B. Tech (Computer Science and Business Systems)

2018 Regulations, Curriculum & Syllabi

Academic Year: 2019 – 2020 Onwards

Stay Ahead

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

SATHYAMANGALAM - 638401 ERODE DISTRICT TAMILNADU INDIA

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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. Biomedical Engineering
v. Civil Engineering
vi. Computer Science and Engineering
vii. Electronics and Communication Engineering
viii. Electrical and Electronics Engineering
ix. Electronics and Instrumentation Engineering
x. Information Science and Engineering
xi. Mechanical Engineering
xii. Mechatronics

B. Tech. Programmes

i. Artificial Intelligence and Data Science
ii. Artificial Intelligence and Machine Learning
iii. Biotechnology
iv. Computer Science and Business Systems
v. Computer Technology

vi. Fashion Technology
vii. Food Technology
viii. Information Technology
ix. Textile Technology

3. STRUCTURE OF THE PROGRAMME

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

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

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

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

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

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

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

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

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

3.3 All the B.E. / B.Tech. Students will study Communicative English I during the First Semester. In the Second Semester, they will be divided into two streams based on their English language proficiency assessed in the Continuous Assessment during

semester I, in which the upper segment will be provided an option to enroll and study Communicative English II / German / Japanese / French / Chinese / Hindi while the lower segment will study Communicative English II.

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

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

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

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

Controller of Examinations. However one credit courses completed during I to III semesters shall be maintained in the Grade sheet as "Additional credits earned" (not considered for the computation of SGPA/CGPA).

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

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

3.9 **Industrial Training / Internship**

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

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

3.10 **Socially Relevant Projects**

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

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

4. VALUE ADDED COURSES

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

5. DURATION OF THE PROGRAMME

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

5.2 The total period for completion of the programme from the commencement of the semester, to which the student was admitted, shall not exceed the maximum period

(Clause 5.1), regardless to the break-of-study (vide Clause 15) or period of prevention in order.

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

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

6. COURSE ENROLLMENT AND REGISTRATION

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

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

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

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

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

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

6.4 Flexibility to Add or Drop courses

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

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

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

6.5 Reappearance Registration

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

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

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

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

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

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

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

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

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

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

7.1 Every student is expected to attend all the periods and earn 100% attendance. However, a student shall secure not less than 80% attendance course wise taking

into account the number of periods required for that course as specified in the curriculum.

7.2 If a student, secures attendance between 70% and 79% in any course(s) in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) or participation in Institution/ University/ State/ National/ International level extra and co-curricular activities, with prior permission from the Head of the Department, shall be permitted to appear for the current semester examinations subject to the condition that the student shall submit the medical certificate / participation certificate attested by the Head of the Department (along with Condonation form). Such certificates along with the condonation forms shall be forwarded to the Controller of Examinations for verification and permission to attend the examinations. However during the entire programme of study, a student can avail such Condonation in any two semesters only (regardless the number of courses).

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

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

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

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

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

8. FACULTY ADVISOR

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

The responsibilities of the faculty advisor shall be:

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

9. COMMITTEES

9.1 Common Course Committee

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

First meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. Two subsequent meetings in a semester may be held at suitable intervals. During these

meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all the students.

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

9.2 Class Committee Meeting

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

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

10. SYSTEM OF EXAMINATION

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

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

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

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

11. PASSING REQUIREMENTS AND PROVISIONS

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

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

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

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

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

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

Branch of Study	**Minimum Credits**	
	Regular Admission	**Lateral Entry**
B.E. Programmes		
Aeronautical Engineering	172	135
Agricultural Engineering	172	134
Automobile Engineering	170	133
Biomedical Engineering	171	132
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
Information Science and Engineering	172	131
Mechanical Engineering	170	131
Mechatronics	170	132
B.Tech. Programmes		
Artificial Intelligence and Data Science	172	134
Artificial Intelligence and Machine Learning	172	135
Biotechnology	172	134
Computer Science and Business Systems	172	128
Computer Technology	170	128
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	
	Report[#] (20)	**50**
	Presentation (20)	
	Viva voce (10)	
	Total Marks	**100**

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

VI	**LANGUAGE ELECTIVE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test 1	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Test 2	
	Listening (5)	
	Speaking (10)	**25**
	Reading (5)	
	Writing (5)	
	Oral Exam	**50**
	Total Marks	**100**
VII	**ONE-CREDIT COURSE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	Test I	**50**
	Quiz/ Assignment	**50**
	Total Marks	**100**

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

VIII	**INDUSTRIAL TRAINING/ INTERNSHIP (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Assessment by Industry	**30**
	Viva-voce	**20**
	Presentation	**30**
	Case Study / Report	**20**
	Total Marks	**100**
IX	**SOFT SKILLS (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory)	
X	**VALUE ADDED / CERTIFICATE COURSES (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Evaluation / Test	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory)	
XI	**ENGINEERING GRAPHICS**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Exercise (Minimum 10 Exercises/Modelling)	**60**
	Model Examination	**40**
	Total Marks	**100**

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

17. FIELD / INDUSTRIAL VISIT / INTERNSHIP

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

18. PERSONALITY AND CHARACTER DEVELOPMENT

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

19. DISCIPLINE

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

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

20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

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

VISION

To syndicate industry and institute to impart high quality knowledge through scholarity, research and creative endeavor

MISSION

1. To impart contemporary technology to meet the requirements of the industry and society.
2. To build technologically competent individuals for industry by providing infrastructure and human resources.
3. To promote students with ethical responsibility through industry alliance for higher education and research oriented activities.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

I. To perform well in their professional career by acquiring enough knowledge, technical competency in the domain of Computer Science and Business Systems to concord the industry engrossment.

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

III. To update themselves in business level innovation with societal consideration.

PROGRAMME OUTCOMES (POS)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

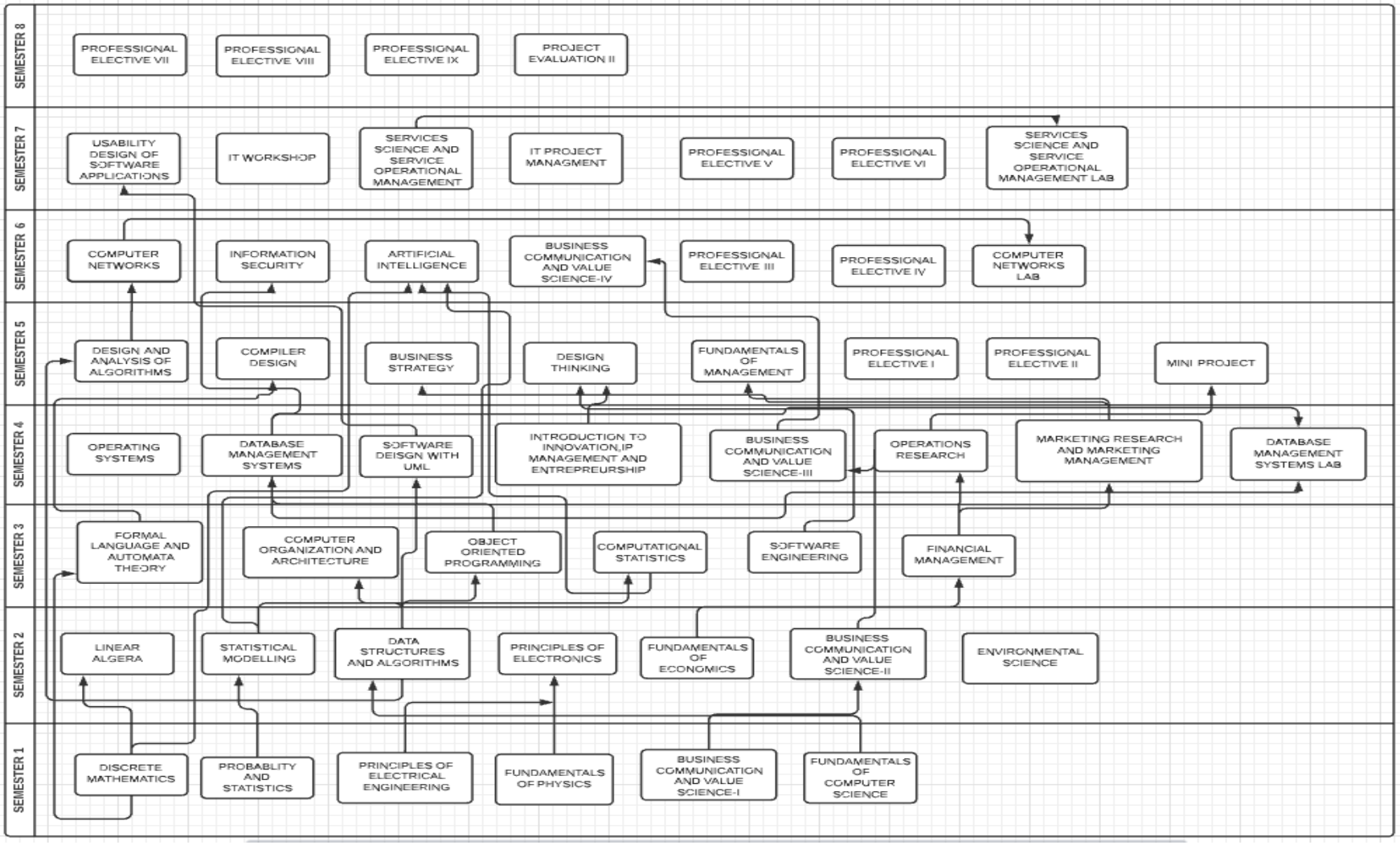
k. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

