hours**
INTRODUCTION

Software Quality Challenge - Software Quality Factors - Components of the Software Quality Assurance System. Pre-Project Software Quality Components - Contract Review - Development and Quality Plans

UNIT II **10 Hours**

SQA COMPONENTS IN THE PROJECT LIFE CYCLE

Integrating Quality Activities in the Project Life Cycle - Reviews - Software Testing - Strategies -Software Testing -Implementation - Assuring the Quality of Software Maintenance - Assuring The Quality of External Participants' Parts - Case Tools and their Affect on Software Quality.

UNIT III **9 Hours**

SOFTWARE QUALITY INFRASTRUCTURE COMPONENTS

Procedures and Work Instructions - Supporting Quality Devices - Staff Training Instructing and Certification - Preventive and Corrective Actions - Configuration Management - Documentation and Quality Records Controls.

UNIT IV **10 Hours**

SOFTWARE QUALITY MANAGEMENT COMPONENTS

Project Progress Control - components of project progress control- Progress control of internal projects and external participants- Implementation of project progress control. Software Quality Metrics - Objectives of quality measurement- Process metrics- Product metrics . Software Quality Costs - Objectives of cost of software quality metrics- classic model of cost of software quality.

UNIT V **9 Hours**

STANDARDS- CERTIFICATION AND ASSESSMENT

SQA Standards - ISO 9001 Certification - Software Process Assessment. Organizing for Quality Assurance -Management and its Role in Quality Assurance - The Software Quality Assurance Unit - SQA Trustees and Committees

Total: 45 Hours

Reference(s)

1 Daniel Galin – "Software Quality Assurance: From Theory to Implementation" - Pearson Addison-Wesley, 2012.
2 Richard F. Gilberg, and Behrouz A. Forouzan, Data Structures - A Pseudocode Approach with C, Thomson 2011.
3 Y.Langsam, M.J.Augenstein and A.M.Tenenbaum, Data Structures using C, PHI, 2007.
4 Aho, J.E.Hopcroft and J.D.Ullman, Data Structures and Algorithms, Pearson education, Asia, 2010.
5 Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, 2009.

18CS010 GRAPHICS AND MULTIMEDIA 3 0 0 3

Course Objectives

- Understand the fundamentals of graphics and multimedia.
- Gain knowledge in the concepts of 2D and 3D graphics programming.
- Acquire skills related to multimedia compression and animation.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Acquire skills related to multimedia compression and animation.
2. Design and develop 3D projections and transformations.
3. Implement graphics programming using OpenGL.
4. Explain the basics of multimedia.
5. Understand the multimedia authoring systems.

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	3	2		2						2	
3	2	3	3	2	3		2						2	
4	2	2	2	2	2		2						2	
5	2	2	2	2	2		2						2	

UNIT I **9 Hours**

2D PRIMITIVES

Output primitives- Line, Circle and Ellipse drawing algorithms - Attributes of output primitives- Two dimensional Geometric transformations - Two dimensional viewing - Cohen-Sutherland Line Clipping, Sutherland Hodgeman Polygon clipping algorithms.

UNIT II **8 Hours**

3D CONCEPTS

Parallel and Perspective projections - Three dimensional object representation - Polygons, Curved lines, Splines, Quadric Surfaces- Visualization of data sets - 3D transformations - Viewing - Visible surface identification.

UNIT III **10 Hours**

GRAPHICS PROGRAMMING

Color Models- RGB, YIQ, CMY, HSV - Animations - General Computer Animation, Raster, Key frame Graphics programming using OPENGL - Basic graphics primitives - Drawing three dimensional objects.

UNIT IV **9 Hours**

MULTIMEDIA BASICS

Introduction and definitions - applications - elements - Animations - Compression-Types of Compressions: Lossless - Lossy - Video compression - Image Compression -Audio compression- Data and file format standards.

UNIT V **9 Hours**

MULTIMEDIA SYSTEMS

Multimedia Authoring Systems - Hypermedia Design considerations - User Interface Design - Object Display and Play back issues- Hypermedia Messaging- Distributed Multimedia Systems - Components multimedia Object Servers -Managing Distributed Objects.

FOR FURTHER READING

Virtual reality, Augmented reality, Content based retrieval in digital libraries.

Total: 45 Hours

Reference(s)

1 Donald Hearn, M.Pauline Baker, Computer Graphics C Version, 2nd edition, Pearson Education,2004.
2 Ze-Nian Li and Mark S.Drew, Fundamentals of Multimedia, 1st Edition, Pearson Education,2007.
3 F.S.Hill,Computer Graphics using OPENGL, 2nd edition, Pearson Education,2009.
4 Prabhat K Andleigh, Kiran Thakrar, Multimedia systems design, 1st Edition, PHI,2007.
5 Srinivasan Desikan and Gopalaswamy Ramesh, Software Testing, Principles and Practices, Pearson Education, 2008.

18CS011 XML AND WEB SERVICES 3 0 0 3

Course Objectives

- Construct the web page using XML and service oriented architecture
- Implement the real time applications using XML technologies
- Analyze the design principles and applications of SOAP based Web Services
- Use the key technologies in web services.
- Evaluate the security issues in XML.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Construct the web page using XML and service oriented architecture.
2. Apply DTD and Schema for structuring XML page and use presentation techniques and transfromation in web page creation.
3. Analyze the design principles and applications of SOAP based Web Services.
4. Analyze the paradigms needed for designing the standards of web services.
5. Apply XML security standards in web pages.

Articulation Matrix

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

UNIT I **8 Hours**
INTRODUCTION
Role of XML - XML and the Web - XML Language Basics - SOAP - Web Services - Revolutions of XML - Service Oriented Architecture (SOA)

UNIT II **9 Hours**
XML TECHNOLOGY
XML - Name Spaces - Structuring with Schemas and DTD - Presentation Techniques - Transformation.

UNIT III **9 Hours**
SOAP SERVICES
Overview of SOAP - HTTP - XML - RPC - SOAP: Protocol - Message Structure - Intermediaries - Actors - Design Patterns and Faults - SOAP with Attachments.

UNIT IV **11 Hours**
WEB SERVICES
Overview - Architecture - Key Technologies - UDDI - WSDL - ebXML - SOAP and Web Services in ECom - Overview of .NET and J2EE.

UNIT V **8 Hours**
XML SECURITY
Security Overview - Canonicalization - XML Security Framework - XML Encryption - XML Digital Signature - XKMS Structure - Guidelines for Signing XML Documents - XML in Practice.

Total: 45 Hours

Reference(s)

1 Frank. P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2007.
2 David Hunter, Jeff Rafter, Joe Fawcett, Eric Van der Vlist, Danny Ayers, Jon Duckett, Andrew Watt, Linda McKinnon, Begining XML , Fourth Edition, Wrox publication.
3 Deitel H M, Deitel P J, Nirto T R, Lin T M, XML How to Program, Pearson Edition, 2011

18CS012 INTERNET OF THINGS 3 0 0 3

Course Objectives

- Understand the components and protocols used in IOT.
- To Understand the IoT Reference Architecture and Real World Design Constraints
- Ability to understand the Security requirements in IoT.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Identify physical design, communication and Technologies used in IOT.
2. Illustrate the IoT reference models and IoT protocols.
3. Examine the components, interfacing devices and communication models of IoT
4. Analyze the cloud storage models and web service and data analytics for IoT
5. Analyse the security requirements and threats in IOT.

Articulation Matrix

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

UNIT I **8 Hours**

INTRODUCTION TO INTERNET OF THINGS

IOT Fundamentals - Characteristics of IoT - Physical Design of IoT - IoT Protocols - IoT communication models - IOT Communication APIs -IOT enabled Technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, and Communication protocols, Embedded Systems, IOT Levels and Templates.

UNIT II **10 Hours**

IOT REFERENCE ARCHITECTURE

Introduction- State of the art - Architecture Reference Model- IOT reference Model-IOT Protocols: Zigbee, RFID, BLE, NFC, BACnet, 6LowPAN, RPL, XMPP, CoAP, and MQTT.

UNIT III **9 Hours**

IOT DEVICES AND INTERFACING

IOT components - Sensors - Actuators - Hardware Platforms - Interfacing with devices: Setting up the board -Programming for IOT - Reading from Sensors, Communication: Connecting microcontroller with mobile devices - communication through Bluetooth, wifi, Ethernet.

UNIT IV **9 Hours**

IOT CLOUD, WEB SERVICES AND DATA ANALYTICS

Introduction to Cloud Storage models - Cloud services and IOT - communication APIs -Cloud for IOT -Web server: Web server for IOT - Amazon Web services for IOT- Data analytics for IOT.

UNIT V **9 Hours**

IOT SECURITY

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. Vulnerabilities - Secrecy and Secret- Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption.

Total: 45 Hours

Reference(s)

1 Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2 Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1stEdition, VPT, 2014.
3 Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things Key applications and Protocols, Wiley, 2012
4 Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) [Kindle Edition] by CunoPfister,2011 Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren

18CS013 E-COMMERCE 3 0 0 3

Course Objectives

- Familiar with the concepts of E-Commerce.
- Understand the approaches in internet business environment.
- Understand the role of internet marketing in an organization.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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. 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. Identify the pros and cons of E-Commerce and roles of E-strategy
2. Analyze the architecture of internet and functions provided by ISP
3. Analyze the internet marketing and customer relationship management
4. Examine the encryption techniques used for authentication in e-commerce websites
5. Analyse the security issues in electronic money transactions.

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Electronic Commerce (E-Commerce) -Marks of Maturity Drivers - Advantages & issues in E-Commerce - Benefits & Limitations of the Internet - Role of E-Strategy- Value chain, integration and business model in E-Commerce- World Wide Web: Making of the WWW- ISP- Web fundamentals.

UNIT II **7 Hours**

TECHNOLOGY OF E-COMMERCE

Internet Architecture: Network-Information Transfer-Network Hardware - Design considerations-Issues Intranets and Extranets: Technical Infrastructure -Planning an Intranet - Email and Intranet - Hosting a Web Site: How ISPs work- ISP structure and services - Choosing an ISP- Registering a domain name.

UNIT III **10 Hours**

E- STRATEGIES AND TACTICS

Building E-Presence - Internet Marketing : Online shopping- Internet Marketing Techniques - E-Cycle of Internet Marketing -How to market Presence - Attracting and tracking customers - Customer relationship and Management -Business-to-Business Commerce.

UNIT IV **10 Hours**

SECURITY THREATS

E- Security and USA Patriot Act: Security in Cyberspace- Designing for security - Security Protection

and Recovery-Encryption: Basic Algorithm - Authentication and Trust- Managing Cryptographic Keys - Internet Security Protocols and Standards.

UNIT V **9 Hours**

PAYMENT SYSTEMS AND CUSTOMER RELATED ISSUES

Getting Money: E-Money -Internet based payments - Types (Credit, Debit, Smart, Digicash, E-cash and E-wallet, EFT) - Going Online: Life Cycle Approach- Business Planning and Strategizing Phase - Hardware, Software, Security and Setup, Design, Marketing, Fulfillment, Maintenance & Enhancement Phase.

Total: 45 Hours

Reference(s)

1 Elias M. Awad, Electronic Commerce- From the Vision to Fulfillment, Prentice Hall of India,2011
2 Ravi Kalakota and Andrew B.Whinston, Frontiers of E-Commerce, Pearson Education Asia,2006
3 Kamesh K.Bajaj and Debjani Nag, E-Commerce the Cutting Edge of Business, Tata McGraw Hill, 2005

18CS014 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.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
f. 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. 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. Analyze the role of information systems in global business
2. Identify the ethical and social issues related to an IT infrastructure.
3. Analyze the application of databases to improve the information management.
4. Examine the tools and technologies used for securing information system.
5. Compare E-commerce and M-commerce based on its services and applications.

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	2	3	2	2		2	2							
3	2	3	2	2		2	2							
4	2	3	2	2		2	2							
5	2	3	2	2		2	2							

UNIT I **8 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 **10 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 **8 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 **10 Hours**

NEW IT INITIATIVES

Enterprise Applications: Enterprise Systems - Supply Chain Management Systems - Customer Relationship Management Systems - Electronic Commerce: Types of Electronic Commerce - M-Commerce Services and Applications - The Knowledge Management Landscape: Important Dimensions of Knowledge - The Knowledge Management Value Chain - Types of Knowledge Management Systems.

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 E- business 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.

18CS015 TOTAL QUALITY MANAGEMENT 3 0 0 3

Course Objectives

- Study principles and philosophies of quality management.
- Understand the different quality systems.
- Learn the tools and techniques for management

Programme Outcomes (POs)

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

b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

d. 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.

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

Course Outcomes (COs)

1. Explore the TQM framework and quality statements.
2. Describe the philosophy and principles of Total Quality Management.
3. Interpret Statistical Process Control And Process Capability.
4. Implement the tools and techniques to enhance Management process.
5. Understand the Quality systems and implementation.

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						
3	2	2		3				3						
4	2	2		2				2						
5	2	2		2				2						

UNIT I **8 Hours**

INTRODUCTION TO QUALITY MANAGEMENT

Definitions - TQM framework, benefits, awareness and obstacles. Quality vision, mission and policy
statements. Customer Focus -customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality.

UNIT II **8 Hours**

PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques - introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles.

UNIT III **10 Hours**

STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY

Meaning and significance of statistical process control (SPC) -construction of control charts for variables and attributed. Process capability - meaning, significance and measurement -Six sigma concepts of process capability. Reliability concepts -definitions, reliability in series and parallel, and product life characteristics curve. Total productive maintenance (TMP).

UNIT IV **10 Hours**

TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Quality functions development (QFD) -Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) - requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven old (statistical) tools. Seven new management tools.

UNIT V **9 Hours**

QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION

Introduction to IS/ISO 9004:2000 - quality management systems - guidelines for performance improvements. Quality Audits. TQM culture, Leadership - quality council, employee involvement, motivation, empowerment, recognition and reward.