MAPPING OF PEOs AND POs

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

CONNECTIVITY CHART
DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS
CURRICULUM DESIGN & INTERLINKING OF COURSES



DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS
Minimum Credits to be Earned : 172

I SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
19CB101	DISCRETE MATHEMATICS	3	0	0	3	3	50	50	100	BS
19CB102	PROBABILITY AND STATISTICS	3	0	0	3	3	50	50	100	BS
19CB103	PRINCIPLES OF ELECTRICAL ENGINEERING	3	0	2	4	5	50	50	100	ES
19CB104	FUNDAMENTALS OF PHYSICS	3	0	2	4	5	50	50	100	BS
19HS105	BUSINESS COMMUNICATION AND VALUE SCIENCE - I	3	0	2	4	5	100		100	HSS
19CB106	FUNDAMENTALS OF COMPUTER SCIENCE	2	1	2	4	5	50	50	100	ES
Total		**17**	**1**	**8**	**22**	**26**				

II SEMESTER

Code No.	Course	L	T	P	C	Hours/ Week	Maximum Marks			Category
							CA	ES	Total	
19CB201	LINEAR ALGEBRA	3	1	0	4	4	50	50	100	BS
19CB202	STATISTICAL MODELING	3	1	0	4	4	50	50	100	BS
19CB203	DATA STRUCTURES AND ALGORITHMS	2	1	2	4	5	50	50	100	ES
19CB204	PRINCIPLES OF ELECTRONICS	3	0	2	4	5	50	50	100	ES
19CB205	FUNDAMENTALS OF ECONOMICS	2	0	0	2	2	50	50	100	BS
19HS206	BUSINESS COMMUNICATION AND VALUE SCIENCE - II	2	1	2	4	5	100		100	HSS
	ENVIRONMENTAL SCIENCES	3	-	-	-	3	100		100	BS
Total		**18**	**4**	**6**	**22**					

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
19CB301	FORMAL LANGUAGE AND AUTOMATA THEORY	3	2	0	4	5	50	50	100	PC
19CB302	COMPUTER ORGANIZATION AND ARCHITECTURE	3	2	0	4	5	50	50	100	PC
19CB303	OBJECT ORIENTED PROGRAMMING	3	0	2	4	5	50	50	100	PC
19CB304	COMPUTATIONAL STATISTICS	3	0	2	4	5	50	50	100	ES
19CB305	SOFTWARE ENGINEERING	3	1	2	5	6	50	50	100	PC
19CB306	FINANCIAL MANAGEMENT	3	0	0	3	3	50	50	100	PC
	SOFT SKILL – APTITUDE - I	3	-	-	-	3	100			EEC
Total		**21**	**5**	**6**	**24**	**32**				**-**
IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
19CB401	OPERATING SYSTEMS	3	0	2	4	5	50	50	100	PC
19CB402	DATABASE MANAGEMENT SYSTEMS	3	1	0	4	4	50	50	100	PC
19CB403	SOFTWARE DESIGN WITH UML	3	0	2	4	5	50	50	100	PC
19CB404	INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP	3	0	0	3	3	50	50	100	EEC
19HS405	BUSINESS COMMUNICATION AND VALUE SCIENCE – III	2	0	4	4	6	50	50	100	HSS
19CB406	OPERATIONS RESEARCH	2	0	2	3	4	50	50	100	PC
19CB407	MARKETING RESEARCH AND MARKETING MANAGEMENT	3	0	0	3	3	50	50	100	PC
19CB408	DATABASE MANAGEMENT SYSTEMS LAB	0	0	2	1	2	100		100	PC
	SOFT SKILL – APTITUDE - II	2	-	-	-	2	100			HSS
Total		**21**	**1**	**12**	**26**	**34**				**-**

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
19CB501	DESIGN AND ANALYSIS OF ALGORITHMS	2	0	2	3	4	50	50	100	PC
19CB502	COMPILER DESIGN	3	0	0	3	3	50	50	100	PC
19CB503	BUSINESS STRATEGY	3	0	0	3	3	50	50	100	PC
19CB504	DESIGN THINKING	2	0	2	3	4	50	50	100	PC
	ELECTIVE I	3	0	0	3	3	50	50	100	PE
	ELECTIVE II	3	0	0	3	3	50	50	100	PE
19CB508	COMPILER DESIGN LAB	0	0	2	1	2	100		100	PC
19CB509	MINI PROJECT	0	0	2	1	2	100			EEC
Total		**16**	**0**	**8**	**20**					**-**
VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
19CB601	COMPUTER NETWORKS	2	1	0	3	3	50	50	100	PC
19CB602	INFORMATION SECURITY	2	1	2	4	5	50	50	100	PC
19CB603	ARTIFICIAL INTELLIGENCE	2	0	4	4	6	50	50	100	PC
19HS604	BUSINESS COMMUNICATION AND VALUE SCIENCE – IV	2	0	2	3	4	100		100	HSS
	ELECTIVE III	3	0	0	3	3	50	50	100	PE
	ELECTIVE IV	3	0	0	3	3	50	50	100	PE
19CB607	COMPUTER NETWORKS LAB	0	0	2	1	2	100		100	
Total		**14**	**2**	**10**	**21**	**34**				**-**

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
19CB701	USABILITY DESIGN OF SOFTWARE APPLICATIONS	3	0	0	3	3	50	50	100	PC
19CB702	IT WORKSHOP	3	0	0	3	3	50	50	100	PC
19CB703	SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT	3	0	0	3	3	50	50	100	PC
19CB704	IT PROJECT MANAGEMENT	3	0	2	4	5	50	50	100	PC
	ELECTIVE V	3	0	0	3	3	50	50	100	PE
	ELECTIVE VI	3	0	0	3	3	50	50	100	PE
19CB707	SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT LAB	0	0	4	2	4	100		100	PC
Total		**18**	**0**	**6**	**21**	**24**				
VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/ Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
	ELECTIVE VII	3	0	0	3	3	50	50	100	PE
	ELECTIVE VIII	3	0	0	3	3	50	50	100	PE
	ELECTIVE IX	3	0	0	3	3	50	50	100	PE
19CB804	PROJECT EVALUATION	0	0	14	7	14	50	50	100	EEC
Total		**9**	**0**	**14**	**16**	**23**	**-**	**-**	**-**	**-**

ELECTIVES										
LANGUAGE ELECTIVES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /week**	**CA**	**ES**	**Total**	**Category**
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
18GE0P4	BIO-PHOTONICS	3	0	0	3	3	50	50	100	BS
18GE0P5	PHYSICS OF SOFT MATTER	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										
19CB001	CONVERSATIONAL SYSTEMS	3	0	0	3	3	50	50	100	PE
19CB002	CLOUD, MICROSERVICES AND APPLICATION	3	0	0	3	3	50	50	100	PE
19CB003	MACHINE LEARNING	3	0	0	3	3	50	50	100	PE
19CB004	BEHAVIOURAL ECONOMICS	3	0	0	3	3	50	50	100	PE
19CB005	COMPUTATIONAL FINANCE AND MODELLING	3	0	0	3	3	50	50	100	PE
19CB006	PSYCHOLOGY	3	0	0	3	3	50	50	100	PE
19CB007	ROBOTICS AND EMBEDDED SYSTEMS	3	0	0	3	3	50	50	100	PE
19CB008	MODERN WEB APPLICATIONS	3	0	0	3	3	50	50	100	PE
19CB009	DATA MINING AND ANALYTICS	3	0	0	3	3	50	50	100	PE
19CB010	ENTERPRISE SYSTEMS	3	0	0	3	3	50	50	100	PE
19CB011	ADVANCE FINANCE	3	0	0	3	3	50	50	100	PE
19CB012	IMAGE PROCESSING AND PATTERN RECOGNITION	3	0	0	3	3	50	50	100	PE
19CB013	COGNITIVE SCIENCE AND ANALYTICS	3	0	0	3	3	50	50	100	PE
19CB014	INTRODUCTION TO IOT	3	0	0	3	3	50	50	100	PE
19CB015	CRYPTOLOGY	3	0	0	3	3	50	50	100	PE
19CB016	QUANTUM COMPUTATION AND QUANTUM INFORMATION	3	0	0	3	3	50	50	100	PE
19CB017	ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS	3	0	0	3	3	50	50	100	PE
19CB018	MOBILE COMPUTING	3	0	0	3	3	50	50	100	PE
ONE CREDIT COURSES										