Total: 45 Hours

Reference(s)

1 Dale H. Besterfiled, et al, Total Quality Management, Pearson Education Asia, Third Edition,Indian Reprint (2011).
2 James R. Evans and William M. Lindsay, The Management and Control of Quality, 8^{th} Edition,South-Western (Thomson Learning), 2011.
3 Oakland, J.S. TQM Text with Cases, Butterworth Heinemann Ltd., Oxford, 3rd Edition, 2003.
4 Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd.,2006
5 Janakiraman, B and Gopal, R.K, Total Quality Management Text and Cases, Prentice Hall (India)Pvt. Ltd., 2006

18CS016 DEEP LEARNING TECHNIQUES 3 0 0 3

Course Objectives

- Gain knowledge in Machine Learning Basics.
- Understand and apply Optimization on Deep Models and Networks.
- Understand and analyze Recurrent and Recursive Networks.
- Understand the representation of neural networks in machine learning.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
l 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Apply linear algebra and probability & information theory for deep learning models
2. Construct machine learning models for real-time applications
3. Apply the advanced concepts of neural networks
4. Apply Deep Models Optimization and construct Convolutional Neural Networks
5. Analyse the recurrent and recursive Neural Networks and its application.

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					2	3	3
2	2	3	2	2	2	2	2					3	3	3
3	2	3	3	2	3	2	2					3	3	3
4	2	3	3	2	2	2	2					3	3	3
5	2	3	3	3	2	2	2					3	3	3

UNIT I **8 Hours**
INTRODUCTION
Introduction: Historical Trends in Deep Learning - Linear Algebra: Scalars - Vectors - Matrices - Tensors - Matrices - Norms - Eigendecomposition - Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.

UNIT II **10 Hours**
MACHINE LEARNING BASICS
Numerical Computation: Overflow and Underflow - Gradient based Optimization - Constrained Optimization - Learning Algorithms: Capacity - Overfitting - Under fitting - Bayesian Classification - Supervised - unsupervised algorithms - Building machine learning algorithm.

UNIT III **9 Hours**
ADVANCED NEURAL NETWORKS
Deep Feed forward Networks : Gradient based learning - Hidden Units - Architectural design – Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustes -Semi supervised learning - Multitask learning - Adserial training.

UNIT IV **9 Hours**
OPTIMIZATION ON DEEP MODELS
Optimization for training Deep Models: Challenges in Neural Networks optimization - Basic Algorithms - Algorithms Adaptive learning Rates - Approximate Second Order Methods - Optimization Strategies and Meta Algorithms -Convolutional Networks: Motivation - Structured Output - Unsupervised features - Neuroscientific basics for Convolutional Networks.

UNIT V **9 Hours**
RECURRENT AND RECURSIVE NETWORKS
Computational graphs - Recurrent Neural networks - Bidirectional RNN - Deep Recurrent Networks - Echo State Networks - Practical Methodology - Applications: Large Scale Deep Learning – Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.

Total: 45 Hours

Reference(s)

1 Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience. 2nd Edition.2001
2 Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
3 Russell, S. and Norvig, N. Articial Intelligence: A Modern Approach. Prentice Hall Series in Articial Intelligence. 2003.
4 Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
5 Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.

18CS017 MOBILE APPLICATION DEVELOPMENT 3 0 0 3

Course Objectives

- Understand the basics of mobile application development.
- Work with mobile app development platforms.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
g. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Understand the basics of mobile application development.
2. Design the architecture of android application development.
3. Develop software using android.
4. Develop applications using components of android framework.
5. Develop android applications including files and databases.

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Introduction to Android, Android versions and its feature set The various Android devices on the market , The Android Market application store, Android Development Environment - System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE), Creating Android Virtual Devices (AVDs).

UNIT II **9 Hours**

ANDROID ARCHITECTURE OVERVIEW AND CREATING AN EXAMPLE ANDROID APPLICATION

The Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework, Creating a New Android Project ,Defining the Project Name and SDK Settings, Project Configuration Settings, Configuring the Launcher Icon, Creating an Activity, Running the Application in the AVD, Stopping a Running Application, Modifying the Example Application, Reviewing the Layout and Resource Files.

UNIT III **9 Hours**

ANDROID SOFTWARE DEVELOPMENT PLATFORM

Understanding Java SE and the Dalvik Virtual Machine , The Directory Structure of an Android Project , Common Default Resources Folders , The Values Folder , Leveraging Android XML, Screen Sizes , Launching Your Application: The AndroidManifest.xml File ,Creating Your First Android Application.

UNIT IV **9 Hours**

ANDROID FRAMEWORK OVERVIEW

Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool.

UNIT V **9 Hours**

FILES, CONTENT PROVIDERS, AND DATABASES

Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers.

FOR FURTHER READING

Mobile networking applications-network emulators.

Total: 45 Hours

Reference(s)

1 Code Complete: A Practical Handbook of Software Construction, 2nd Edition by Steve McConnell.
2 Mobile Apps Made Simple: The Ultimate Guide to Quickly Creating, Designing and Utilizing Mobile Apps for Your Business, 2nd Edition by Jonathan McCallister.
3 Android Application Development Cookbook- Second Edition by Rick Boyer and Kyle Mew.

18CS018 HUMAN COMPUTER INTERACTION 3 0 0 3

Course Objectives

- Co-relate the Human input-output channels and identify the suitable methods and devices for Human Computer Interaction.
- Develop the models for interaction design for an application.
- Apply the software engineering principles for Human Computer Interaction.
- Apply the concept of implementation support and design the evaluation techniques for Interactions.
- Analyze the cognitive models and explicate the concept of cognitive architecture.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Analyze capabilities of human and computer in terms of human information processing.
2. Develop the models for interaction design for an application.
3. Apply the software engineering principles for Human Computer Interaction.
4. Apply the concept of implementation support and design the evaluation techniques for interactions.
5. Analyze the cognitive models and explicate the concept of cognitive architecture.

Articulation Matrix

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

UNIT I **9 Hours**

FOUNDATIONS

The Human - Input-output channels - Human Memory - Thinking - Emotions - Psychology and design of interactive systems; Computer - Text entry devices - Positioning, Pointing & drawing - Display devices for Virtual reality and 3D interaction.

UNIT II **9 Hours**
INTERACTION
Introduction- Models of introduction, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity. Interaction Design Basics: The process design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping.

UNIT III **9 Hours**
SOFTWARE PROCESS AND DESIGN RULES
HCI in the software process: Introduction, The software life cycle, Usability engineering, Iterative design and prototyping. Design Rules: Introduction- Principles to support Usability - Standards - Guidelines - Golden rules.

UNIT IV **9 Hours**
IMPLEMENTATION SUPPORT AND EVALUATION TECHNIQUES
Implementation support - Windowing system elements- Using tool kits - User interface management - Evaluation techniques - Goals of Evaluation - Evaluation through expert analysis - Evaluation through User Participation - Universal design principles - Multimodal interaction.

UNIT V **9 Hours**
MODELS AND THEORIES
Cognitive models - Goal & task hierarchies - Linguistic models - Physical and device models - Cognitive Architectures - Socio-Organizational issues and stakeholder requirements- Organizational issues- capturing Requirements- Communication and collaboration Models - Face-to-Face communication - Conversation -Text based communication -Group working.

Total: 45 Hours

Reference(s)
1 Alan Dix , Janet Finlay, Gregory D.Abowd, Russell Beale, Human Computer Interaction, Third Edition, Pearson Education, 2017.
2 Julie A. Jacko and Andrew Sears, The human-computer interaction handbook: fundamentals, evolving Technologies, and emerging applications, Lawrence Erlbaum Associates, Inc., Publishers, 2003.
3 Lloyd P. Rieber, Computers, Graphics, & Learning, Brown & Benchmark publishers, 2005.
4 Yvonne Rogers, Helen Sharp, Jenny Preece, Interaction Design: beyond human-computer interaction, Second Edition, John-Wiley and Sons Inc., 2009.
5 DovTe-eni, Jane Carey, Ping Zhang, Human-Computer Interaction: Developing Effective Organizational Information Systems, John-Wiley and Sons Inc., 2007.

18CS019 VIRTUAL REALITY 3 0 0 3

Course Objectives

- Understand the concept of virtual reality and its classic components.
- Impart image virtualization having big data.
- Compute high performance system with virtual reality.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Compare virtual reality technology with augumented reality and telepresence.
2. Utilize the various input and output devices of virtual reality.
3. Apply the different modelling concepts to visual virtualization.
4. Analyze the performance of given simple applications related to virtual reality.
5. Implement 3D technology with virtual programming concepts.

Articulation Matrix

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

UNIT I **9 Hours**
INTRODUCTION
The three I's of virtual reality, commercial VR technology and the five classic components of a VR system, Augmented Reality and Telepresence.

UNIT II **9 Hours**
INPUT AND OUTPUT DEVICES
Input Devices : (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers,
navigation and manipulation, interfaces and gesture interfaces. Output Devices: Graphics displays, sound displays & haptic feedback.

UNIT III **9 Hours**
MODELING
Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management and Modeling real-life from sensors.

UNIT IV **9 Hours**
HUMAN FACTORS
Methodology and terminology, user performance studies, VR health and safety issues.Applications:Medical applications, military applications, robotics applications, Virtual product design (CAD display, process simulation, virtual prototyping).

UNIT V **9 Hours**
VR PROGRAMMING
VR Programming-I: Introducing Unity 3D, Project panel, Scene hierarchy, Simple game object, Scene editor.
VR Programming-II: Middle VR, device management, graphics card limitation, 3D user interactions, deployment, VR software: VRPN, VR Juggler.

Total: 45 Hours

Reference(s)
1 Virtual Reality Technology, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc., Second Edition,2006
2 Killer Game Programming in Java, Andrew Davison, O'reilly-SPD, 2005.
3 Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan
4 Craig, Elsevier (Morgan Kaufmann), First edition, 2002.
5 3D Modeling and surfacing, Bill Fleming, Elsevier (Morgan Kauffman), 1999.
6 3D Game Engine Design, David H.Eberly, Elsevier, Second Edition, 2006.

18CS020 DIGITAL MARKETING 3 0 0 3

Course Objectives

- To Provide an Overview of Digital Marketing plans.
- To Provide a Foundation of a Greater market share and Increasing brand awareness.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
j. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Identify some of the latest digital marketing trends and skills sets needed for today's Marketer.
2. Discover the hottest techniques to help to successfully plan, predict, and manage your digital Marketing campaigns
3. Evaluate the importance of your digital marketing assets, which ones actually matter the most to your business
4. Assess digital marketing as a term career opportunity
5. Understand experiments using A/B testing

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			3		3	2	
2	2	3	3		3	2	3			2		3	2	
3	2	3	3		3	3	3			3		3	2	
4	2	3	3		3	3	3			3		3	2	
5	3	3	2		3	2	3			2		3	2	

UNIT I **9 Hours**
INTRODUCTION OF DIGITAL MARKETING
Introduction of Digital Marketing - Planning Digital Marketing Campaigns - Website designing with Word Press - Essentials of a website.

UNIT II **9 Hours**
SEARCH ENGINE OPTIMIZATION
Introduction to Search Engines - Keyword Research and Competition - On page Optimization - Off page Optimization - Local SEO - Search Engine Algorithm Updates - SEO Reporting.

UNIT III **9 Hours**
GOOGLE ADWORDS
PPC Advertising (Online Advertisement) - Display Advertising - Google Shopping Ads - Introduction to Bing Ads - Mobile Marketing - Video Marketing - Google online Advertisement program – Certification.

UNIT IV **9 Hours**
SOCIAL MEDIA MARKETING
Introduction to SMM - Facebook Marketing - Facebook Advertising - Twitter Marketing & Ads - YouTube Marketing - LinkedIn Marketing - InstaGram Marketing - Email Marketing - Pinterest Marketing - Online Reputation Management -Inbound Marketing - Google Analytics - Audience Reports - Traffic Reports - Behavior Reports.

UNIT V **9 Hours**
EXPERIMENTAL TESTING
Conversion Tracking - Personality Development - Google AdSense - Getting Started as Freelancer - Affiliate Marketing.

Total: 45 Hours

Reference(s)

1 Shivani Karwal, Digital Marketing Handbook: A Guide to Search Engine Optimization Paperback - Import, 25 Nov 2015.
2 Philip kolter and Gary Armstrong, Principles of marketing, Pearson education, 2010.
3 Michael Millerth, B2B Digital Marketing: Using the Web to Market Directly to Businesses,first edition, Que Biz-Tech series2012.
4 Dave Chaffey, Fiona Ellis Chadwick, Digital Marketing: Strategy, Implementation & Practice, Paperback - Import, 2012.

18CS021 SOCIAL NETWORK ANALYSIS 3 0 0 3

Course Objectives

- Apply knowledge for current web development in the era of Social Web.
- Develop a model for integrating data for knowledge representation.
- Apply the tools and an algorithm for mining in social networks.
- Examine the human behavior and trust disputes of social networks.
- Apply visualization technique in Social networks.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
j. 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Apply knowledge for current web development in the era of Social Web.
2. Develop a model for integrating data for knowledge representation.
3. Apply the tools and an algorithm for mining in social networks.
4. Examine the human behavior and trust disputes of social networks.
5. Apply visualization technique in Social networks.

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO SOCIAL NETWORK ANALYSIS

Introduction to 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 - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks.

UNIT II **8 Hours**

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

Ontology languages for the Semantic Web: RDF and OWL - Modelling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III **9 Hours**

EXTRACTION AND MINING COMMUNITITES IN WEB SOCIAL NETWORKS

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- Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities - Decentralized Online Social Networks: Introduction- Challenges for DOSNs- General purpose DOSNs.

UNIT IV **10 Hours**

PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES

Understanding and Predicting Human Behavior for Social Communities - User Data Management-Inference and Distribution - Enabling New Human Experiences: Reality Mining - Context Awareness - Privacy in Online Social Networks: Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis - Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons

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 and Node- Link Diagrams - Hybrid Representations - Applications of social network analysis: Covert Networks -Community Welfare - Collaboration Networks .