19CB0XA	DIGITAL MARKETING-BEGINNERS	-	-	-	1	-	100	0	100	EEC
19CB0XB	DIGITAL MARKETING-INTERMEDIATE	-	-	-	1	-	100	0	100	EEC
19CB0XC	DIGITAL MARKETING-ADVANCED	-	-	-	1	-	100	0	100	EEC
ADDITIONAL ONE CREDIT COURSES(I to III Semesters)										
18GE0XA	ETYMOLOGY	-	-	-	1	-	100	0	100	EEC
18GE0XB	GENERAL PSYCHOLOGY	-	-	-	1	-	100	0	100	EEC
18GE0XC	NEURO BEHAVIORAL SCIENCE	-	-	-	1	-	100	0	100	EEC
18GE0XD	VISUAL MEDIA AND FILM MAKING	-	-	-	1	-	100	0	100	EEC
18GE0XE	YOGA FOR HUMAN EXCELLENCE	-	-	-	1	-	100	0	100	EEC
18GE0XF	VEDIC MATHEMATICS	-	-	-	1	-	100	0	100	EEC
18GE0XG	HEALTH AND FITNESS	-	-	-	1	-	100	0	100	EEC
18GE0XH	CONCEPT, METHODOLOGY AND APPLICATIONS OF VERMICOMPOSTING	-	-	-	1	-	100	0	100	EEC
18GE0XI	BLOG WRITING	-	-	-	1	-	100	0	100	EEC
18GE0XJ	INTERPERSONAL SKILLS	-	-	-	1	-	100	0	100	EEC
18GE0XK	NEW AGE INNOVATION AND ENTREPRENEURSHIP	-	-	-	1	-	100	0	100	EEC
18GE0XL	NATIONAL CADET CORPS	-	-	-	1	-	100	0	100	EEC
18GE0XM	COMMUNITY SERVICE AND LEADERSHIP DEVELOPMENT	-	-	-	1	-	100	0	100	EEC
18GE0XN	DISRUPTIVE INNOVATION BASED STARTUP ACTIVITIES	-	-	-	1	-	100	0	100	EEC
18GE0XO	SOCIAL PSYCHOLOGY	-	-	-	1	-	100	0	100	EEC

S.No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDIT	CREDITS in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	12	10						-	22	12.22	15%	20%
2	ES	10	8	6					-	24	13.3	15%	20%
3	HSS	4	4		4		3		-	15	8.3	5%	10%
4	PC			16	19	14	14	18		81	45	30%	40%
5	PE					8	8	9	-	25	13.8	10%	15%
6	EEC				3	4			7	14	7.8	7%	10%
Total		22	22	24	26	26	26	27	7	180	100	-	-

BS - Basic Sciences
ES - Engineering Sciences
HSS - Humanities and Social Sciences
PC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course
CA - Continuous Assessment
ES - End Semester Examination

19CB101 DISCRETE MATHEMATICS 3 0 0 3

Course Objectives

- Understand the basic concepts of propositions by various discrete structure techniques.
- Analyse the combinatorics techniques in solving the system by various methodology.
- Apply the different differential and integral techniques in solving the real time engineering problems.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Formulate short proofs using the following methods: direct proof, indirect proof and proof by contradiction.
2. Represent characteristics of Sets, Group, Ring and Field.
3. Interpret the concepts of Permutations, Combinations and Mathematical induction
4. Apply the language of graphs and trees to the real world problems.
5. Apply formalised arguments to clarify and assess real-world arguments

Articulation Matrix

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

UNIT I **9 Hours**

BOOLEAN ALGEBRA

Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

UNIT II **9 Hours**

ABSTRACT ALGEBRA

Set, relation, group, ring, field.

UNIT III **9 Hours**

COMBINATORICS

Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

UNIT IV **9 Hours**

GRAPH THEORY

Graphs and digraphs, complement, isomorphism, connectedness and reachability,adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Eulers formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

UNIT V **9 Hours**

LOGIC

Propositional calculus - propositions and connectives, syntax; Semantics - truthassignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

FOR FURTHER READING

Functions -Types of Functions- Composition of relation and functions- Inverse functions

Total: 45 Hours

Reference(s)

1. I. N. Herstein, Topics in Algebra, John Wiley and Sons, 2015
2. M. Morris Mano,Digital Logic & Computer Design, Pearson.
3. C. L. LiuMcGraw Hill,Elements of Discrete Mathematics, (Second Edition) New Delhi.
4. J. A. Bondy and U. S. R. Murty,Graph Theory with Applications, Macmillan Press, London.
5. L. Zhongwan,Mathematical Logic for Computer Science, World Scientific, Singapore.

19CB102 PROBABILITY AND STATISTICS 3 0 0 3

Course Objectives

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

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Demonstrate and apply the basic probability axioms and concepts in their core areas of random phenomena
2. Execute the concepts of probability distributions in an appropriate place of science and Engineering.
3. Exemplify the basics concepts of statistics through various representations of data
4. Analyze the various collections of data in science / engineering problems using statistical inference techniques
5. Apply differential and integral calculus concepts to calculate the area and volume by appropriate vector integral theorems.

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												
4	2	2												
5	1	3												

UNIT I **9 Hours**

PROBABILITY AND MOMENTS

Probability: Concept of experiments, sample space, event. Definition of Combinatorial Probability, Conditional Probability, Bayes Theorem. Expected values and moments: mathematical expectation and its properties, Moments (including variance) and their properties, Moment generating function.

UNIT II **9 Hours**

PROBABILITY DISTRIBUTIONS

Discrete Probability distributions: Binomial, Poisson and Geometric distributions. Continuous Probability distributions: Uniform, Exponential, Normal, Chi-square, t and F distributions.

UNIT III **9 Hours**

STATISTICS

Introduction to Statistics: Definition of Statistics. Basic objectives, Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample.

UNIT IV **9 Hours**

DESCRIPTIVE STATISTICS

Descriptive Statistics: Classification and tabulation of uni variate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.

UNIT V **9 Hours**

CALCULUS

Basic concepts of Differential and integral calculus, application of double and triple integral.

FOR FURTHER READING

Collections of data and use the testing of hypothesis to analyze the Design of experiments.

Total: 45 Hours

Reference(s)

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

19CB103 PRINCIPLES OF ELECTRICAL ENGINEERING 3 0 2 4

Course Objectives

- To understand the basic concepts of electric circuits
- To understand the basic concepts of magnetic circuits.
- To identify the types of sensors and measure quantities in AC and DC systems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the basic concepts and terminology of electrical quantities
2. Analyze the DC circuit using various network theorems
3. analyze the electrical parameters of AC circuits with R-L-C elements.
4. Analyze the Static and dynamic characteristics of Electro-static and Electromagnetic fields.
5. Apply the concept of sensors in measurement of various electrical quantities

Articulation Matrix

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

UNIT I **7 Hours**

INTRODUCTION

Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, Concept of work, power, energy and conversion of energy.

UNIT II **10 Hours**

DC CIRCUITS

Current-voltage relations of electric network by mathematical equations to analyse the network (ThéveninÃƒÂ¢??s theorem, Norton-s Theorem, Maximum Power Transfer theorem) voltage source and current sources, ideal and practical, Kirchhoff-s laws and applications to network solutions using mesh analysis, Simplifications of networks using series- parallel, Star/Delta transformation. Superposition theorem.

UNIT III **9 Hours**

AC CIRCUITS

AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits.

UNIT IV **10 Hours**

ELECTROSTATICS AND ELECTRO-MECHANICS

Electrostatic field, electric field intensity, electric field strength, absolute permittivity, relative permittivity, permittivity, capacitor composite, dielectric capacitors, capacitors in series& parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and faraday"s law, self and mutual inductance, Ampere"s law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion,

UNIT V **9 Hours**

MEASUREMENTS AND SENSORS

Introduction to measuring devices/sensors and transducers related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems and their practical application. Electrical Wiring and Illumination system: Basic layout of distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Different types of lamps (Incandescent, Fluorescent, Sodium Vapour, Mercury Vapour, Metal Halide, CFL, LED)

FOR FURTHER READING

Principle of batteries , types, construction and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments.

1 **4 Hours**

EXPERIMENT 1

Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits

2 **4 Hours**

EXPERIMENT 2

Determination of resistance temperature coefficient

3 **4 Hours**

EXPERIMENT 3

Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power Transfer theorem)

4 **4 Hours**

EXPERIMENT 4

Simulation of R-L-C series circuits for XL>XC , XL< XC

5 **5 Hours**

EXPERIMENT 5

Simulation of Time response of RC circuit

6 **4 Hours**

EXPERIMENT 6

Verification of relation in between voltage and current in three phase balanced star and delta connected loads.

7 **5 Hours**

EXPERIMENT 7

Demonstration of measurement of electrical quantities in DC and AC systems.

Total: 75 Hours

Reference(s)

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Smarjith Ghosh, Fundamentals of Electrical and Electronics Engineering, Prentice Hall (India) Pvt. Ltd., 2010
3. A. Sudhakar, Shyammohan S Palli, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill, 2010
4. Muthusubramanian&Salivahanan, Basic Electrical and Electronics Engineering and Communication Engineering, Seventh Edition, Tata MCGraw Hill Education Private Limited, 2011
5. William H. Hayt, Jr. John A. Buck, Engineering Electromagnetics, McGraw Hill Higher Education, 8th revised Edition, 2011.
6. K. A. Gangadhar, P.M. Ramanathan, Electromagnetic Field Theory, Khanna Publishers, Sixteenth Edition, 2011.

19CB104 FUNDAMENTALS OF PHYSICS 3 0 2 4

Course Objectives

- Understand the characteristics of simple and damped harmonic motion and illustrate the interference, diffraction and polarization of light.
- Exemplify the dual nature of matter and apply the Schrodinger wave equation to determine the wave function of particle in one dimensional box and assess the crystallographic parameters of seven crystal systems.
- Compare the different types of lasers based on pumping method, active medium and energy levels and analyze the laws of thermodynamics and different thermodynamic processes.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Explain the different types of harmonic oscillations and compare electrical oscillator with mechanical oscillator.
2. Illustrate the interference, diffraction and polarization of light in NewtonÃ¢??s rings, diffraction grating and double refraction respectively.
3. Apply the concepts of quantum mechanics to solve the Schrodinger time dependent and time independent wave equations.
4. Assess the crystallographic parameters of seven crystal systems and compare the unit cell characteristics of SC, BCC, FCC and HCP crystal structures.
5. Outline the different types of lasers and compare the different types of optical fibers based on mode and refractive index profile for data communication system.

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

UNIT I **9 Hours**

OSCILLATIONS

Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple springs mass system. Resonance-definition., damped harmonic oscillator - heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators

UNIT II **9 Hours**

CLASSICAL OPTICS

Theory of interference fringes-types of interference- Fresnels prism- Newtons rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction Fresnels half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence. Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewsters law, double refraction. Basics ideas of electromagnetism- maxwell equations

UNIT III **9 Hours**

QUANTUM PHYSICS

Dual nature of matter - development of quantum theory- de-Broglie wavelength - Heisenberg uncertainty principle - Schrodingers wave equation: time dependent and time independent wave equations - physical significance of wave function - application: particle in one dimensional box.

UNIT IV **9 Hours**

CRYSTAL PHYSICS

Crystalline and amorphous materials -lattice - space lattice point - basis - UNIT cell - crystal systems- Bravais lattices - Miller indices - "d" spacing in cubic lattice - calculation of number of atoms per unit cell, atomic radius, coordination number and packing density for SC, BCC, FCC and HCP structures - classification of solids - basic concept of band theory.

UNIT V **9 Hours**

MODERN OPTICS

Energy levels - principle of laser - characteristics of laser radiation - Einsteins coefficients- population inversion - optical pumping - pumping mechanisms - types of laser - Neodymium laser - CO2 laser - homo junction GaAs laser- laser speckles - applications of lasers in engineering - Fiber optics - principle - structure of an optical fiber- types of optical fibers - applications.

FOR FURTHER READING

Zeroth law of thermodynamics - heat - equilibrium and quasistatic process - path functions - comparison between heat and work - internal energy - first law of thermodynamics - isothermal and adiabatic process - work done - reversible and irreversible process - Carnot ideal engine and its efficiency - Carnots theorem - actual heat engine- second law of thermodynamics - entropy - enthalpy.

1 **4 Hours**

EXPERIMENT 1

Magnetic field along the axis of current carrying coil -Stewart and Gee

2 **4 Hours**

EXPERIMENT 2

Determination of Hall coefficient of semi-conductor

3 **4 Hours**

EXPERIMENT 3

Determination of Plank constant

4 **4 Hours**

EXPERIMENT 4

Determination of wavelength of light by Laser diffraction method

5 **4 Hours**

EXPERIMENT 5

Determination of wavelength of light by Newton's Ring method

6 **5 Hours**

EXPERIMENT 6

Determination of laser and optical fiber parameters

7 **5 Hours**

EXPERIMENT 7

Determination of Stefan's constant

Total: 75 Hours

Reference(s)

1. Basics of laser physics: for students of science and engineering http://www.springer.com/978-3-319- 50650-0
2. AjoyGhatak, Optics, 5th Ed., Tata McGraw Hill, 2012
3. Arthur Beiser, Shobhit Mahajan and S Rai Choudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2014
4. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt Ltd., New Delhi, 2017.
5. Halliday and Resnick, Fundamentals of Physics, 11 th edition, John Wiley and Sons, Inc, 2018

19HS105 BUSINESS COMMUNICATION AND VALUE SCIENCE-I 2 1 2 4

Course Objectives

- Augment students overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals.
- Focus on the development of basic fluency in English, usage of words and also introduce them to the concept and importance of interpersonal skills so as to effectively present their personalities.

Programme Outcomes (POs)

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes (COs)

1. Speak fluently in English without errors in tenses and hence present themselves as effective English communicators. They will be able to learn the 12 tenses and use them appropriately.
2. Differentiate between active and passive vocabulary and be able to use the 60 words discussed in class for their daily conversation and 40 words also given as assignments
3. The ability to process their ideas and thoughts (verbal communication) into written communication in an effective, coherent and logical manner within a stipulated time and specific word limit of 100-150 words for paragraph writing
4. Present them in a certain manner by using the 50-55 phrases discussed in class appropriately for group discussions, personal interviews during the campus recruitment process/competitive exams.
5. Enhance their communication skills by acquainting with the 2 important aspects of communication and helping them to overcome the 10 most common barriers of communication.

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	1			
5										2	2			

UNIT I **6 Hours**

ESSENTIAL GRAMMAR I

Tenses: Basic forms and use, sentence formation (general & Technical), Common errors, Parts of speech through context, Direct and reported speech structures and voices. Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms,

significant abbreviations formal business vocabulary Phonetic: Pronunciation, Reduction of MTI in spoken English, Question formation with emphasis on common errors made during conversation

UNIT II **6 Hours**

WRITTEN COMMUNICATION-I

Letter Writing -Formal and Informal letter writing, application letters, Report writing academic and business report, Job application letter

UNIT III **6 Hours**

COMMUNICATION SKILLS

Importance of effective communication, types of communication- verbal and non - verbal, barriers of communication, effective communication, Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening.

UNIT IV **6 Hours**

SELF - AWARENESS

Self - Assessment, Self - Appraisal, SWOT, Goal setting - Personal & career- Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self - appraisal, Personal Goal setting, Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, and prioritization. Socio-Cultural and Cross-Cultural Sensitivities at the Workplace: What is Inclusion? Women""s contributions in Industry, work issues faced by women, what is sexual harassment, what is appropriate behavior for everyone at work

UNIT V **6 Hours**

INTERPERSONAL SKILLS I

Team work, Team effectiveness, Group discussion, Decision making - Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity
Time Management: The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritize using decision matrices, to beat the most common time wasters, how to plan, how to handle interruptions, to maximize your personal effectiveness, how to say no to Time wasters
Values of a good manager: Understanding Corporate Values and behavior; Personal / Human Values; Pride and grace in Nationalist

1 **2 Hours**

EXPERIMENT 1

Module 1: Self-Introduction

2 **2 Hours**

EXPERIMENT 2

Module 2: Likes, Dislikes, and Social goals (strengths, ambition)

3 **2 Hours**

EXPERIMENT 3

Module 3: Offering opinions (GD, disagreeing politely, accepting opinions)

4 **2 Hours**

EXPERIMENT 4

Module 4: Asking questions (Formal writing, formal events)

5 **2 Hours**

EXPERIMENT 5

Module 5: Answering questions (politeness markers)

6 **2 Hours**

EXPERIMENT 6

Module 6: Asking permission (leave, OD)

7 **2 Hours**

EXPERIMENT 7

Module 7: Communication etiquette (Telephone, E-mail

8 **2 Hours**

EXPERIMENT 8

Module 8: Banks/ Reservation/ Application forms (Travel) (why would you like to join the course? Self-expression- Writing

9 **2 Hours**

EXPERIMENT 9

Module 9: Constructive criticism, respond to compliment

10 **2 Hours**

EXPERIMENT 10

Module 10: Convincing (Interactive group game) and persuading (literature, Debate)

11 **2 Hours**

EXPERIMENT 11

Module 11: Accepting

12 **2 Hours**

EXPERIMENT 12

Module 12: Narration with Discourse Markers and connectives (offer a commentary on a research project, compare and contrast-writing skills)

13 **2 Hours**

EXPERIMENT 13

Module 13: Description with describing markers (story mapping, mind mapping, create a web page to sell own product, write food, film reviews, creating hashtags)

14 **2 Hours**

EXPERIMENT 14

Module 14: Public events (MoC, Welcome address, Vote of Thanks, Body Language

15 **2 Hours**

EXPERIMENT 15

Module 15: Seminar/ Presentation

Total: 75 Hours

Reference(s)

1. Business Communication Dr. Saroj Hire math
2. English vocabulary in use Alan McCarthy and Dell
3. Strategic Writing by Charles Marsh
4. The Seven Basic Plots by Christopher Booker

19CB106 FUNDAMENTALS OF COMPUTER SCIENCE 2 1 2 4

Course Objectives

- Understand the basics of problem solving methods and programming languages.
- Gain knowledge about the different primitive and user defined data types
- Impart knowledge about the structural programming concepts

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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. Explore the basics of problem solving.
2. Develop programs using control statements.
3. Implement the concepts of functions.
4. Exemplify the concepts of Arrays and pointers.
5. Explore the concepts of structures and basics of linux system interface.