Total: 45 Hours

Reference(s)

1 Borko Furht, -Handbook of Social Network Technologies and Applications, Springer, 1st edition,2010. Peter Mika,-Social Networks and the Semantic Web, Springer, 1st edition 2007.

2 Guandong Xu , Yanchun Zhang and Lin Li,Web Mining and Social Networking Techniques and applications, Springer, 1st edition, 2011.

3 Dion Goh and Schubert Foo, Social information retrieval systems: Emerging technologies and applications for searching the Web effectively, IGI Global snippet, 2008.

4 Max Chevalier, Christine Julien and Chantal Soul-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling, IGI Global snippet, 2009

5 Borko Furht, -Handbook of Social Network Technologies and Applications, Springer, 1st edition,2010. Peter Mika,-Social Networks and the Semantic Web, Springer, 1st edition 2007.

18CS022 NATURAL LANGUAGE PROCESSING 3 0 0 3

Course Objectives

- To provide a self-contained introduction to the central issues of Natural Language Processing (NLP).
- To introduce various practical skills associated with the design and implementation of NLP Systems.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Explain the concept of language processing and algorithms.
2. Exemplify the Morphology and Finite-State Transducers.
3. Implement the logic of syntax parsing methods.
4. Represent the semantics for language processing.
5. Summarize the approaches for machine translation and applications of NLP.

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	3	3										2	
4	2	2	3										2	
5	2	2	3										2	

UNIT I 9 Hours

INTRODUCTION

Knowledge in Speech and Language Processing- Ambiguity- Models and Algorithms- Language,Thought, and Understanding- The State of the Art and the Near-Term Future - Regular Expressions-Basic Regular Expression Patterns- Disjunction, Grouping, and Precedence- Using an FSA to Recognize Sheeptalk- Formal Languages.

UNIT II 9 Hours

MORPHOLOGY AND FINITE-STATE TRANSDUCERS

Inflectional Morphology - Derivational Morphology- Finite-State Morphological Parsing- The Lexicon and Morphotactics - Morphological Parsing with Finite-State Transducers- Combining

FST Lexicon and Rules- Lexicon-free FSTs: The Porter Stemmer- Human Morphological Processing- Speech Sounds and Phonetic Transcription- The Phoneme and Phonological Rules.

UNIT III **9 Hours**
SYNTAX PARSING
Tagsets for English - Part of Speech Tagging- Rule-based Part-of-speech Tagging- Stochastic Part-of speech Tagging- Transformation-Based Tagging- Context-Free Grammars for English - Context-Free Rules and Trees- The Noun Phrase. The Verb Phrase and Subcategorization- Grammar Equivalence &Normal Form- Finite State & Context-Free Grammars.

UNIT IV **9 Hours**
SEMANTICS
Computational Desiderata for Representations- Meaning Structure of Language- First Order Predicate Calculus- Elements of FOPC- The Semantics of FOPC- Syntax-Driven Semantic Analysis- Attachments for a Fragment of English.

UNIT V **9 Hours**
MACHINE TRANSLATION AND APPLICATIONS
Basic Issues in Machine Translation- Statistical Translation- Word Alignment- Phrase based Translation- Synchronous Grammars- Applications of Natural Language Processing: Spell Check- Summarization- Language Translation.

Total: 45 Hours

Reference(s)
1 Daniel Jurafsky and James H. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech recognition", Prentice Hall, 2nd edition, 2008.
2 Steven Bird, Ewan Klein and Edward Loper "Natural Language Processing with Python", O'Reilly Media; 1 edition, 2009.
3 Roland R. Hausser "Foundations of Computational Linguistics: Human-Computer Communication in Natural Language", Paperback, MIT Press, 2011.
4 Christopher D. Manning and Hinrich Schuetze, "Foundations of Statistical Natural Language Processing" by MIT Press, 1999.
5 Pierre M. Nugues, "An Introduction to Language Processing with Perl and Prolog: An Outline of Theories, Implementation, and Application with Special Consideration of English, French, and German (Cognitive Technologies)", Softcover reprint, 2010.

18CS023 WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE 3 0 0 3

Course Objectives

- To understand the fundamentals of Service-Oriented Architecture (SOA).
- To illustrate the principle of service orientation.
- To demonstrate plan, analyze and design in building SOA.

Programme Outcomes (POs)

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

b. 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 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.

g. 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. Represent the fundamentals of SOA and web services.
2. Exemplify Activity management and Composition of SOA.
3. Illustrate SOA and Service Orientation.
4. Generalize planning and analysis in building SOA.
5. Explain Technology And Design in building SOA.

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	3	2	3				2							
4	3	3	2				3							
5														

UNIT I **9 Hours**

SOA AND WEB SERVICES FUNDAMENTALS

Introduction - Evolution of SOA - Web services and primitive SOA: Web services framework, services as web services, service description, messaging.

UNIT II **9 Hours**

ACTIVITY MANAGEMENT AND COMPOSITION

Message exchange patterns, service activity coordination, atomic transaction, business activities, Orchestration, Choreography - Advanced messaging, Meta data and security. Web services and contemporary SOA: Meta data exchange, security.

UNIT III **9 Hours**

SOA AND SERVICE ORIENTATION

Principles of service orientation: SO and enterprise, Anatomy, principles, SO and object orientation, Native web services and support for SO - Service layers: SOA and contemporary SOA, service layer abstraction, application, business, orchestration service layers, agnostic services, service layer configuration scenarios.

UNIT IV **9 Hours**

BUILDING SOA: PLANNING AND ANALYSIS

SOA delivery strategies - Introduction to SO analysis, benefits of business centric SOA, deriving business services - SOA service modeling: guidelines, logic, approaches.

UNIT V **9 Hours**

BUILDING SOA: TECHNOLOGY AND DESIGN

Introduction - SOA composition guideline - Service Design - Entity centric business service design, Taskcentric business service design, service design guidelines- Business Process Design - SOA platforms.

Total: 45 Hours

Reference(s)

1 Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2008.
2 Thomas Erl, "SOA Principles of Service Design " (The Prentice Hall Service-Oriented Computing Series from Thomas Erl), 2005.
3 Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
4 Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services, an Architect's Guide", Pearson Education, 2005.
5 Dan Woods and Thomas Mattern, "Enterprise SOA Designing IT for Business Innovation" O'REILLY, First Edition, 2006

18CS024 BUSINESS ANALYTICS 3 0 0 3

Course Objectives

- Understand data analytics.
- Understand and apply open source modelling.
- Analyzing and develop techniques to solve data analytics problems.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Illustrate the fundamental Concepts of Data Science and its related theories
2. Implement R programming for Bayes model for real-time applications
3. Implement R program for discriminate and factor analysis for problem solving
4. Apply clustering and classification techniques in real-time scenario
5. Analyse the techniques involved in growth of Big Data and its future inventions.

Articulation Matrix

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

UNIT I **8 Hours**

THE ART OF DATA SCIENCE

Volume, Velocity, Variety - Machine Learning -Supervised and Unsupervised Learning - Predictions and Forecasts -Innovation and Experimentation - The Dark Side - Big Errors -Privacy -Theories, Models, Intuition, Causality, Prediction, Correlation -Normal Distribution - Poisson Distribution-Statistical Regression.

UNIT II **10 Hours**

OPEN SOURCE MODELLING

Introducing to R - R Data Structures - Help functions in R - Vectors - Scalars - Declarations - recycling -Common Vector operations - Learning from Experience: Bayes Theorem -Introduction - Bayes and Joint Probability Distributions- Bayes Nets - Bayes Rule in Marketing - Bayes Models in Credit Rating Transitions Accounting Fraud.

UNIT III **9 Hours**

DISCRIMINANT AND FACTOR ANALYSIS

Discriminant Analysis - Notation and assumptions -Discriminant Function - Implementation using R - Confusion Matrix -Multiple groups - Eigen Systems - Factor Analysis.

UNIT IV **9 Hours**

CLUSTER ANALYSIS AND PREDICTION TREES

Introduction -Clustering using k-means -Example: Randomly generated data in kmeans- Hierarchical Clustering - Prediction Trees- Classification Trees - The C4.5 Classifier - Regression Trees.

UNIT V **9 Hours**

BIG DATA ANALYTICS: INTRODUCTION

Big Data Ecosystem-Future trends in Big Data Analytics: Growth of social medium, Creation of Data Lakes, Visualization tools at the hands of business users , Prescriptive Analytics, IoT, Artificial Intelligence, Whole data processing, Vertical and Horizontal Applications, Real-time Analytics, Putting the Analytics in the hands of business users, Migration of solutions from one tool to another, Cloud cloud Everywhere the cloud, In-Database Analytics, In-memory Analytics, Autonomous services for machine Learning, Addressing Security & compliance, Healthcare.

Total: 45 Hours

Reference(s)

1 Data science for Business ,Foster Provost & Tom Fowcett ,O Reilly,2013.
2 Mark Gardener, " Beginning R- The Statistical Programming Language", Wiley, 2013.
3 Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.
4 Umesha Nayak, Umesh R Hodeghatta, Business Analytics using R, A Press.

18CS025 OPEN STACK ESSENTIALS 3 0 0 3

Course Objectives

- Familiarize students with the practical aspects of IaaS (Infrastructure as a Service) cloud computing model.
- Familiarize students with the installation and configuration procedure of compute, storage and networking components of open stack platform for establishing enterprise private cloud.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Explain Openstack Architecture and list the components in it.
2. Interpret Identity Management and the role of image management using web interface.
3. Summarize network management in neutron.
4. Implement the block storage to the instance using Dashboard.
5. Exemplify the architecture of swift and its role in object storage.

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										
3	2	3	3	3										
4	2	2	2	2										
5	2	2	2	3										

UNIT I **9 Hours**

ARCHITECTURE AND COMPONENT OVERVIEW

OpenStack Architecture - DashBoard - Keystone - Glance - Neutron - Nova - Cinder - swift - ceilometer - Heat – Summary.

UNIT II **9 Hours**

IDENTITY MANAGEMENT

RDO Installation: Installing RDO using packstack - Identity Management:Services and End Points - Hierarchy of User,tenants and roles - creating a user - creating a tenant - Granting a role - Interacting with keystone in dashboard - End Points in the dashboard - Image Management:Glance as a registry of images- using the web interface - Building an image.

UNIT III **9 Hours**
NETWORK MANAGEMENT
Networking and Neutron - Open VSwitch Configuration - Creating a network - Web Interface Management - External Network Access - Web Interface External Network Setup.

UNIT IV **9 Hours**
INSTANCE MANAGEMENT AND BLOCK STORAGE
Instance Management: Managing Flavors - Managing Key Pairs - Launching an Instance – Managing Floating IP address - Managing Security groups - Communicating with Instances - Launching an Instances using Web Interface - Creating and Using block storage - Attaching the block storage to an Instance - Managing Cinder Volumes in the Web Interface - Backing Storages.

UNIT V **9 Hours**
OBJECT STORAGE AND TELEMETRY
Object Storage: Architecture of swift cluster - Creating and Using Object Storage - Object File Management in Web Interface - Using Object Storage on an Instance - Ring Files - Telemetry: Understanding Data Store - Ceilometer's Configuration Terms - Graphing the data.

FOR FURTHER READING
Telemetry, Orchestration, Scaling Horizontally, Monitoring, Troubleshooting,

Total: 45 Hours

Reference(s)

1 Dan Radez, OpenStack Essentials, PackT publishing, 2015
2 Omar Khedhar, "Mastering Openstack", PackT Publishing, 2015
3 docs.openstack.org

18CS026 EMBEDDED SYSTEMS 3 0 0 3

Course Objectives

- To be familiar with 8051 microcontoller.
- Understand the basic OS concepts.
- Design and develop embedded systems

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
n. Design and develop cost-effective solutions based on cutting-edge hardware and software tools and techniques to meet global requirements.

Course Outcomes (COs)

1. Explore the concepts of embedded computing with 8051 microcontroller.
2. Illustrate the memory and I/O operations.
3. Explain the processes and operating system concepts.
4. Elucidate the embedded software concepts
5. Develop embedded systems using case studies.

Articulation Matrix

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

UNIT I **9 Hours**

EMEDDED COMPUTING

Challenges of Embedded Systems - Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor - Architecture, Instruction sets and programming.

UNIT II **9 Hours**

MEMORY AND I/O MANAGEMENT

Programming Input and Output - Memory system mechanisms - Memory and I/O devices and interfacing- Interrupts handling.

UNIT III **9 Hours**

PROCESSES AND OPERATING SYSTEMS

Multiple tasks and processes - Context switching - Scheduling policies - Interprocess communication mechanisms - Performance issues.

UNIT IV **9 Hours**

EMBEDDED SOFTWARE

Programming embedded systems in assembly and C - Meeting real time constraints - Multi-state systems and function sequences. Embedded software development tools - Emulators and debuggers.

UNIT V **9 Hours**

EMBEDDED SYSTEM DEVELOPMENT

Design issues and techniques - Case studies - Complete design of example embedded systems.

FOR FURTHER READING

Embedded programming in C,C++ - Real time operating systems - study of Micro C/OS II.

Total: 45 Hours

Reference(s)

1 Wayne Wolf, Computers as Components: Principles of Embedded Computer System Design, Elsevier, 2008.
2 Michael J. Pont, Embedded C, Pearson Education , 2007.
3 Steve Heath, Embedded System Design, Elsevier, 2005.
4 Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051

18CS027 SOFT COMPUTING 3 0 0 3

Course Objectives

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

Programme Outcomes (POs)

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

b. 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 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. 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.

f. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

l. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Understand the basic concepts of soft computing.
2. Classify the architecture and working principles of specialized neural networks.
3. Apply the concept of fuzzification and defuzzification in fuzzy systems.
4. Analyze the fundamental concepts of genetic algorithm and classify its types.
5. Apply hybrid soft computing techniques 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					3	3	
2	2	2	3	2		2	2					3	3	
3	2	3	3	2		2	2					3	3	
4	3	3	3	3		3	2					3	3	
5	3	3	3	3		3	2					3	3	

UNIT I **10 Hours**

INTRODUCTION TO SOFT COMPUTING

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic

Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II **10 Hours**

ARTIFICIAL NEURAL NETWORKS

Back propagation Neural Networks- Kohonen Neural Network -Learning Vector Quantization – Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III **9 Hours**

FUZZY SYSTEMS

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations - Membership Functions -Defuzzification- Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV **8 Hours**

GENETIC ALGORITHMS

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction -Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator- Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V **8 Hours**

HYBRID OF SYSTEMS

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR- Type Fuzzy Numbers - Fuzzy Neuron- Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller.