Articulation Matrix

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

UNIT I **6 Hours**

GENERAL PROBLEM SOLVING CONCEPTS AND IMPERATIVE LANGUAGE

Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops. Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C) .Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation

UNIT II **6 Hours**

CONTROL FLOW WITH DISCUSSION ON STRUCTURED AND UNSTRUCTURED PROGRAMMING

Statements and Blocks, If-Else-If, Switch, Loops while, do, for, break and continue, Goto Labels, structured and un- structured programming.

UNIT III **6 Hours**

FUNCTIONS AND PROGRAM STRUCTURE WITH DISCUSSION ON STANDARD LIBRARY

Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialization, Recursion, Preprocessor, Standard Library Functions and return types

UNIT IV **6 Hours**

POINTERS AND ARRAYS

Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

UNIT V **6 Hours**

STRUCTURES

Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields Input and Output: Standard I/O, Formatted Output printf, Formated Input scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions

FOR FURTHER READING

Unix system Interface: File Descriptor, Low level I/O read and write, Open, create, close and unlink, Random access lseek, Discussions on Listing Directory, Storage allocator Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility.

1 **3 Hours**

EXPERIMENT 1

Algorithm and flowcharts of small problems like GCD

2 **3 Hours**

EXPERIMENT 2

Structured code writing with C

3 **3 Hours**

EXPERIMENT 3

Small but tricky codes

4 **3 Hours**

EXPERIMENT 4

Proper parameter passing

5 **3 Hours**

EXPERIMENT 5

Command line Arguments

6 **3 Hours**

EXPERIMENT 6

Variables and parameter, Pointer to functions

7 **3 Hours**

EXPERIMENT 7

User defined headers, Make file utility

8 **3 Hours**

EXPERIMENT 8

Multi file program and user defined libraries

9 **3 Hours**

EXPERIMENT 9

Interesting substring matching / searching programs

10 **3 Hours**

EXPERIMENT 10

Parsing related assignments

Total: 75 Hours

Reference(s)

1. Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill, 2017.
2. Yashavant Kanetkar, Let Us C, Sixteenth Edition, BPB Publications, 2017.
3. B. W. Kernighan and D. M. Ritchi, The C Programming Language, Second Edition, PHI, 1998
4. B. Gottfried, Programming in C, Third Edition, Schaum"s Outline Series, 2017.

19CB201 LINEAR ALGEBRA 3 1 0 4

Course Objectives

- Understand the basic concepts of matrices and their Eigen values and Eigen vectors to solve the system of equations.
- Analyze the system of vectors by different vector space techniques.
- Apply the concepts of linear algebra in the field of computer science.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Represent characteristics of matrices and determinants with their properties.
2. Analyze the characteristics of a linear system with Eigen values and vectors.
3. Implement the various matrix techniques in solving the system of linear equations.
4. Identify the vector spaces to represent the systems geometrically.
5. Analyze the systems by vector space techniques.

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	3												
4	1	2												
5	2	2												

UNIT I **9 Hours**

MATRICES

Determinants - Properties of determinants - Matrices - Operations in matrices - Hermitian and unitary matrices - Rank of a matrix - Solution of system of Linear equations: Cramers rule - Matrix Inversion method - Rank method.

UNIT II **9 Hours**

EIGEN VALUES AND EIGEN VECTORS

Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values- Cayley - Hamilton Theorem.

UNIT III **9 Hours**

MATRIX DECOMPOSITION

Positive definite matrix -Gauss Elimination method - Gauss Jordan method - LU decomposition - Singular value decomposition.

UNIT IV **9 Hours**

VECTOR SPACES

Vector spaces - Sub spaces - Linear combinations and linear system of equations - Linear independence and linear dependence - Linear Transformations - Basis and dimensions.

UNIT V **9 Hours**

INNER PRODUCT SPACES

Principal component analysis- Orthogonality of vectors - Projections - Gram-Schmidt orthogonalization - QR decomposition- introduction to their applications in Image Processing and Machine learning

Total: 60 Hours

Reference(s)

1. Kreyszig Erwin, Advanced Engineering Mathematics, 7th Edition, John Wiley, 1993.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication, 2017
3. Peter V. O Neil, Advanced Engineering Mathematics, Seventh Edition, Thomson Learning, 2011
4. Michael. D. Greenberg, Advanced Engineering Mathematics, Second Edition, Pearson , 2002.
5. Gilbert Strang, Introduction to linear algebra, Fifth Edition, ANE Books, 2016.
6. https://machinelearningmastery.com/introduction-matrices-machine-learning/

19CB202 STATISTICAL METHODS 3 1 0 4

Course Objectives

- Learn the fundamental concepts of linear statistical models, estimation methods, Non parametric inference
- Understand the fundamental concepts of programming in R

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Understand the basic concepts of Statistical techniques and Linear Statistical methods.
2. Understand the basic concepts of Design of experiments and Methods of Estimation
3. Understand the basic concepts of non parametric inference in testing of hypothesis
4. Understand the concepts of time series analysis and Forecasting techniques in Statistical Modeling
5. Understand the introductory R language with fundamental concepts, major R data analysis and create visualizations 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												
3	2	3												
4	2	2												
5	1	3												

UNIT I **9 Hours**

SAMPLING TECHNIQUES

Random sampling-Sampling from finite and infinite populations- Estimates and standard error (sampling with replacement and sampling without replacement)- Sampling distribution of sample mean- Stratified random sampling. Linear Statistical Models: Linear regression -Correlation- Rank correlation

UNIT II **9 Hours**

DESIGN OF EXPERIMENTS AND ESTIMATION

Analysis of variance - Completely randomized design - Randomized block design. Estimation: Point estimation- criteria for good estimates (un-biasedness, consistency)- Methods of estimation including maximum likelihood estimation. Sufficient Statistic- Complete sufficiency- application in estimation

UNIT III **9 Hours**

NON-PARAMETRIC INFERENCE

Comparison with parametric inference- Use of order statistics-Sign test- Wilcoxon signed rank test- Mann-Whitney test- Run test- Kolmogorov-Smirnov test. Spearmans and Kendalls test- Tolerance region

UNIT IV **9 Hours**

TIME SERIES ANALYSIS

Basics of Time Series Analysis- Stationary- ARIMA Models: Least Square method and maximum likelihood Identification - Estimation - Forecasting

UNIT V **9 Hours**

R STATISTICAL PROGRAMMING LANGUAGE

Introduction to R- Functions- Control flow and Loops- Working with Vectors and Matrices- Reading in Data- Writing Data- Working with Data- Manipulating Data- Simulation- Linear model-Data Frame- Graphics in R

FOR FURTHER READING

Analysis of Variance: Latin Square Method - 2^2 Factorial Design and Testing of Hypothesis - Neyman Pearson lemma.

Total: 60 Hours

Reference(s)

1. R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, Fourth Edition, Pearson, 2015.
2. A. Goon, M. Gupta and B.Dasgupta, Fundamentals of Statistics (vOL. I & Vol. II), The Word Press, 1933.
3. Chris Chatfield ,The Analysis of Time Series, Third Edition, Chapman & Hall/CRC Press, 2010.
4. D.C. Montgomery and E.Peck , Introduction to Linear Regression Analysis, Third Edition, Wiley, 2010.
5. Garrett Grolemund, Hands-on Programming with R, Shroff Publishers & Distributors Pvt Ltd, 2018.
6. Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, Second Edition, Addison-Wesley Professional, 2017.

19CB203 DATA STRUCTURES AND ALGORITHMS 2 1 2 4

Course Objectives

- Understand the basics of abstract data types.
- Impart knowledge about the principles of linear and nonlinear data structures.
- Build an application using sorting and searching.

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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Explore the basics of data structures and algorithm analysis.
2. Demonstrate the concept of linear data structures.
3. Demonstrate the concept of non- linear data structures.
4. Design algorithms for various searching and sorting techniques.
5. Exemplify the concept of files and its operations

Articulation Matrix

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

UNIT I **6 Hours**

BASIC TERMINOLOGIES

Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

UNIT II **6 Hours**

LINEAR DATA STRUCTURE

Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

UNIT III **6 Hours**

NON-LINEAR DATA STRUCTURE

Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations (search and traversal algorithms and complexity analysis) & Applications of Non-linear Data Structures

UNIT IV **6 Hours**

SEARCHING AND SORTING ON VARIOUS DATA STRUCTURES

Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort.

UNIT V **6 Hours**

FILES

Definition, File Organization: Sequential file Organization, Direct file Organization, Indexed Sequential, Hashed and accessing schemes

1 **5 Hours**

EXPERIMENT 1

Towers of Hanoi using user defined stacks.

2 **5 Hours**

EXPERIMENT 2

Reading, writing, and addition of polynomials.

3 **5 Hours**

EXPERIMENT 3

Line editors with line count, word count showing on the screen.

4 **5 Hours**

EXPERIMENT 4

Trees with all operations

5 **5 Hours**

EXPERIMENT 5

All graph algorithms.