FOR FURTHER READING

Neural network implementation - Fuzzy logic implementation - Genetic algorithm implementation - MATLAB environment for Soft Computing Techniques.

Total: 45 Hours

Reference(s)

1 N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2 S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 3rd Edition, 2018.
3 Kwang H.Lee, "First course on Fuzzy Theory and Applications, Springer, 2005.
4 James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.

18CS028 DIGITAL IMAGE PROCESSING 3 0 0 3

Course Objectives

- Understand the image fundamentals necessary for Digital Image Processing.
- Apply the concept of image enhancement, degradation function, restoration and the image segmentation techniques.
- Impart the knowledge on image compression and recognition methods.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems.

Course Outcomes (COs)

1. Review the fundamental concepts of a digital image processing system.
2. Apply the techniques used for image enhancement in both spatial and frequency domain using various transforms.
3. Evaluate the techniques for image restoration and Wavelets.
4. Evaluate various techniques for image segmentation.
5. Interpret image compression standards and the image representation techniques

Articulation Matrix

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

UNIT I **6 Hours**

IMAGE PROCESSING FUNDAMENTALS

Introduction to image processing - Steps in Digital Image Processing – Components – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels

UNIT II **6 Hours**

IMAGE ENHANCEMENT

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering

UNIT III **6 Hours**

IMAGE RESTORATION

Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV **6 Hours**

IMAGE SEGMENTATION

Edge detection – Thresholding – Region based segmentation–Region growing – Region splitting and merging – Morphological processing**-** erosion and dilation, opening and closing Segmentation by morphological watersheds – basic concepts

UNIT V **6 Hours**

IMAGE COMPRESSION AND RECOGNITION

Need for data compression, Huffman, Run Length Encoding, JPEG standard. Boundary representation, Boundary description, Fourier Descriptor, Texture – Patterns and Pattern classes – Recognition based on matching.

1 **6 Hours**

EXPERIMENT 1

a) Write a program to display grayscale image using read and write operation using MATLAB

b) Write a program to find histogram value and display histograph of a grayscale and color image using MATLAB

c) Write a program to obtain histogram equalization image from the original image using MATLAB

2 **6 Hours**

EXPERIMENT 2

a) Write a MATLAB program to perform various Point Processing Operations.

b) Write a MATLAB program to perform Bit Plane Extraction and Removal Operations.

3 **6 Hours**

EXPERIMENT 3

a) Write a MATLAB program to filter an image using averaging low pass filter in spatial domain and median filter.

4 **6 Hours**

EXPERIMENT 4

a) Write a MATLAB program to fill the region of interest for the image.

b) Write a MATLAB program for detecting edges in an image using Roberts cross gradient operator, sobel operator and Laplacian Operator

5 **6 Hours**

EXPERIMENT 5

a) Write a MATLAB Program for morphological image operations-erosion, dilation, opening &closing

b) Write a MATLAB Program for performing DCT/IDCT computation in JPEG

Total: 60 Hours

Reference(s)

1 Rafael C Gonzalez, Richard E Woods, "Digital Image Processing" - 2nd Edition, Pearson Education 2003
2 Jain A.K., "Fundamentals of Digital Image Processing", Pearson education
3 D, E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4 William K. Pratt,Digital Image Processing John Wiley, New York, 2002
5 Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

18CS029 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

3 0 0 3

Course Objectives

- To empower students with overall Professional and Technical skills required to solve a realworld problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skillsof the students.
- To keep up with the industry demand and to havecritical thinking, teambased project experience and timely delivery of modules in a project that solves world problems using emerging technologies.
- To prepare the students with digital skills for the future, the Experiential Project Based Learning is introduced to give them hands-on experience using digital technologies on open-source platforms with an end-to-end journey to solve a problem. By the end of this course, the student understands the approach to solve a problem with team collaboration with mentoring from Industry and faculties. **This is an EEC category course offered as an elective, under the type, "Experiential Project Based Learning".**

Highlights of this course

- Students undergo training on emerging technologies
- Students develop solutions for real-world use cases
- Students work with mentors to learn and use industry best practices
- Students access and use Self-Learning courses on various technologies, approaches and methodologies.
- Collaborate in teams with other students working on the same topic
- Have a dedicated mentor to guide

Course Outcomes (COs)

1. To upskill in emerging technologies and apply to real industry-level use cases
2. To understand agile development process
3. To develop career readiness competencies, Team Skills / Leadership qualities
4. To develop Time management, Project management skills and Communication Skills
5. To use Critical Thinking for Innovative Problem Solving
6. To develop entrepreneurship skills to independently work on products

The course will involve 40-50 hours of technical training, and 40-50 hours of project development. The activities involved in the project along with duration are given in Table 1.

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & businessdomains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on trainingon selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to thementors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to beuploaded to cloud based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverablesas per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team toevaluate the project deliverables, and the scoring will be provided based on the evaluationmetrics	1
TOTAL		**16 WEEKS**

TABLE 2: EVALUATION SCHEMA

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY ANDENTREPRENEURSHIP			
Technical Skills		**Soft Skills**	
Criteria	**Weightage**	**Criteria**	**Weightage**
Project Design using DesignThinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis usingCritical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools,Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		

Performance of Product/ Application	5		
Technical Training & Assignments	5		
Total	70	Total	30
		Total Weightage	100
		Passing Requirement	50
Continuous Assessment Only			

AMENDMENT IN RESPECTIVE REGULATIONS:

1. Course is offered in the
   - $6^{th}/7^{th}$ semesters of UG programmes
2. This is an EEC category course offered as an elective under the type, "Experiential ProjectBased Learning".
3. **Evaluation of Experiential Project Based Learning:**
   - **Project Review & Scoring**: Evaluator accesses the project deliverables, reviews the work done by the team and assigns the score for defined metrics.
   - **Project Status Review**: Mentor reviews the deliverables submitted by student teams and shares his/her comments. Mentor ensures the timely completion of project.
   - The evaluation shall be carried out as per the metrics given in Table 2.
4. If a student takes a break and rejoins the programme at a later point in time in a semesterother than the prescribed semesters identified for the course, he/she is permitted to opt for a professional elective in lieu of this course.

Course Assessment scheme: Assessed through **Continuous assessment mode**

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Passing Criteria:

The passing requirement for the courses of the type 'Experiential Project Based Learning' fallingunder the category of EEC is 50% of the continuous assessment marks only.

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18CS0YA E-LEARNING TECHNIQUES 3 0 0 3

Course Objectives

- Understand the technologies involved in e-learning.
- Gain the fundamentals of e-learning techniques
- Determine the characteristics of Teaching-Learning Process

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Acquire knowledge about the basic concepts of e-learning.
2. Explain the technology mediated communication in e-learning.
3. Exemplify of e-learning and content the process management.
4. Analyze the teaching and learning processes in e-learning environment.
5. Assess the various applications of e-learning.

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	3										2	
3	3	3	3										3	
4	2	2	2										2	
5	2	2	2										2	

UNIT I **9 Hours**

INTRODUCTION

Evolution of Education - Generations of Distance Educational Technology - Role of E-Learning -Components of e-learning: CBT, WBT, Virtual Classroom - Barriers to e-Learning Roles and Responsibilities: Subject Matter Expert - Instructional Designer - Graphic Designer - Multimedia Author- Programmer - System Administrator - Web Master.

UNIT II **9 Hours**

TECHNOLOGIES

Satellite Broadcasting - Interactive Television - Call Centers - Whiteboard Environment –

Teleconferencing: Audio Conferencing - Video Conferencing -Computer Conferencing. Internet: E-mail, Instant Messaging, Chat, Discussion Forums, Bulletin Boards, Voice Mail, File Sharing, Streaming Audio and Video.

UNIT III **9 Hours**
MANAGEMENT
Content: E-Content, Dynamic Content, Trends - Technology: Authoring, Delivery, Collaboration - Services: Expert Service, Information Search Service, Knowledge Creation Service - Learning Objects and E-Learning Standards. Process of E-Learning: Knowledge acquisition and creation, Sharing of knowledge, Utilization of knowledge - Knowledge Management in E-Learning.

UNIT IV **9 Hours**
TEACHING-LEARNING PROCESS
Interactions: Teacher-Student - Student-Student - Student-Content - Teacher- Content - Teacher-Teacher -Content-Content Role of Teachers in E-Learning - Blended Learning -Cooperative Learning - Collaborative Learning - Multi Channel learning -Virtual University - Virtual Library.

UNIT V **9 Hours**
APPLICATIONS
Customer service training - Sales training - Customer training - Safety training - IT training – Product training - Healthcare training.

FOR FURTHER READING
Course delivery and evaluation: Components of an instructor led or facilitated course – Facilitating learners - activities - Using communication tools for e-learning - Course evaluation - Learning platforms - Proprietary vs. open-source LMS - Moodle and other open-source LMS solutions - Solutions for limited or no connectivity.

Total: 45 Hours

Reference(s)
1 E-Learning: An Expression of the Knowledge Economy, Gaurav Chadha, S.M. Nafay Kumail, Tata McGraw-Hill Publication, 2002.
2 E-Learning: New Trends and Innovations, P.P. Singh, Sandhir Sharma, Deep & Deep Publications, 2005.
3 E-Learning: Concepts, Trends and Applications, Epignosis LLC, LLC publications, 2014.
4 Michael Allen's Guide to E-Learning, Michael W. Allen, Michael Allen, Wiley Publication,2002.

18CS0YB SOFTWARE TESTING AND QUALITY ASSURANCE 3 1 0 4

Course Objectives

- Understand the basic software testing principles.
- Understand the working principles of various testing methodologies.
- Understand the importance of quality assurance in software development process.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
e. 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

Course Outcomes (COs)

1. Determine the risk strategies in software testing.
2. Explain the organization and development of testing approach.
3. Exemplify the verification and validation process.
4. Differentiate pre operational and post operational testing.
5. Illustrate the importance of quality assurance in software testing.

Articulation Matrix

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

UNIT I 7 Hours
INTRODUCTION

Minimizing Risks - Writing a policy - Building a structured approach - Developing a test strategy - Building the software testing process - Software testing guidelines -Customizing the software testing process.

UNIT II 11 Hours
ORGANIZATION AND DEVELOPMENT OF TESTING APPROACH

The cost of computer testing - Seven step software testing process - Organizing for testing - Developing Test plan -Profile the software project - Understand project risk -Select a testing technique - Unit testing and analysis - Build and Inspect Test Plan.

UNIT III **8 Hours**
VERIFICATION AND VALIDATION

Verification Testing: Test during requirements phase - Test during design phase -test during programming phase - Guidelines - Validation Testing: Build the test data - Execute tests - Record Test Results

UNIT IV **8 Hours**
IMPLEMENTATION
Acceptance and Operational Testing: Acceptance Testing - Pre-operational Testing - Post-Operational Testing -Develop and Test - Post Implementation Analysis - Workbenches - Procedures

UNIT V **11 Hours**
QUALITY ASSURANCE
Quality management - The role of SQA- SQA plan- SQA considerations- Establishing software standards- Basic inspection principles- Conduct of inspections- Establishing software quality program-Quality Assurance - Root Cause Analysis, modelling, technologies, standards and methodologies for defect prevention

FOR FURTHER READING
Installing Software Testing Tools- Software Development Methodologies- Testing Client/Server System -Testing COTS and Contracted Software- Configuration accounting and audit

Total: 45 Hours

Reference(s)
1 William E Perry, Effective Methods for Software Testing, John Wiley & Sons, USA,Third Edition 2014.
2 Watts S. Humphrey, Managing the software process, Addison Wesley, 2013.
3 Roger S Pressman, Software Engineering-A Practitioners Approach, Mc Graw Hill International, Singapore, 2010.
4 Nina S Godbole, Software Quality Assurance Principles and Practice, Narosa Publishing House Pvt. Ltd., 2010

18CS0YC JAVA FUNDAMENTALS **3 0 0 3**

Course Objectives

- Understand fundamental Java concepts including data types, variables, classes, inheritance, and exception handling.
- Implement input/output operations, file handling, and serialization using Java I/O classes and interfaces.
- Manipulate strings effectively, utilize java.lang functionalities, and work with the Collections Framework for string-related operations.
- Develop graphical user interfaces, handle events, and utilize AWT controls and JDBC concepts for GUI-based applications.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Demonstrate applications based on core Java Concepts with examples
2. Construct application using inheritance, packages and exception handling for real time problems.
3. Explain the Java I/O concepts to handle input and output operations.
4. Develop programs to perform string manipulation in java.
5. Design GUI with Java for event handling and database applications.

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	2		2								2	
3	3	3	3		3								3	
4	2	2	2		2								2	
5	2	2	2		2								2	

UNIT I **9 Hours**

BASICS OF JAVA

The Genesis of Java - Overview of Java - Data Types, Variables, and Arrays - Operators – Control Statements - Introducing Classes - Methods and Classes.

Inheritance: Basics - Using Super - Creating a Multilevel Hierarchy - Method overriding - Using Abstract Classes - Packages and Interfaces: Packages - Access Protection - Importing Packages- Interfaces Definitions and Implementations - Exception Handling: Types - Try and Catch - Throw.

UNIT III **9 Hours**

EXPLORING JAVA I/O

I/O Basics - Reading Console Input -Writing Console output - Native Methods - I/ O Classes and Interfaces - File - The Byte Streams - The Character Streams - Using Stream I/ O - Serialization.

UNIT IV **9 Hours**

JAVA STRINGS

String Handling: Special String operations and Methods - String Buffer - Exploring java.lang: Simple type Wrappers - System - Math - Collections Framework: Collections Interfaces and Classes – Utility Classes: String Tokenizer - Date and Time.

UNIT V **9 Hours**

GUI WITH JAVA

Applet Basics - Applet Architecture - Applet Display Methods - Parameter Passing - Event Handling Mechanisms - Event Classes - Event Listener - Working with Windows, Graphics, Colors and Fonts - AWT Controls - Layout Managers and Menus - JDBC Concepts.

FOR FURTHER READING

Developing GUI applications using Swing controls - Container concepts - DAO and JDBC support.

Total: 45 Hours

Reference(s)

1 Herbert Schildt, Java 2-Complete Reference, Tata Mc Graw Hill, 2015.
2 Deitel & Deitel, Java How to Program, Prentice Hall of India, 2010.
3 Gary Cornell and Cay S.Horstmann, Core Java Vol.1 and Vol.2, Sun Microsystems Press, 2008.

18CS0YD NETWORK ENGINEERING AND MANAGEMENT 3 0 0 3

Course Objectives

- Understand the concepts of computer networks and to study the functions of different layers.
- Familiarized with different protocols and network components.
- Understand the implementation of network management protocol.

Programme Outcomes (POs)

c. 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. 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. 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.

Course Outcomes (COs)

1. Explain the fundamentals of networking.
2. Explore the Data link Layer and Network layer.
3. Elucidate the High Performance Networks.
4. Exemplify the SNMP and Network Management.
5. Illustrate the RMON and Telecommunication Network Management

Articulation Matrix

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

UNIT I **9 Hours**

FOUNDATIONS OF NETWORKING

Data communication networks - Protocols and standards -OSI model - Layers in OSI -TCP/IP protocol suite Addressing. Physical layer and Media-analog and digital-transmission impairment-data rate limits- performance

UNIT II **9 Hours**

DATA LINK LAYER AND NETWORK LAYER

Wireless LANs-IEEE 802.11- Bluetooth-Connecting Devices-Backbone Networks-Virtual LANs - IPv4 -IPv6- Transition from IPv4 to IPv6 -Address mapping - ICMP-ICMPv6 -Congestion control open-loop and Closed-loop Congestion control.

UNIT III **9 Hours**

HIGH PERFORMANCE NETWORKS

Optical Networks: Optical links-WDM System-Optical cross connects-Optical LANs-Optical paths and networks-Switching: Switching performance measures-Modular switch design-packet Switching.

UNIT IV **9 Hours**

SNMP AND NETWORK MANAGEMENT

Network Monitoring-Architecture-Performance-Fault-Accounting- Network Control- Network Management concepts- Network Management Information - Standard MIBs - Simple Network Management Protocol.

UNIT V **9 Hours**

RMON AND TELECOMMUNICATION NETWORK MANAGEMENT

Remote monitoring - RMON SMI and MIB - RMON1 - RMON2-ATM Remote monitoring - TMN -TMN conceptual model-TMN architecture - TMN management service architecture - TMN integrated view.

Total: 45 Hours

Reference(s)

1 Behrouz A. Forouzan, "Data Communication and Networking",Fourth Edition,Tata McGraw Hill,2007.
2 Mani Subramanium, "Network Management Principles and practices",Pearson Education,2010.
3 Jean Warland and Pravin Vareya, "High Performance Networks", Morgan Kauffman Publishers,2002.
4 Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach",Morgan Kaufman Publishers, 2007
5 William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON1 and RMON2", Third Edition Pearson Education,2002.
6 Lakshmi G. Raman, " Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999

18CS0YE AGENT BASED INTELLIGENT SYSTEMS 3 0 0 3

Course Objectives

- Understand the fundamental concepts of artificial intelligence
- Impart the different paradigms in knowledge representation and reasoning
- Determine the problems to solve using artificial intelligence and machine learning

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)

1. Understand the awareness of intelligent agents and problem solving using uninformed, informed and local search method.
2. Identify the knowledge representation and reasoning techniques in logic programming
3. Implement the use of planning and simple decision making
4. Apply and integrate various artificial intelligence techniques in intelligent system development
5. Summarize the basic features of JADE and develop simple programs using it

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	
3	2	3	3										2	
4	2	2	2										3	
5	2	3	2										2	

UNIT I **9 Hours**

INTRODUCTION AND PROBLEM SOLVING

Definitions of AI - Intelligent Agents. Problem solving by searching: Problem-solving agents-Example problems -Search for solutions Uninformed search strategies- Informed search strategies-Heuristic functions.

UNIT II **9 Hours**

KNOWLEDGE REPRESENTATION AND REASONING

Logical Agents: Propositional logic-Reasoning patterns in propositional logic-Agent based propositional logic-First order logic: Syntax and semantics-First order inference: Unification Chaining- Resolution strategies-Knowledge representation: Objects-Actions-Events.

UNIT III **9 Hours**

LOGIC

Logical agents: Knowledge-based agents -The Wumpus world. Logic - Propositional logic: A very simple logic-Propositional theorem proving. First order logic: Representation -Syntax and semantics of first order logic - Using first order logic. Inference in first order logic: Propositional versus first order inference- Unification and lifting - Forward chaining - Backward chaining-Resolution.

UNIT IV **10 Hours**

HIGHER LEVEL AGENTS

Knowledge in learning: Explanation based learning-Relevance information-Statistical learning methods:Instance based learning-Neural network-Reinforcement learning: Passive and active communication: Formal grammar- Augmented grammars-Future of AI.

UNIT V **8 Hours**

JADE PLATFORM

The JADE Platform - Programming with JADE - Basic Features

Total: 45 Hours

Reference(s)

1. Stuart Russell and Peter Norvig, Artificial Intelligence - A Modern Approach, Prentice Hall India,2012Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Tata Mcgraw-Hill, 1997.
2. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill,2010.
3. M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publisher, 2010.
4. Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi agent Systems with JADE, John Wiley and Sons Ltd, 2007

18CS0YF E-BUSINESS **3 0 0 3**

Course Objectives
- Understand the concepts of E-Business
- Impart knowledge about the approaches in internet business environment
- Understand the role of internet marketing in an organization.

Programme Outcomes (POs)

c. 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. 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. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. 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. Illustrate the overall framework of E-Commerce.
2. Identify the role internet in modern business.
3. Analyze the security issues and consumer oriented e-commerce
4. Explore the concepts of electronic payment system.
5. Compare the inter and intra organizational e-commerce and advertising on the internet

Articulation Matrix

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

UNIT I **9 Hours**
INTRODUCTION TO ELECTRONIC COMMERCE
Electronic Commerce Framework - E-Commerce and Media Convergence- The Anatomy of E-Commerce Application- E-Commerce Consumer Applications- E-Commerce Organization Application- Market Forces Influencing the I-Way- Components of the I-Way-Network access equipment- The Last Mile, Global Information Distribution Networks, Public Policy Issues.

UNIT II **8 Hours**

NETWORK INFRASTRUCTURE

The Internet Terminology - Chronological History of the Internet - NSFNET architecture and components- National Research and Education network - Globalization of the Academic Internet - Telco cable Online Companies - National independent ISP- Regional Level ISP- Local Level ISP.

UNIT III **11 Hours**

NETWORK SECURITY AND CONSSUMER ORIENTED E-COMMERCE

Client Server Network Security- Emerging Client - Server security threads- Firewalls and Network Security- Data and Message Security- Encrypted Documents and Email- Architectural Framework of E- commerce- Security and the Web-Consumer- oriented Applications, Mercantile Process Model -Mercantile Models from the Consumer Perspective-Mercantile Models from the Merchants Perspective.

UNIT IV **7 Hours**

ELECTRONIC PAYMENT SYSTEM

Types of E-Payment System - Digital Token Based E-Payment System- Smart Cards based Electronic payment System- Credit Card based Electronic Payment System- Risk and Electronic payment system - Designing Electronic payment system.

UNIT V **10 Hours**

INTERORGANIZATIONAL AND INTRAORGANIZATIONAL E-COMMERCE

Electronic Data interchange-EDI applications in Business- EDI legal, security and privacy issues-EDI and electronic commerce- - Internal Information Systems- Macroforces and Internal Commerce-Work- flow automation and coordination-customization and internal commerce- supply chain management-Advertising on the Internet- charting the on-line marketing process-Market research.

Total: 45 Hours

Reference(s)

1 Ravi Kalakota and Andrew B.Whinston, Frontiers of E-Commerce, Pearson Education Asia,2009.
2 Elias M. Awad, Electronic Commerce- From the Vision to Fulfillment, Prentice Hall of India,2009.
3 Kamesh K.Bajaj and Debjani Nag, E-Commerce the Cutting Edge of Business, Tata McGraw Hill, 2005.

18CS0YG KNOWLEDGE DISCOVERY IN DATABASES 3 0 0 3

Course Objectives
- Introduce the basic concepts of data warehousing.
- Impart knowledge about the data mining functionalities.
- Assess the strengths and weaknesses of association mining and cluster analysis.

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Apply suitable algorithmic thinking and data management practices to design, develop, and evaluate effective solutions for real-life and research problems

Course Outcomes (COs)
1. Explain the concepts of Data Warehousing architecture and business analysis process.
2. Illustrate the process of Data Mining and preprocessing techniques for data cleansing.
3. Apply the association rules for mining the various kinds of data
4. Analyze Classification and Clustering algorithms for various problems with high dimensional data.
5. Illustrate the various data mining techniques on complex data objects.

Articulation Matrix

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

UNIT I 10 Hours
DATA WAREHOUSING AND BUSINESS ANALYSIS
Data warehousing Components -Building a Data warehouse -Data Warehouse and DBMS- Metadata-Multidimensional data model - Data Extraction, Cleanup and Transformation Tools - Reporting, Query tools and Applications - OLAP vs OLTP - OLAP operations - Data Warehouse Schemas: Stars, Snowflakes and Fact constellations.

UNIT II **8 Hours**

INTRODUCTION TO DATA MINING

Introduction - Steps in knowledge discovery from databases process - Architecture of a Typical Data Mining Systems - Data Mining Functionalities - Classification of Data Mining Systems - Data mining on different kinds of data - Different kinds of pattern - Task Primitives - Integration of a Data Mining System with a Data Warehouse - Major issues in Data mining.

UNIT III **9 Hours**

ASSOCIATION RULE MINING

Market Basket Analysis- Frequent Item Set Mining methods: Apriori algorithm - Generating Association Rules - A Pattern Growth Approach- Pattern mining in multilevel and multidimensional space - Mining Various Kinds Of Association Rules - Association Analysis to Correlation Analysis - Constraint Based Association Mining.

UNIT IV **10 Hours**

CLASSIFICATION AND CLUSTERING

Decision Tree Induction - Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines - Clustering: Types of data - Partitioning methods: k-means, k- medoid - Hierarchical Methods: distance based agglomerative and divisible clustering, BIRCH – Density Based Method: DBSCAN - Grid Based Method: STING.

UNIT V **10 Hours**

DATA MINING APPLICATIONS

Mining complex data objects - Text Mining - Graph mining - Web mining - Spatial Data mining -Application and trends in data mining - Social impacts of Data mining.

Total: 45 Hours

Reference(s)

1. Jiawei Han, Micheline Kamber and Jian Pai , Data Mining: Concepts and Techniques, Morgan Kauffman, 3rd Edition, 2013.
2. Alex Berson and Stephen J Smith, Data Warehousing, Data Mining, and OLAP, Tata Mcgraw- Hill, 1997.
3. David Hand, Heikki Manila, Padhraic Symth, Principles of Data Mining, MIT Press, 2001.
4. Margaret H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education 2003.

18CS0YH SOCIAL NETWORK ANALYSIS CONCEPTS 3 0 0 3

Course Objectives

- Apply knowledge for current web development in the era of Social Web
- Develop a model for integrating data for knowledge representation
- Apply the tools and an algorithm for mining in social networks
- Examine the human behavior and trust disputes of social networks
- Apply visualization technique in Social networks

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Apply knowledge for current web development in the era of Social Web
2. Develop a model for integrating data for knowledge representation
3. Apply the tools and an algorithm for mining in social network
4. Examine the human behavior and trust disputes of social network
5. Apply visualization technique in Social networks

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

UNIT I **9 Hours**

INTRODUCTION TO SOCIAL NETWROK ANALYSIS

Introduction to 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 - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks.

UNIT II **8 Hours**

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION

Ontology languages for the Semantic Web: RDF and OWL - Modelling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III **9 Hours**

EXTRACTION AND MINING COMMUNITITES IN WEB SOCIAL NETWORKS

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- Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities - Decentralized Online Social Networks: Introduction- Challenges for DOSNs- General purpose DOSNs.

UNIT IV **10 Hours**

PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES

Understanding and Predicting Human Behavior for Social Communities - User Data Management- Inference and Distribution - Enabling New Human Experiences: Reality Mining - Context Awareness - Privacy in Online Social Networks: Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Trust Transitivity Analysis - Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons

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 and Node- Link Diagrams - Hybrid Representations - Applications of social network analysis: Covert Networks -Community Welfare - Collaboration Networks

Total: 45 Hours

Reference(s)

1. Borko Furht, -Handbook of Social Network Technologies and Applications, Springer, 1st edition,2010.
2. Peter Mika,-Social Networks and the Semantic Web, Springer, 1st edition 2007.
3. Guandong Xu, Yanchun Zhang and Lin Li,Web Mining and Social Networking Techniques and applications, Springer, 1st edition, 2011.
4. Dion Goh and Schubert Foo, Social information retrieval systems: Emerging technologies and applications for searching the Web effectively, IGI Global snippet, 2008.