6 **5 Hours**

EXPERIMENT 6

Saving / retrieving non-linear data structure in/from a file

Total: 75 Hours

Reference(s)

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, 2009.
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. Open Data Structures: An Introduction (Open Paths to Enriched Learning), 31st ed.

19CB204 PRINCIPLES OF ELECTRONICS 3 0 2 4

Course Objectives

- Understand about current, voltage and power, basic laws in circuits.
- Understand about semiconductor materials and its application
- Understand working principal of BJT and FET
- Understand about Integrated circuit and its application
- Understand about the fundamentals of Electronics and its applications.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Apply Voltage-Current laws and transformation techniques to solve linear electric circuits.
2. Apply the diodes in rectifier and regulator applications and also analyze its characteristics.
3. Explain the working of Bipolar Junction and Field Effect Transistors with different configurations and also analyze their characteristics.
4. Illustrate the working of analog IC with different configurations and its applications.
5. Simplification of Boolean expressions using K-map and implementation of combinational & sequential circuits.

Articulation Matrix

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

UNIT I **6 Hours**

ELECTRIC CIRCUITS

DefinitionofVoltage,Current,Power&Energy,Ohmslaw,KirchoffsLaw & its applicationssimple problems,Simple mesh and Node problems, Generation of Alternative EMF, Average value of current and voltage, Form Factor, Peak Factor.

UNIT II **9 Hours**

SEMICONDUCTOR DIODE AND ITS APPLICATION

Conductor, Semiconductors & Insulators, Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers. Characteristics of PN Junction Diode and Zener diode, Rectifier Circuits Half wave, Full wave circuits, Efficiency, PIV, Ripple factor and AC and DC current and voltage in rectifier.

UNIT III **10 Hours**

BIPOLARJUNCTION AND FIELDEFFECTTRANSISTOR

Structure and working of bipolar junction transistor, CB,CC,CE configurations, relation between alpha and beta, Concept of transistor as an amplifier and transistor as a switch, Field Effect Transistors: Construction and characteristics of JFET-parameters of JFET-MOSFET - Depletion&enhancementmodes Construction and characteristics

UNIT IV **10 Hours**

FEED BACK AMPLIFIER, AND OPERATIONAL AMPLIFIERS

Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors, Introduction to integrated circuits: operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Voltage follower, Comparator, Integrator, Differentiator

UNIT V **10 Hours**

DIGITAL ELECTRONICS FUNDAMENTALS

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

1 **3 Hours**

EXPERIMENT 1

To plot V-I characteristics of PN junction diode.

2 **3 Hours**

EXPERIMENT 2

To plot regulation characteristics of half wave rectifier

3 **3 Hours**

EXPERIMENT 3

To plot regulation characteristics of Full wave rectifier

4 **3 Hours**

EXPERIMENT 4

To plot input-output characteristics of CE configuration of BJT.

5 **3 Hours**

EXPERIMENT 5

To study Biasing techniques of BJT- to find stability factor of self-bias, collector to base bias,fixed bias circuits.

6 **3 Hours**

EXPERIMENT 6

To plot frequency response of single stage FET amplifier (CS/CD configuration) and find itsbandwidth.

7 **3 Hours**

EXPERIMENT 7

To study Colpitts Oscillator.

8 **3 Hours**

EXPERIMENT 8

Study of OP-AMP circuits: Inverting and Non-inverting Amplifier.

9 **3 Hours**

EXPERIMENT 9

Study of basic logic gates and De-Morgan's Theorem.

10 **3 Hours**

EXPERIMENT 10

Study of half adder and full adder.

Total: 75 Hours

Reference(s)

1. William Hayt,JVJack,EKemmerly and Steven M Durbin, Engineering Circuits Analysis, Tata McGraw-Hill, 2013
2. L Robert Boylestead, Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Education,2012.
3. J Millman, C. Halkias&SatyabrataJIT "Electronic Devices and Circuits", Tata McGraw-Hill,2010
4. RamakantA.Gayakwad, OP-AMP and Linear IC"s , Prentice Hall of India, 2002.
5. Thomas L.Floyd, Digital Fundamentals, Prentice Hall, 11th Edition, 2015.

19CB205 FUNDAMENTALS OF ECONOMICS 2 0 0 2

Course Objectives

- Exemplify the demand curves of households and supply curves of firms with the principles.
- Differentiate Price ceilings , Price floors and compare income effects ,substitute effects
- Analyze the Keynesian"s process of multiplier theory in macro economics

Programme Outcomes (POs)

f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. To explain the functioning of elasticity of demand in micro economics.
2. To analyze the supporting of price, income and substitution effects in the consumers and producers surplus.
3. To compare the equilibrium of a firm under perfect competition, monopoly and monopolistic competition.
4. To study the concepts of demand for money and supply of money with appropriate model in macro economic analysis.
5. To examine and evaluate the problems of voluntary and involuntary unemployment

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

UNIT I **6 Hours**

MICRO ECONOMICS

Principles of Demand and Supply Supply Curves of Firms Elasticity of Supply; Demand Curves of Households Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve);

UNIT II **6 Hours**

WELFARE ANALYSIS

Consumers and Producers Surplus- Price Ceilings and Price Floors; Consumer Behaviour - Axioms of Choice-Budget Constraints and Indifference Curves; Consumers Equilibrium Effects of a Price Change, Income and Substitution Effects Derivation of a Demand Curve

UNIT III **6 Hours**

APPLICATIONS

Tax and Subsidies - Inter temporal Consumption -Suppliers- Income Effect; Theory of Production - Production Function and Isoquants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

UNIT IV **6 Hours**

MACRO ECONOMICS

National Income and its Components - GNP, NNP, GDP, NDP Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector -Taxes and Subsidies; External Sector - Exports and Imports; Money -Definitions; Demand for Money Transaction and Speculative Demand; Supply of Money - Banks Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model

UNIT V **6 Hours**

BUSINESS CYCLES AND STABILIZATION

Monetary and Fiscal Policy - Central Bank and the Government; the Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

FURTHER READING

Monetary and Fiscal Policy - Central Bank and the Government; the Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment

Total: 30 Hours

Reference(s)

1. Pindyck, Robert S and Daniel L. Rubinfeld , Microeconomics, Eighth Edition, 2013 .
2. Dornbusch, Fischer and Startz, Macroeconomics, Tenth Edition, Tata Mcgraw Hill, 2012.
3. Paul Anthony Samuelson, William D. Nordhaus, Economics, Nineteenth Edition, McGraw-Hill Education, 2010.
4. Hal R, Varia, Intermediate Microeconomics: A Modern Approach, Eighth Edition Affiliated East-West Press, 2006
5. N. Gregory Mankiw, Principles of Macroeconomics, Seventh Edition, Cengage Learning, 2018.

19HS206 BUSINESS COMMUNICATION AND VALUE SCIENCE - II 2 1 2 4

Course Objectives

- Augment students overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals.
- Develop students expertise on public speaking skills and to deal positively with criticism and so as to effectively present their personalities

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Speak fluently in English without errors in the sentence construction and hence present themselves as effective English communicators. They will be able to learn 20-25 common errors made in parts of speech and also use 10 modal verbs efficiently during professional communication.
2. Differentiate between vocabulary used as adjectives, verbs and adverbs and be able to use the 60-70 words for their daily conversation.
3. Overcome the fear of speaking and will be aware of the 3 types of public speaking necessary according to the contemporary requirements. They would be able to deliver a public speech according to the need of the audience and also be aware of positive body language to be manifested during a speech.
4. Deal with the deeper parameters of working in teams like team motivation, multicultural team activity and team conflict resolution
5. Analyze them relating to their hobbies and strengths and hence set realistic goals in terms of personal and professional growth. They will be able to identify at least 5-7 strengths and a couple of goals to be achieved that will enable their lives to be directed appropriately.

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 **6 Hours**

ESSENTIAL GRAMMAR Ã,?? II

Application of tenses, Auxiliaries- correct usage and importance in formal communication, Business Vocabulary - Vocabulary exercises through web-based applications. Written Communication - II: Email writing- Formal and Informal, email writing structure, Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc. Technical writing, Essay writing, Paragraph writing.

UNIT II **6 Hours**

VOCABULARY - II

Vocabulary exercises through web-based applications, Usage and application through mock meetings Situational Conversation: Application of grammar and correct spoken English according to context/ situation and application in business scenario.