18CS0YI OPERATING SYSTEM CONCEPTS 3 0 0 3

Course Objectives

- To understand the concepts of the basic functionalities of an Operating Systems
- To analyse and evaluate the process of Operating Systems

Programme Outcomes (POs)

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

Course Outcomes (COs)

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

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO OPERATING SYSTEM STRUCTURE

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

UNIT II **9 Hours**

PROCESS MANAGEMENT

Processes - Process Concept - Process Scheduling - Operations on Processes - Interprocess

Communication. Threads: Overview - Multithreading Models - Threading Issues. CPU Scheduling – Basic Concepts- Scheduling Criteria- Scheduling Algorithms

UNIT III **9 Hours**

PROCESS SYNCHRONIZATION AND DEADLOCK

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

UNIT IV **8 Hours**

MEMORY MANAGEMENT

Main Memory: Background- Swapping- Contiguous Memory Allocation- Segmentation- Paging- Structure of the Page Table. Virtual Memory: Background- Demand Paging- Page Replacement - Allocation of Frames- Thrashing.

UNIT V **10 Hours**

STORAGE MNAGEMENT AND CASE STUDIES

Overview of Mass Storage Structure - Disk Structure - Disk Attachment - Disk Scheduling - Disk Management - Swap-Space Management. File -System Interface: File Concept - Access Methods - File System Implementation: File-System Structure - Directory Implementation - Allocation Methods - Free- Space Management. Case study: Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management.

Total: 45 Hours

Reference(s)

1 Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, Operating System concepts Seventh Edition, John Wiley & Sons, 2004.
2 Daniel P Bovet and Marco Cesati, Understanding the Linux kernel 3rd edition, O'Reilly, 2005.
3 William Stallings, "Operating System", Pearson Education, Sixth Edition, 2012.
4 Harvey M. Deitel, "Operating Systems", Pearson Education Pvt. Ltd, Third Edition, 2003.
5 Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition Prentice Hall of India Pvt.Ltd, 2010.

18CS0YJ OBJECT ORIENTED PROGRAMMING 3 0 0 3

Course Objectives
- Understand the concepts of Object Oriented Programming
- Study the concepts of objects and classes.
- Familiarize in the types of constructors.

Programme Outcomes (POs)
a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.

Course Outcomes (COs)
1. Identify the characteristics and data types of C++ language.
2. Develop programs using objects and classes for real world applications
3. Construct programs to implement operator overloading and inheritance techniques
4. Apply Polymorphism and File streams concepts to develop C++ program
5. Design applications using templates and apply exception handling mechanisms

Articulation Matrix

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

UNIT I 9 Hours
INTRODUCTION
Need for object oriented programming - Procedural Languages vs. Object oriented approach - Characteristics Object oriented programming - C++ Programming Basics: Basic Program Construction - Output Using cout - Input with cin - Data types- Variables and Constants - Operators - Control Statements-Manipulators - Type conversion. Function Prototyping- call by reference, return by reference- Inline function- Default arguments - Function overloading.(sona)

UNIT II **8 Hours**

OBJECTS AND CLASSES

Objects and Classes Simple Class - C++ Objects as Physical Objects - C++ Object as Data types-CONSTRUCTORS: Parameterized Constructors - Multiple Constructors in a Class - Constructors with Default Arguments - Dynamic Initialization of Objects - Copy and Dynamic Constructors - Destructors(PSG) - Structures and Classes - Arrays and Strings

UNIT III **10 Hours**

OPERATOR OVERLOADING AND INHERITANCE

Operator Overloading and Inheritance Need of operator overloading- Overloading Unary Operators-Overloading binary Operators - Overloading Special Operators - Data Conversion Inheritance: Derived Class and Base Class - Derived Class Constructors-Overriding Member Functions-Class Hierarchies- Public and Private Inheritance-Levels of Inheritance-Multiple Inheritance.

UNIT IV **10 Hours**

POLYMORPHISM AND FILE STREAMS

Polymorphism and File Streams Virtual Function - Friend Function - Static Function-Assignment and Copy Initialization- Memory Management: new and delete Pointers to Objects, this Pointer-Streams - String I/O - Character I/O - Object I/O - I/O with Multiple Objects - File Pointers - Disk I/O with Member Functions- Error Handling in File I/O.

UNIT V **10 Hours**

TEMPLATES AND EXCEPTION HANDLING

Templates: Introduction - Function Templates - Overloading Function Templates-, user defined template arguments(sona) - Class Templates - Exception Handling - Syntax, multiple exceptions, exceptions with arguments.

Total: 45 Hours

Reference(s)

1 Deitel & Deitel, C++ How to program, Prentice Hall,2005
2 Robert Lafore, Object Oriented Programming in-C++, Galgotia Publication.
3 D.S.Malik, C++ Programming, Thomson, 2007.
4 K.R. Venugopal, Rajkumar and T.Ravishankar, Mastering C++, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2006.
5 E.Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill Publishing,New.

18CS0YK ADVANCED SOCIAL TEXT AND MEDIA ANALYTICS 3 0 0 3

Course Objectives

- Understand the basic ideas of Text mining.
- Analyze the methods and approaches used in analytics.
- Gain knowledge on various types of analytics like web, social network, and social media.

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 modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Demonstrate the concepts and applications of text mining
2. Explain Content analysis and Sentiment analysis
3. Illustrate web analytics with a suitable model
4. Illustrate social network and media analytics with suitable example.

Articulation Matrix

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

UNIT I **7 Hours**
TEXT MINING
Introduction, Core text mining operations, Preprocessing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications.

UNIT II **9 Hours**
METHODS
Content Analysis-Natural Language Processing-Clustering & Topic Detection-Simple Predictive Modeling-Sentiment Analysis; Sentiment Prediction.

UNIT III **9 Hours**
WEB ANALYTICS
Web analytics tools-Clickstream analysis-A/B testing, online surveys-Web search and retrieval-Search engine optimization-Web crawling and Indexing-Ranking algorithms-Web traffic models.

UNIT IV **10 Hours**
SOCIAL NETWORK ANALYTICS
Social contexts: Affiliation and identity - Social network analysis - Social network and web data and methods. Graphs and Matrices - Basic measures for individuals and networks

UNIT V **10 Hours**
SOCIAL MEDIA ANALYTICS
Information visualization - Making connections: Link analysis - Random graphs and network evolution.

Total: 45 Hours

Reference(s)

1 Ronen Feldman and James Sanger, The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data, Cambridge University Press, 2006.
2 Hansen, Derek, Ben Sheiderman, Marc Smith. Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 2011.
3 Avinash Kaushik. Web Analytics 2.0: The Art of Online Accountability, 2009.
4 Hanneman, Robert and Mark Riddle. Introduction to Social Network Method, 2005.
5 Wasserman, S. & Faust, K. Social network analysis: Methods and applications. New York: Cambridge University Press, 1994.
6 Monge, P. R. & Contractor, N. S. Theories of communication networks. New York: Oxford University, 2003

18CS0XA 3D ANIMATIONS **1 0 0 1**

Course Objectives

- Demonstrate the basic and fundamental concepts in 3D animation.
- Understand the texture operations in 3D objects.
- Learn the basics of Modeling with 3D animation.

Course Outcomes (COs)

1. Explain the basic concepts of 3D animation.
2. Explore the visual effects,lights and rendering of 3D objects.
3. Illustrate modelling with 3D.

UNIT I **20 Hours**

3D ANIMATION

3D Animation Overview - 3D Animation Preproduction - Postproduction - Understanding digital imaging - digital video - Exploring animation, story and pre -visualization - Understanding modeling and Texturing - Rigging and Animation - Understanding visual effects, lights and rendering - Modeling with 3D- Lights - camera and materials - 3D Motion Graphics - FX Rendering and V-Ray - Digital FX - 3D Animation - Architectural Visualization Portfolio - Stop Motion Pro - 3Ds Max 2010 - Adobe After Effects CS4 Professional - texture operations in 3D - Pre-production.

Total: 20 Hours

Reference(s)

1 Andy Beane, 3D Animation Essentials, John Wiley & Sons, 2012.

18CS0XB QUANTUM COMPUTING **1 0 0 1**

Course Objectives

- Understand the building blocks of a quantum computer.
- Understand the principles, quantum information and limitation of quantum operations formalizing.
- Gain knowledge about the quantum error and its correction.

Course Outcomes (COs)

1. Explain the basic concepts of quantum computing.
2. Explore the quantum computing algorithms an operations.
3. Describe the various types of quantum computers.

UNIT I **20 Hours**

QUANTUM COMPUTING

Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. Quantum Computation: Quantum Circuits - Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms - Quantum counting- Speeding up the solution of NP complete problems - Quantum Search for an unstructured database.

Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.

Total: 20 Hours

Reference(s)

1 Micheal A. Nielsen. & Issac L. Chuang - Quantum Computation and Quantum Information, Cambridge University Press,2011.

18CS0XC AGILE PROGRAMMING 1 0 0 1

Course Objectives

- Understand the internal of the agile programming.
- Understand the implementation of agile project development.

Course Outcomes (COs)

1. Explore the basic concepts of agile programming.
2. Illustrate the methodology used in extreme programming.
3. Describe the unified process.

UNIT I **20 Hours**

ITERATIVE AND EVOLUTIONARY

Iterative and Evolutionary: Definition - comparison - major activities. Agile: Basic concepts – Major activities - available agile methods. Motivation: Change on software projects - key motivation- requirement challenge -problems of water fall. Evidence: Research and early historical standard and though leader-business case -water fall validity. Serum: Concepts, Method overview, Lifecycle, Work products, Roles and Practices, Values, Common mistakes and misunderstandings, Process Mixtures, Adaption Strategies, Fact versus Fantasy, Strength Versus Other, Sample Projects Extreme Programming: Concepts, Method overview, Lifecycle, Work products, Roles and Practices, Values, Common Mistakes and Misunderstandings, Sample Projects Unified Process: Concepts, Method overview, Lifecycle, Work products, Roles and Practices, Values, Common mistakes and misunderstandings, , Process Mixtures, Adaption Strategies, Fact versus Fantasy, Strength Versus Other, Sample Projects. Practice Tips: Project - management - environment - requirements - tests - Frequently raised questions and answers.

Total: 20 Hours

Reference(s)

1 Craig Lannan, "Agile and Iterative Development A Manger's Guide" Pearson Education, FirstEdition, India, 2004.
2 I.Shore, "Art of Agile Development", Shroff Publishers & Distributors, 2007

18CS0XD MOBILE OPERATING SYSTEMS 1 0 0 1

Course Objectives

- Acquire knowledge about mobile operating systems.
- Understand the architectures of emerging mobile OS.
- Develop applications using mobile OS.

Course Outcomes (COs)

1. Explore the architecture and features of Andriod OS.
2. Illustrate the features of MeeGO OS.
3. Explicate the features of Symbian OS.

UNIT I **20 Hours**

INTRODUCTION TO ANDROID:

Android - Features - Architechture - Applications - Application framework - Libraries – Application fundamentals - Application components - The Manifest file - Application resources. MeeGo: Introduction to the MeeGo project - MeeGo architechture - MeeGo notebook UX – enefits of the MeeGo software platform - MeeGo applications. Symbian: Introduction to symbian OS - versions of symbian - user interfaces - Features – Architecture - Application development.

Total: 20 Hours

Reference(s)

1. http://developer.android.com/guide/topics/fundamentals.html
2. http://wiki.meego.com/images/MeeGo_Introduction.pdf
3. http://www.symbioosi.net/English/symbian_os_en.html
4. http://en.wikipedia.org/wiki/Symbian

18CS0XE INTERNET MARKETING **1 0 0 1**

Course Objectives

- Understand the E- Marketing context.
- Gain knowledge about the marketing strategies of segmenting, targeting, positioning, and differentiation.
- Evaluate several customer relationship management (CRM) strategies using internet technology.

Course Outcomes (COs)

1. Explain the theories involved in e-marketing.
2. Implement a e-commerce website for a company.

UNIT I **20 Hours**

INTERNET MARKETING

Theories of E-Marketing - Introduction to E-Marketing - E-Marketing Plan - Strategic E-Marketing and Performance Metrics - The E-Marketing Plan - Internet Marketing Overview - Website Planning & Development - Let Companies Search you on Google for Jobs - Internet Marketing Strategy and Planning - Search Engine Optimization - Social Media Marketing - Make E-Commerce website in 20 Minutes - Introduction- ATM - Selling Products Through Online Modes - Making Money via Adsense and Blogging - Explore your Talent to earn money through Internet - Affiliate Marketing- Making Tons of Money Part Time - Making Money as a FreeLancer.

Total: 20 Hours

Reference(s)

1 Mary lou Roberts, Debra Zahay Internet Marketing: Integrating Online and Offline Strategies, TataMcGrawHill,2012.

18CS0XF SCRIPTING LANGUAGES 1 0 0 1

Course Objectives

- Gain knowledge about the scripting languages such as PERL, TCL/TK, Python and BASH.
- Create and run scripts using Perl / TCL / Python.
- Creation of programs in the Linux environment.

Course Outcomes (COs)

1. Illustrate the basic concepts of Linux Administration.
2. Implement programs using PERL scripts.
3. Explore the concepts of TCL.

UNIT I **20 Hours**

SCRIPTING LANGUAGES

Introduction to Linux- File System of the Linux-General usage of Linux kernel & basic commands- Linux users and group- Permissions for file- directory and users- Searching a file & directory- zipping and unzipping concepts Introduction to Perl Scripting, working with Simple Values- Lists and Hashes- Loops and Decisions- Regular Expressions, Files and Data in Perl Scripting- Tcl Fundamentals- String and Pattern Matching- Tcl Data Structures- Control Flow Commands- Tk Fundamentals- Tk by Examples- Introduction to Python- Using the Python Interpreter.

Total: 20 Hours

Reference(s)

1 David Barron, The World of Scripting Languages, 1st Edition, Wiley publications, 2000

18CS0XG RASPBERRY PI **1 0 0 1**

Course Objectives

- Demonstrate the basic and fundamental concepts in Raspberry PI tool.
- Gain knowledge about Linux system administration commands.
- Understand the implementation of understanding game programming.

Course Outcomes (COs)

1. Explain the basic concepts of Raspberry PI tool.
2. Explore the Linux Shell Programming model.
3. Describe the Game Programming.

UNIT I 20 Hours

INTRODUCTION TO RASPBERRY PI

Introduction to Raspberry Pi - Hardware aspects - Board details - Overview of available hardware resources - Operating systems available - Pre-requisites of using raspberry pi - Installation of OS on Raspberry Pi - Download Image and Prepare SD Card - Install Raspberry Pi operating system-Linux Commands - Basic Operations of Linux and commands understanding - Raspberry Pi Configuration - Installing and uninstalling software - Boot and Display Options. Programming the Pi - Introduction to Compilers - GCC, and C programming - Python Programming for Pi - Shell Programming - Accessing resources of Raspberry pi using shell - GPIO programming over shell. Hardware Interfacing - GPIO interfacing through Python - LED, Buzzer, Switch interfacing - Sensors Interfacing. Understanding Game Programming - Learning About Game Frameworks and Libraries - Setting Up the PyGame Library - Using PyGame - Learning More About PyGame - Dealing with PyGame Action.

Total: 20 Hours

Reference(s)

1 Matt Richardson and Shawn Wallace, "Getting started with Raspberry pi", O'Reilly, 2013.
2 Simon Monk, "Programming the raspberry pi", Second Edition: Getting Started with Python, Tata McGraw Hill Publishing Co. Ltd., 2015.
3 Simon Monk, "Raspberry pi Cookbook", O'Reilly, 2014.

18CS0XH AUTOMATION TESTING USING QTP **1 0 0 1**

Course Objectives

- To describe the basic concepts of QTP automation testing
- To analyze the syntax and styles
- To create test path runner, win runner scripts and QTP object model.

Course Outcomes (COs)

1. Illustrate the basic concepts of QTP automation testing.
2. Solve the testing-oriented problems using QTP.

UNIT I **20 Hours**

Introduction to Automation - Architecture – Introduction to Framework and QTP - Versions - Object Repository - Object Spy - Object Identification - QTP Testing Process Phases - Working with Dynamic Objects and Data - Types of Parameters - Working with Actions - Environment Parameters and Variables - Random Number Parameters - Library Files and User- Functions - Regular Expressions - Virtual Object Configuration - Recovery Scenario Manager - Transaction Statements - Step Generator - Merge Repositories Utility - Test Bath Runner - Calling Win Runner Scripts from QTP - Quick Test Automation Object Model .

Total: 20 Hours

Reference(s)

1 Rajeev Gupta," Specifications of Test Automation and QTP, Pearson Publications, 2012.
2 Chandra Saurabh, “QC 10, QTP 10 and Automation Framework”, 2011.

18CS0XI CODE AUGMENTED REALITY 1 0 0 1

Course Objectives

- To understand the basic of Augmented Reality
- To learn the advanced Augmented Reality techniques
- To acquire the knowledge in Augmented Reality and applications

Course Outcomes (COs)

1. Identify the fundamental concepts of Augmented Reality application development
2. Illustrate the attractive user interface in Visualization and Design
3. Explicate the real-world application development

UNIT I 20 Hours

Introduction to Virtual Reality - Output Devices - Input Devices - Virtual Realty APIs - 3D Interaction Techniques - Augmented Reality - Modelling and simulation - Experimental design and user studies - Effects of system fidelity - Real-world Applications of Virtual Reality and Augmented Reality in Visualization and Design - Mobile Augmented Reality.

Total: 20 Hours

Reference(s)

1 Greg Kipper, Joseph Rampolla, Augmented Reality: An Emerging Technologies Guide to AR, 2013.

18CS0XJ ANGULAR JAVA **1 0 0 1**

Course Objectives

- To understand the design of single-page applications and AngularJS facilitates
- To acquiring knowledge in AngularJS expressions, filters, and scopes
- To build Angular forms and applications

Course Outcomes (COs)

1. Identify the fundamental concepts of AngularJS
2. Illustrate the structure of AngularJS applications
3. Explicate the real-world application development in AngularJS

UNIT I **20 Hours**

JavaScript fundamentals: Scope & Function Context - Closures - Object-Oriented in JavaScript - Async and Parallel in JavaScript - JavaScript Design Pattern - Introduction to AngularJS - first AngularJS application - Single Page Applications – AngularJS Building Blocks for Building SPA - Model, View & Controller (MVC). Forms in AngularJS: ng-model directive - ngModelController and FormController - Custom Validation - Input directive. AngularJS Filters: Filter Syntax - AngularJS Filters - Custom filters - Communications - AngularJS Internal: AngularJS Start-up Process - AngularJS Runtime - Scope Communication - Template Services: Injector Service - Modules – Caching - $provide service – Routing - Ajax, Data, and Angular – AngularJS Testing - AngularJS Animation.

Total: 20 Hours

Reference(s)

1 AngularJS in Action, Brian Ford, Lukas Ruebbelke, 2014.

18CS0XK TENSORFLOW

1 0 0 1

Course Objectives

- Understand working in TensorFlow framework for implementing Machine Learning algorithms

Course Outcomes (COs)

1. Implement programs in Python and execute them in TensorFlow
2. Debug TensorFlow programs
3. Deploy the programs in GPU

UNIT I **20 Hours**

Tensor flow

Estimators- Pre-made estimators, Custom Estimators

Tensors- Rank, Shape, Data types, Evaluating tensors, Printing Tensors

Variables- Creating a variable, variable collections, Device placement, Initializing variables, using variables, Sharing variables.

Graphs and Sessions- Building a tf.graph, Naming operations, Tensor-like objects, tf.session, Visualizing a graph, Programming with Multiple graphs

Saving and Restoring- Saving variables, Restoring Variables, Building a SavedModel, Loading a SavedModel in Python, Standard constants, Using SavedModel with Estimators, CLI to inspect and execute SavedModel

Importing Data-Basic mechanics, Dataset structure, Creating an iterator, Consuming values from an iterator, Consuming NumPy arrays, Consuming TFRecord data, Consuming text data, Preprocessing data with Dataset.map(),Batching dataset elements, Training workflows.

Threading and Queues- Queue Usage Overview, Manual Thread Management-Coordinator, QueueRunner, Handling exceptions

Hours Embeddings-Introduction, Training an Embedding,Visualizing Embeddings-Setup, Metadata, Images, Interaction, Projections, Navigation, Collaborative Features

Debugging Tensorflow Programs-Wrapping TensorFlow Sessions with tfdbg, Debugging Model Training with tfdbg, Debugging tf-learn Estimators and Experiments.

Total: 20 Hours

Reference(s)

1 Sam Abrahams,Danijar Hafner, Erik Erwitt, Ariel Scarpinelli “TensorFlow For Machine Intelligence: A hands-on introduction to learning algorithms”, 2016.

18CS0XL STATISTICAL ANALYSIS USING R **1 0 0 1**

Course Objectives

- Demonstrate the basic the basics of R programming.
- Understand the data analysis and statistical models in R.
- Impart knowledge about using graphics in R.

Course Outcomes (COs)

1. Explain the basic concepts of R.
2. Illustrate exploratory data analysis with R.
3. Demonstrate the use of advanced concepts in R.

UNIT I **20 Hours**

R PROGRAMMING BASICS

Introduction to R - R Installation - Basic syntax- R as a calculator -R Libraries- Importing Data– loading packages - Data entry and exporting data - Creating and Manipulating objects in R - Vectors - Matrices - Data Frames – Lists - Basic plotting - 3D plotting- Histograms- Multi-panel plotting- Boxplots - Univariate Analysis - Multivariate Analysis - Linear & Nonlinear Models - Logistic Regression and Survival Analysis in R - Summary statistics - Validating & Exploring Data - Manipulating Data – Summarizing - Sorting – Subsetting – Merging - -Writing R functions - Introduction to Clustering and Classification

Total: 20 Hours

Reference(s)

1 Balas Kausik Natarajan, “Machine Learning: A Theoretical Approach”, Morgan Kaufmann, 2012.

18CS0XM MACHINE LEARNING FOR ENGINEERS 1 0 0 1

Course Objectives

- Demonstrate the basic and fundamental concepts of Machine Learning.
- Understand a wide variety of learning algorithms.
- Learn the basics of clustering with machine learning.

Course Outcomes (COs)

1. Explain the basic idea of the machine learning.
2. Explore the support vector machines in machine learning.
3. Design machine learning techniques to resolve the issue involved in learning from data.

UNIT I 15 Hours

MACHINE LEARNING

Algorithmic models of learning - Learning classifiers – functions – relations – grammars - probabilistic models - value functions -Parameter estimation - sufficient statistics - decision trees - neural networks - support vector machines - Bayesian networks - bag of words classifiers - Markov and Hidden Markov models - association rules - nearest neighbor classifiers - ensemble classifiers - Computational learning theory - feature selection and visualization – Clustering - Reinforcement learning - Learning from heterogeneous – distributed - data and knowledge - Selected applications in data mining - automated knowledge acquisition - pattern recognition - program synthesis - text and language processing - internet-based information systems - human-computer interaction - semantic web and bioinformatics

Total: 15Hours

Reference(s)

1. Balas Kausik Natarajan, “Machine Learning: A Theoretical Approach”, Morgan Kaufmann, 2012.

18CS0XN BLOCK CHAIN TECHNOLOGIES **1 0 0 1**

Course Objectives

- Understand how block chain systems (mainly Bit coin and Ethereum) work, to securely interact with them.
- Design, build, and deploy smart contracts and distributed applications,
- Integrate ideas from block chain technology into their own projects.

Course Outcomes (POs)

1. Explain design principles of Bit coin and Ethereum.
2. Explain the Simplified Payment Verification protocol.
3. Interact with a block chain system by sending and reading transactions.

UNIT I **20 Hours**

BLOCK CHAIN AND CRYPTO CURRENCY

Block chain: Introduction, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

Crypto currency: History, Distributed Ledger, Bit coin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin

Crypto currency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects - Crypto currency Exchange, Black Market and Global Economy.

Total: 20 Hours

Reference(s)

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

18CS0XO .NET PROGRAMMING **1 0 0 1**

Course Objectives

- Understand the fundamental concepts of C# and .NET.
- Implement string manipulation, events and exception handling within .NET application environment

Course Outcomes (COs)

1. Understand the basics of .NET Framework Architecture.
2. Apply the concept of Objects, Inheritance and Generics in C#.
3. Analyze the concept of arrays, operators and type casting for accessing and storing the data.

UNIT I

Need for programming - Introduction to .NET and .NET Core - Introduction to C# - Features of C# - Namespace - access modifiers - Data Types – Keywords - Variables and Operators - Flow control-Enumeration- Namespaces - Class- Structs - Static Classes- The object class- Extension Methods-Inheritance- Types of Inheritance- Implementation Inheritance- Modifiers- Interfaces-Generics overview- creating generic classes- Generics Features- Generic Interfaces- Generic Structs- Generic Methods - Simple arrays- Multidimensional arrays- Jagged arrays-operators and cast- operators - Operator Overloading-User Defined casts- Referencing methods- Delegates- Lambda Expressions-Events - Collection Interface and Types - Lists- Queues- Stacks- Dictionaries- Sets- Observable Collections- BIT Arrays- Immutable Collections- Concurrent Collections-LINQ overview- Standard Query Operators- Reflection- Manipulating and Inspecting code at runtime- Custom Attributes- Using Reflection

20 Hours

Reference(s)

1. Christian Nagel, Jay Glynn, Morgan Skinner, Professional C# 5.0 and .NET 4.5.1 , John Wiley & Sons, 2014
2. http://www.tutorialspoint.com/csharp/
3. http://www.csharp-station.com/Tutorial.aspx

18CS0XP GO PROGRAMMING **1 0 0 1**

Course Objectives

- Understand the fundamental concepts of Go language
- Implement functions and operators using Go programming

Course Outcomes (COs)

1. Understand the basics of Go programming.
2. Apply the concept of branching and looping in Go programming
3. Analyze the concept of composite datatypes, functions and methods.

UNIT I **20 Hours**

INTRODUCTION

Golang Introduction – brief history, strength and weakness – statically typed, garbage collected, concurrency, keywords. Packages – introduction, standard packages.

Variables & Constants: Variable Declaration – naming constraints, different styles of declaration, data types, memory s size allocations, scope of variables, Constants – different styles of declaration and scope. Iota – declaration and usage.

Operators & Pointers: Operator types – arithmetic, relational, logical, bitwise, shift, unary and binary. Operator precedence. Pointers – different styles of declarations and usage.

Branching & Looping Structures: If Statement – condition evaluation, nested if else. Switch Statement - different types of condition evaluation and case matching, fall through and break. Loops – for and for range, break and continue statements. Go to statements.

Composite Data Types Arrays – declaration, initialization, accessing and modifying elements, Slice – slicing arrays, length and capacity, add, modify and remove elements from slices. Maps – declaration, add, modify and remove elements in maps. Structs – declaration and initialization, accessing struct fields, type embedding,

Functions & Methods: Functions - function signature and multiple return variables. Methods – method receivers, difference between function and methods. Defer keyword & order of defer execution.

Interfaces: Interface declaration, implementation, interface embedding, benefits.

REFERENCES

1. Alan A. A. Donovan, Brian W. Kernighan, “The Go Programming Language” Addison-Wesley Professional, 2015
2. https://www.tutorialspoint.com/go/index.htm
3. http://www.https://go.dev/

18CS0XQ REACT JS **1 0 0 1**

Course Objectives

- To understand the design of applications and React JS facilitates.
- To acquiring knowledge in React JS expressions, List, and keys.
- To build React forms and applications

Course Outcomes (COs)

1. Explore the basic concepts of React JS facilitates.
2. Illustrate the components, event used in React JS for web application
3. Development of forms and web applications.

UNIT I **20 Hours**

REACT JavaScript

Introduction: React Getting Started, React Directly in HTML, setting up a React Environment, Run the React Application–Rendering Elements: Rendering an Element into the DOM, Updating the Rendered Element.

5 Hours

Components and Props: Function and Class Components, rendering a Component, Composing Components, Extracting Components - State and Lifecycle: Converting a Function to a Class, Adding Local State to a Class, Adding Lifecycle Methods to a Class, The Data Flows Down.