UNIT III **6 Hours**

FUNDAMENTALS OF EFFECTIVE COMMUNICATION

Public Speaking: fundamentals of effective public speaking, types- Extempore speech, manuscript speech, and ways to enhance public speaking skills, storytelling, oral review. Presentation Skills: PowerPoint presentations, Effective ways to structure the presentation, importance of body language. Leadership Skills, Leader's Role, Responsibilities And Skill Required: Understanding good Leadership behaviours, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules, Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback. Problem Solving Skill: Problem solving skill, Confidence building

UNIT IV **6 Hours**

CORPORATE / BUSINESS ETIQUETTES

Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities

UNIT V **6 Hours**

DIVERSITY AND INCLUSION PART II

Socio-Cultural and Cross-Cultural Sensitivities at the Workplace: PwD and LGBT at the workplace, Learning disabilities at the workplace; Caste, class, regionalism, religion and poverty: the different identities of Indian employees and employers and how to include everyone; Global diversity identities of race, religion, nationhood; Appropriate Social Media Use Values Sciences Part II: Values of a good manager: Ethics in Business; Embodying organizational pride with grace

1 **2 Hours**

EXPERIMENT 1

Module 1: Self-Introduction

2 **2 Hours**

EXPERIMENT 2

Module 2: Likes, Dislikes, and Social goals (strengths, ambition)

3 **2 Hours**

EXPERIMENT 3

Module 3: Offering opinions (GD, disagreeing politely, accepting opinions)

4 **2 Hours**

EXPERIMENT 4

Module 4: Asking questions (Formal writing, formal events)

5 **2 Hours**

EXPERIMENT 5

Module 5: Answering questions (politeness markers)

6 **2 Hours**

EXPERIMENT 6

Module 6: Asking permission (leave, OD)

7 **2 Hours**

EXPERIMENT 7

Module 7: Communication etiquette (Telephone, E-mail

8 **2 Hours**

EXPERIMENT 8

Module 8: Banks/ Reservation/ Application forms (Travel) (why would you like to join the course? Self-expression- Writing

9 **2 Hours**

EXPERIMENT 9

Module 9: Constructive criticism, respond to compliment

10 **2 Hours**

EXPERIMENT 10

Module 10: Convincing (Interactive group game) and persuading (literature, Debate)

11 **2 Hours**

EXPERIMENT 11

Module 11: Accepting

12 **2 Hours**

EXPERIMENT 12

Module 12: Narration with Discourse Markers and connectives (offer a commentary on a research project, compare and contrast-writing skills)

13 **2 Hours**

EXPERIMENT 13

Module 13: Description with describing markers (story mapping, mind mapping, create a web page to sell own product, write food, film reviews, creating hashtags)

14 **2 Hours**

EXPERIMENT 14

Module 14: Public events (MoC, Welcome address, Vote of Thanks, Body Language

15 **2 Hours**

EXPERIMENT 15

Module 15: Seminar/ Presentation

Total: 75 Hours

Reference(s)

1. Business Communication Today by Bovee, Thill, Raina
2. APAART: Speak Well 1 (English Language and Communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Strategic Communication by Charles Marsh
5. English vocabulary in use Alan Mccarthy and Odell
6. Business Communication Dr. Saroj Hiremath

19CB301 FORMAL LANGUAGE AND AUTOMATA THEORY 3 2 0 4

Course Objectives

- Understand different formal language classes and their relationships
- Construct the mathematical models and grammars to recognize formal languages
- Analyse the undecidability and complexity of computational problems

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Design finite automata to recognize regular languages and prove their equivalence
2. Construct push down automata to accept context free languages and prove their equivalence
3. Generate Linear bounded automata and Turing Machines for a given computation and languages
4. Analyse the undecidability of languages
5. Examine the problems based on their complexity

Articulation Matrix

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

UNIT I **10 Hours**

REGULAR LANGUAGES AND FINITE AUTOMATA

Alphabet-languages and grammars- Productions and derivation-Chomsky hierarchy of languages. Regular expressions and languages- Deterministic Finite Automata (DFA) and equivalence with regular expressions-Nondeterministic Finite Automata (NFA) and equivalence with DFA- Regular grammars and equivalence with finite automata - Properties of regular languages - Kleene""s theorem - Pumping lemma for regular languages- Myhill- Nerode theorem and its uses- Minimization of finite automata.

UNIT II **10 Hours**

II CONTEXT-FREE LANGUAGES AND PUSHDOWN AUTOMATA

Context-free grammars (CFG) and languages (CFL)- Chomsky and Greibach normal forms - Nondeterministic pushdown automata (PDA) and equivalence with CFG - Parse trees- Ambiguity in CFG - Pumping lemma for context-free languages - Deterministic pushdown automata- Closure properties of CFLs.

UNIT III **10 Hours**

TURING MACHINES

Context-sensitive grammars (CSG) and languages - Linear bounded automata and equivalence with CSG.

The basic model for Turing machines (TM) - Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties - Variants of Turing machines - Nondeterministic TMs and equivalence with deterministic TMs - Unrestricted grammars and equivalence with Turing machines -TMs as enumerators.

UNIT IV **8 Hours**

UNDECIDABILITY

Church-Turing thesis -Universal Turing machine - The universal and diagonalization languages - Reduction between languages- Rice's theorem -Undecidable problems about languages.

UNIT V **7 Hours**

COMPLEXITY THEORY

Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines - P and NP, NP- completeness - Cooks Theorem, other NP - Complete problems.

FOR FURTHER READING

Applications of finite automata - string matching algorithms, network protocols and lexical analyzers - Common parsing algorithms - Cellular automata

Total: 75 Hours

Reference(s)

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

19CB302 COMPUTER ORGANIZATION AND ARCHITECTURE 3 2 0 4

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. 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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Identify the basic structure of a digital computer and instruction sets with addressing modes.
2. Illustrate the arithmetic operations of binary number system with its design.
3. Recognize the organization of the basic processing unit and examine the basic concepts of pipe-lining.
4. Explicate the standard I/O interfaces and peripheral devices.
5. Determine the performance of different types of memory.

Articulation Matrix

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

UNIT I **9 Hours**

COMPUTER ARCHITECTURE

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs. Data representation: Signed number representation, fixed and floating point representations, character representation.

UNIT II **9 Hours**

COMPUTER ARITHMETIC

Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication: shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

UNIT III **9 Hours**

CONTROL UNIT AND PIPELINING

Introduction to x86 architecture. CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

UNIT IV **9 Hours**

PERIPHERAL DEVICES AND THEIR CHARACTERISTICS

Input-output subsystems, I/O device interface, I/O transfers program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes: role of interrupts in process state transitions, I/O device interfaces: SCII, USB.

UNIT V **9 Hours**

MEMORY ORGANIZATION AND SYSTEM DESIGN

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

Total: 75 Hours

Reference(s)

1. Morris Mano,"Computer System Architecture", 3rd Edition, Prentice Hall of India, New Delhi,2014
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier, 5th Edition 2013
3. Carl Hamacher, Zvonko Vranesic, SafwatZaky, Naraig Manjikian, Computer Organization and Embedded Systems, McGraw-Hill, 6th Edition 2014
4. John P. Hayes, Computer Architecture and Organization, McGraw-Hill ,3rd Edition,2013
5. William Stallings, Computer Organization and Architecture Ã¢?? Designing for Performance, 10th Edition, Pearson Education, 2015.
6. Vincent P. Heuring and Harry F. Jordan, Computer System Design and Architecture, Prentice Hall,2 nd Edition, 2004

19CB303 OBJECT ORIENTED PROGRAMMING 3 0 2 4

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. 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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

Course Outcomes (COs)

1. Differentiate Structured programming and Object Oriented Programming
2. Interpret the features of object oriented programming and basic structure of C++ program.
3. Illustrate operator overloading, Inheritance and virtual functions
4. Develop applications with concepts of files, templates and exceptions.
5. Understand Object Oriented Design and Modeling

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO OBJECT ORIENTED PROGRAMMING

Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing -value vs reference, passing pointer by value or reference, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments

UNIT II **9 Hours**

CONCEPTS OF OBJECT ORIENTED PROGRAMMING

Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object, Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)

UNIT III **9 Hours**

ESSENTIALS OF OBJECT ORIENTED PROGRAMMI

Operator overloading, Inheritance, Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding

UNIT IV **9 Hours**

FILES, I/O AND GENERIC PROGRAMMING

Streams, Files, Library functions, formatted output Template concept, class template, function template, template specialization

UNIT V **9 Hours**

OBJECT ORIENTED DESIGN AND MODELING

UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design.

1 **5 Hours**

EXPERIMENT 1

Implementation of classes and objects with constructors and destructors.

2 **5 Hours**

EXPERIMENT 2

Implementation of operator and function overloading.

3 **5 Hours**

EXPERIMENT 3

Implementation of types of Inheritance.

4 **5 Hours**

EXPERIMENT 4

Implementation of two different classes for adding a private data member using friend function.

5 **5 Hours**

EXPERIMENT 5

Implementation of file handling operations.

6 **5 Hours**

EXPERIMENT 6

Implementation of templates and UML diagrams.