5 Hours

Handling Events: Passing Arguments to Event Handlers –Conditional Rendering: Element Variables, Inline If with Logical && Operator, Inline If-Else with Conditional Operator, Preventing Component from Rendering –Lists and Keys: Rendering Multiple Components, Keys, Extracting Components with Keys, Embedding map () in JSX.

5 Hours

Forms: Controlled Components, the textarea Tag, the select Tag, the file input Tag, Handling Multiple Inputs, Controlled Input Null Value, Alternatives to Controlled Components, Fully-Fledged Solutions - Lifting State Up: Adding a Second Input, Writing Conversion Functions- Composition vs Inheritance, Containment, Specialization.

Total: 20 Hours

REFERENCES

1. Robin Wieruch. “The Road to React: Your journey to master React.js in JavaScript”, 2022.
2. Eve Porcello, Alex Banks, “Learning React, 2e: Modern Patterns for Developing React Apps”, O’Reilly, 2022.

18CS0XR NODE JS **1 0 0 1**

Course Objectives

- To understand the design of applications and Node JS facilitates.
- To acquiring knowledge in Node File system, Web server, and Event handling.
- To build database connectivity and web applications.

Course Outcomes (COs)

1. Explore the basic concepts of Node JS facilitates.
2. Illustrate the file and I/O operations in Node JS for web application
3. Deploy the application projects.

UNIT I **5 Hours**

Node JS

Node JS Modules: Functions, Buffer, Module, Modules Types, Modules Exports - Node Package Manager: What is NPM, Installing Packages Locally & globally, Adding dependency in package Json, Updating packages.

5 Hours

Creating Web Server: Creating Web Server, Sending Requests, Handling HTTP requests - File System, Read File, Writing a File, Opening a File, Deleting a File, Writing a file asynchronously, Other I/O Operations - Debugging Node JS Application: Core Node JS Debugger.

5 Hours

Events: Event Emitter class, Inheriting Events, Returning event emitter - Express JS: Configuring Routes, Working with Express - Serving Static Resources: Serving Static Files, Working with Middle Ware.

5 Hours

Database Connectivity: Connecting String, Configuring, Updating Records, Working with Select Command, Deleting Records - Project Development: Project Development using Node JS.

Reference(s)

1. Ray Yao, "Node.Js: Node.Js Programming, In 8 Hours, For Beginners, Quick Start Guide: Node.Js Cookbook Crash Course Tutorial & Exercises", 2022.
2. Patrick Mulder, Kelsey Breseman, "Node.Js for Embedded Systems", O'Reilly, 2017.

18CS0XS POSTGRESQL 1 0 0 1

Course Objectives

- To understand the design of database for web applications.
- To acquiring knowledge in querying statements.
- To build database connectivity for web applications.

Course Outcomes (COs)

1. Explore the basic concepts of PostgreSQL.
2. Illustrate the filtering and functions in PostgreSQL for web application.
3. Deploy the application projects using PostgreSQL.

UNIT I **5 Hours**

PostgreSQL

Foundations Basic Concepts: Relational database, SQL vs Postgres, Database tables, Rows and columns, Data types -Graphical User Interface: Object Explorer, Query Window, Results Grid Setting Options.

5 Hours

Querying Select Statements: Syntax of a SELECT statement, Selecting specific columns, Using a LIMIT clause, Distinct records, Using a WHERE clause, Field and Table Aliases - Filtering and Aggregating: Filtering with Text Criteria, Wildcard Filters, Filtering with Numeric Criteria, Using SUM, COUNT and AVG, Using MAX and MIN, Group-by Statements.

5 Hours

Adding – Data Creating tables: Primary keys Foreign keys Data normalization Create statement Constraints Inserting data Insert statement Nulls, empty strings and zeros Update Statement Setting Conflict Actions - Combining tables: Joins Inner Joins Full Outer Joins Left/Right Joins Views Creating a view Performance issues.

5 Hours

Advanced Topics: Advanced querying Subqueries Querying JSON data - Stored Procedures: Creating a stored procedure Transactions Temp Tables –Functions: String Functions Cast Function Convert Function Rounding Functions - Dealing with CSVs: Loading data from a CSV, Exporting a table to CSV.

Total: 20 Hours

Reference(s)

1. Joshua D. Drake, John C. Worsley, “Practical PostgreSQL: A Hardened, Robust, Open Source Database”, O’Reilly, 2022.
2. Hans-JurgenSchonig, “Mastering PostgreSQL 13”, Packt, 2020.

18CS0XT EMBEDDED IOT **1 0 0 1**

Course Objectives

- To understand the basic and fundamental concepts in Arduino IDE.
- To Gain knowledge about ESP32, WDM and Communication protocol administration commands.
- To demonstrate and implements of Network server and Application Server integration in Embedded IOT.

Course Outcomes (COs)

1. Explore the basic concepts of Arduino IDE for Embedded IoT.
2. Illustrate the use of ESP32, WDM and Communication protocol for IoT application
3. Development of Embedded IoT Application for real time problems.

UNIT I **5 Hours**

Embedded IOT

Introduction: IoT and its Application, Arduino IDE and its software installation, Arduino IDE programming, Introduction to ESP32 & WDM -ESP32: Use of IR Sensor, Soil Moisture Sensor / Potentiometer and Ultrasonic sensor HCSR04.

5 Hours

Communication Protocol: I2C, SPI, UART. I2C Sensor datasheet and its Library Installation, I2C Sensor (BH1750) integration with WDM, UART integration with Arduino, Bluetooth and its types: Device control using Classic Bluetooth, Data writing to Serial monitor from BT Serial Monitor

5 Hours

BLE: Introduction to BLE, BLE scan, Characteristics Read and Write using BLE in WDM, Thing speak: Introduction and its account creation, Device Control using Wi-Fi Thing speak.

5 Hours

LoRa & LoRaWAN: Introduction, Specifications and Parameters of LoRaWAN, Activation Methods, Classes of LoRaWAN, Network server: Introduction, Gateway registration procedure, Device Registration in Network Server, Application Server integration: Introduction and usage.

Total: 20 Hours

Reference(s)

1. Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed” Wiley – IEEE, 2018.

18CS0XU TABLEAU **1 0 0 1**

Course Objectives

- Learn how to build visualizations, organize data and design dashboards to empower more meaningful business decisions.

Course Outcomes (COs)

1. Examine, navigate and learn to use the various features of Tableau.
2. Create and design data visualizations and dashboards using Tableau.

UNIT I **20 Hours**

Introduction to Tableau - Different Products by Tableau - Advantages of Tableau- Introduction to Data Visualization- Applications of Tableau- Companies using Tableau- Features of Tableau- Tableau Terminologies- Tableau Navigations- Tableau Design Flow- How to Connect to a File Source- Understanding of Different Data Sources- Data Source Filters- Data Types - Tableau Operators- String Functions in Tableau- Date Functions - Logical Statements - Aggregate Functions- Joins- Data Blending- Field Operator-Filter- Changing Data Type of a Field from Data Pane-Formatting- Worksheet- Line Chart-Bar Chart- Histogram- Scatter Plot- Pie Chart- Bubble chart- Tableau Forecasting- Tableau Dashboard.

Total: 20 Hours

Reference(s)

1. Ben Jones, Communicating Data with Tableau - Designing, Developing, and Delivering Data Visualizations, O’Reilly, 2014
2. https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

18CS0XV TYPE SCRIPT WITH JEST TESTING FRAMEWORK 1 0 0 1

Course Objectives

- Gain Knowledge about the TypeScript with a Testing Framework called Jest which will give you an idea of how the coding standard will look in Production of Top Firms.
- Create and write programs in TypeScript.
- Create the test cases for the program written in Jest Framework.

Course Outcomes (COs)

1. Illustrate how the production code looks like irrespective to languages.
2. Implement TypeScript Language with Jest Testing Framework.
3. Examine the code written with test cases using Jest Testing Framework.

UNIT I 20 Hours

TypeScript 10 Hours

Introduction to JavaScript – Difference between JavaScript and TypeScript – Why do we need to prefer TypeScript over JavaScript – Introduction to TypeScript – Features of TypeScript – Access Modifiers – Data Types – Keywords – Flow Control – Interface, Class, Objects – Practical Session on writing TypeScript Code.

Jest Testing Framework 10 Hours

What is Testing – What is meant by testcase – Introduction to Unit Testing - Difference between Unit Testing, Integration Testing, Regression Testing – Introduction to Jest Testing – Features of Jest – Writing unit tests – Testing the code written in Typescript – Practical Session on Jest Testing Frame work.

Total: 20 Hours

Reference(s)

1. Nathan Rozentals, Jest Mastering Typescript, Fourth Edition, Packt.

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 words enter the language, and how it continues to be dynamic
- To demonstrate the importance of a broad-based vocabulary for effective oral and written communication

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

UNIT I 15 Hours

CONVENTIONS AND WORD ANALYSIS

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.
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

1 0 0 1

18GE0XB GENERAL PSYCOLOGY

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

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 BEHAVIOURAL 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

UNIT I **20 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: 20 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 film making as an art, and video production
- 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

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 Ã¢?? 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

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

UNIT I **20 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: 20 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

Course Outcomes (COs)

1. Solve problems creatively in mathematics and its applications

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

UNIT I **15 Hours**

FITNESS, YOGA AND MEDITATION, NUTRITION AND BALANCE DIET

Meaning & Definition, Need & importance of Physical fitness Types Physical fitness - Exercise, Training and Conditioning and it is important

Meaning and definition; Principles of practicing; Basic Asana and it important, Pranayama and Meditation - Relaxation Techniques

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 health and 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

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 creativity thinking

UNIT I **15 Hours**

CONCEPT AND VOICE

What is blog writing? Types of blog posts—personal experience, opinion, reviews, advice, news/updates. Focusing your blog—concept, audience, uniqueness, posts. Company blogs. Types of structure—inverted pyramid, feature article, list, story, other options. Creating effective openings. Planning a post.

Defining and achieving voice. Exploring various voices. Stylistic tips—rhythm,verbs, interesting words, senses, emphasis. Smartness and sarcasm.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 Huffington Post Complete Guide to Blogging.

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 one's own and other's 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 other's opinion
4. Be responsible and timely with a willingness to collaborate
5. Develop innate personality traits to handle certain social situations

UNIT I **15 Hours**

Conversational Skills – Active Listening – Team working – Empathy – Emotional Intelligence 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 COMMUNITY SERVICE AND LEADERSHIP DEVELOPMENT 1 0 0 1

Course Objectives
- Understand the basic concepts of National Service Scheme and its activity
- Identify the needs and problems of the community and involve them 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

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 – 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-Gaitán and Concha, The Power of Community: Mobilizing for Family and Schooling New 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.

UNIT I **20 Hours**

NCCORGANIZATION

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 - NGO's role and Contribution - Social Security schemes.

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: 20 Hours

Reference(s)

1 Cadet's Hand book Common subject, DG NCC, New Delhi.
2 Cadet's Hand book Special subject, DG NCC, New Delhi. Examinations (English) RPH Editorial Board, 2018.
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

18GE0XN DISRUPTIVE INNOVATION BASED START UP 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

UNIT I **15 Hours**

Creativity linked innovation – 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
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 PSYCHLOGY 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

UNIT I **20 Hours**

Introduction-Ice breaker, Time Line, Tasks and Challenges of the age(Erik Erikson), Introduction to Reproductive Health, Reproductive Organs, Menstruation, Changes during Puberty, Difference between Sex and Gender, Introduction to the origins of Patriarchy, Gender Images of Beauty and Body Image, Introduction to Media, Feedback Attraction, Friendship, Differences and Similarities, Sexuality Boundaries Relationships, Marriage, Love, Emotional Health ,Sexual Abuse and Safety Role of Media Abortions, Contraception.

Total: 20 Hours

Reference(s)

1 https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1540-5885.2005

18GE0XP FM RADIO BROADCASTING TECHNOLOGY 1 0 0 1

Course Objectives

- The course focuses on community radio technology and various program productions techniques for FM Radio Broadcasting.

Course Outcomes (COs)

1. Understand the hardware required for field recording and setting up a studio and carry out studio and field recording.
2. Examine the available options for telephony interfaces for radio.
3. Demonstrate proper techniques of wiring, fixing of connectors, soldering and use of tools and equipment for studio work.

UNIT I **3 Hours**

INTRODUCTION TO AM/ FM RADIO

History of Radio-Types of Radio and its Reach- Entertainment Radio- Community Radio- Internet Radio- Satellite Radio. Evolution of Community Radio (CR) in India- principles behind setting up of FM/CR- policy guidelines and their impact on technology and content of a CR station- fundamental principles behind deciding the technology for a CR station.

UNIT II **3 Hours**

STUDIO TECHNOLOGY

Use of Microphones-Console handling-OB Recordings & Live Shows-Properties and components of sound-difference between analogue and digital audio-hardware required for field recording and setting up a studio-fundamental principles for setting up an audio studio.

UNIT III **3 Hours**

AUDIO PRODUCTION

Concept of recording and storing audio-hardware related to audio recording-opensource software solutions for audio production-telephony interfaces for radio- audio Post Production. Voice Culture Exercise- Radio Production Techniques & Tools.

UNIT IV **3 Hours**

STUDIO OPERATIONS

Wiring, fixing of connectors, soldering and use of tools and equipment- preventive and corrective maintenance of studio and equipment.

3 Hours

UNIT V

RADIO TRANSMISSION TECHNOLOGY

Components of the FM transmission chain- FM transmitter-different types of FM antenna - coaxial cable- propagation and coverage of RF signals-FM transmitter setup- Radio audience - measurements systems.

Total: 15 Hours

Reference(s)

1 UNESCO (2001). Community Radio Handbook.
2 Vinod Pavarala, Kanchan K Malik, Other Voices: The Struggle for Community Radio in India, SAGE Publications India, 2007.
3 Steve Buckley, Mark Raboy, Toby Mendel, Kreszentia Duer, Monroe E. Price, Sean O Siochru, Broadcasting, Voice, and Accountability: A Public Interest Approach to Policy, Law, and Regulation, University of Michigan Press, 2008.
4 www.floridasound.com
5 www.mediacollege.com