Total: 75 Hours

Reference(s)

1. Bjarne Stroustrup, Ã¢??The C++ Programming LanguageÃ¢??1e:3rd Edition, Pearson Education, 2015
2. Debasish Jana, C++ and Object-Oriented Programming Paradigm, 3rd Edition, Prentice Hall of India, New Delhi,2014.
3. Bjarne Stroustrup,Programming Principles and Practice Using C++, 2nd Edition, Addison Wesley, 2014.
4. Bjarne Stroustrup, The Design and Evolution of C++, Addison-Wesley Professional,2013

19CB304 COMPUTATIONAL STATISTICS 3 0 2 4

Course Objectives

- Learn the fundamental concepts of computational statistical models, multivariate regression, Principal component analysis
- Understand the fundamental concepts of Python , Data aggregation and Visualization in Python

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Understand the basic concepts of Statistical techniques and multivariate regression models.
2. Understand the basic concepts of Discriminant analysis and Principal component analysis
3. Understand the concepts of factor analysis and segmentation analysis
4. Understand the introductory ,concepts of Python and Data wrangling techniques in Computational Statistics
5. Understand the fundamental concepts of data aggregation and create visualizations using Python

Articulation Matrix

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

UNIT I **9 Hours**

MULTIVARIATE NORMAL DISTRIBUTION AND MULTIVARIATE REGRESSION

Multivariate Normal Distribution- Multivariate Normal Distribution- Conditional Distribution- Estimation of parameters. Multiple Linear Regression Model- Standard multiple regression models collinearity- outliers, non-normality and autocorrelation. Multivariate Regression- Parameter estimation- Multivariate Analysis of variance and covariance

UNIT II **9 Hours**

DISCRIMINANT ANALYSIS AND PRINCIPAL COMPONENT ANALYSIS

Discriminant Analysis- Statistical background, linear discriminant function analysis- Estimating linear discriminant functions and their properties. Principal Component Analysis- Principal components- Algorithm for conducting principal component analysis- H-plot

UNIT III **9 Hours**

FACTOR ANALYSIS AND SEGMENTATION ANALYSIS

Factor Analysis- Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.Clustering and Segmentation Analysis- Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering

UNIT IV **9 Hours**

PYTHON CONCEPT AND DATA WRANGLING

Python Concepts- Data Structures- Classes- Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Constructors, Text & Binary Files - Reading and Writing. Data Wrangling- Combining and Merging Datasets, Reshaping and Pivoting, Data Transformation, String Manipulation, Regular Expressions

UNIT V **9 Hours**

DATA AGGREGATION AND VISUALIZATION IN PYTHON

Data Aggregation, Group Operations, Time series- Groupby Mechanics, Data Aggregation, Group wise Operations and Transformations, Pivot Tables and Cross Tabulations, Time Series Basics, Data Ranges, Frequencies and Shifting. Visualization in Python- Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches

1 **4 Hours**

EXPERIMENT 1

Basic Python Programs

2 **4 Hours**

EXPERIMENT 2

Program using String Operations

3 **4 Hours**

EXPERIMENT 3

Program on python Data structures

4 **4 Hours**

EXPERIMENT 4

Perform various numpy operations and special functions

5 **4 Hours**

EXPERIMENT 5

Draw statistical graphics using seaborn

6 **5 Hours**

EXPERIMENT 6

Implement k-means, logistic and time series algorithm using Scikit-learn

7 **5 Hours**

EXPERIMENT 7

Visualization in python using matplotlib

Total: 75 Hours

Reference(s)

1. T.W. Anderson, An Introduction to Multivariate Statistical Analysis PHI India 2014.
2. J.D. Jobson, Applied Multivariate Data Analysis , Vol I & II, 1992
3. Magnus Lie Hetland,Beginning Python: From Novice to Professional, 2nd Edition, 2005
4. A.S. Mulaik, The Foundations of Factor Analysis, 2nd Edition, CRC Press, 2014
5. D.C. Montgomery and E.A. Peck, Introduction to Linear Regression Analysis,5th Edition , Willey , 2012
6. Wes Mc Kinney,Python for Data Analysis, 2nd Edition, OÃƒÂ¢??REILLY, 2017

19CB305 SOFTWARE ENGINEERING 3 1 2 5

Course Objectives

- 1. Understand the need for different software development life cycle models
- 2. Impart knowledge on software requirement analysis, estimation, design and testing
- 3. Acquire knowledge on object oriented analysis, design and measurements

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.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes (COs)

1. Analyse and identify a suitable software development life cycle model for an application
2. Develop software requirements specification and cost estimation for an application.
3. Design high quality software for an application based on quality models.
4. Apply different testing methods to identify errors during software development.
5. Apply object oriented methodologies and unified modelling language in software development.

Articulation Matrix

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

UNIT I **6 Hours**

INTRODUCTION

Programming in the small vs. programming in the large-Software project failures and importance of software quality and timely availability-Engineering approach to software development-Role of software engineering towards successful execution of large software projects-Emergence of software engineering as a discipline-Basic concepts of life cycle models-different models and milestones.

UNIT II **11 Hours**

SOFTWARE PROJECT MANAGEMENT AND ESTIMATION TECHNIQUES

Project management: Software project planning identification of activities and resources-Concepts of feasibility study-Techniques for estimation of schedule and effort-Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques-Techniques for requirement modeling decision tables, event tables, state transition tables, Petri nets-Requirements documentation through use cases. Estimation techniques: Software cost estimation models and concepts of software engineering economics - Techniques of software project control and reporting - Introduction to measurement of software size- Introduction to software metrics and metrics based control methods.

UNIT III **9 Hours**

SOFTWARE QUALITY AND RELIABILITY

Introduction to the concepts of risk and its mitigation -Internal and external qualities-Process and product quality-Principles to achieve software quality-Introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO 9126-Introduction to Capability Maturity Models (CMM and CMMI)-Introduction to software reliability, reliability models and estimation-Measures of code and design quality-Configuration management

UNIT IV **10 Hours**

SOFTWARE TESTING

Introduction to faults and failures-Basic testing concepts-Concepts of verification and validation-Black box and white box tests-White box test coverage code coverage, condition coverage, branch coverage-Basic concepts of black-box tests equivalence classes, boundary value tests, usage of state tables-Testing use cases-Transaction based testing-Testing for non-functional requirements volume, performance and efficiency-Concepts of inspection.

UNIT V **9 Hours**

OBJECT ORIENTED ANALYSIS, DESIGN AND CONSTRUCTION

Concepts the principles of abstraction, modularity, specification, encapsulation and information hiding-concepts of abstract data type- Introduction to UML-Class Responsibility Collaborator (CRC) model-Quality of design-Design measurements-Concepts of design patterns-Refactoring-Object oriented construction principles-Object oriented metrics.

1 **4 Hours**

EXPERIMENT 1

Course Registration System

2 **4 Hours**

EXPERIMENT 2

Online ticket reservation system

3 **4 Hours**

EXPERIMENT 3

Student Performance analysis system

4 **4 Hours**

EXPERIMENT 4

Expert system to prescribe the medicines for the given symptoms

5 **4 Hours**

EXPERIMENT 5

ATM system for company

6 **5 Hours**

EXPERIMENT 6

Platform assignment system for the trains in a railway station

7 **5 Hours**

EXPERIMENT 7

Stock maintenance for office

Total: 90 Hours

Reference(s)

1. 1. Ian Sommerville, Software Engineering, Pearson Education, 2016.
2. 2. Ivar Jacobson, Object Oriented Software Engineering: A Use Case Driven Approach, Addison- Wesley Professional, 1992.
3. 3. Carlo Ghezzi, Jazayeri Mehdi and Mandrioli Dino, Fundamentals of Software Engineering, Pearson Education, 2002.
4. 4. Michael Jackson, Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, Addison-Wesley Professional, 1995.
5. 5. Ivar Jacobson, Grady Booch and James Rumbaugh, The Unified Development Process, Addison-Wesley Professional, 1999.
6. 6. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Design Patterns: Elements of Object-Oriented Reusable Software, Addison-Wesley Professional, 1994.

19CB306 FINANCIAL MANAGEMENT 3 0 0 3

Course Objectives

- Understand basics of Financial Management and the concept of Time Value of Money
- Analyse the Securities Value and its Risk & Return
- Analyse the business risk, financial risk and cost of capital for maximizing the share holder
- Analyse the cash flows to make investment decision
- Discover basic understanding of a company's working capital structure.

Programme Outcomes (POs)

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.

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.

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

m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Able to perform the basic Financial Functions and apply the concept of Time Value of Money while taking the Financial Decisions
2. Perform the Security Valuation and construct the Portfolio for given level and risk and expected rate of return
3. Manage the risk using Operating and Financial Leverages and calculate the Cost of Capital
4. Able to apply appropriate Capital Budgeting Techniques while taking Investment Decision
5. Ensure the short-term liquidity by appropriately managing the Working Capital

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Introduction to Financial Management - Goals of the firm - Financial Environments. VALUE OF MONEY: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

UNIT II **9 Hours**

VALUATION OF SECURITIES:

Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM. RISK AND RETURN: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, the Capital Asset Pricing Model (CAPM)

UNIT III **9 Hours**

OPERATING AND FINANCIAL LEVERAGE:

Operating Leverage, Financial Leverage, Total Leverage, and Indifference Analysis in leverage study. COST OF CAPITAL: Concept , Computation of Specific Cost of Capital for Equity ,Preference-Debt, Weighted Average Cost of Capital, Factors affecting Cost of Capital 4L

UNIT IV **9 Hours**

CAPITAL BUDGETING:

The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods

UNIT V **9 Hours**

WORKING CAPITAL MANAGEMENT:

Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital. CASH MANAGEMENT: Motives for holding cash, speeding up Cash Receipts, Slowing down Cash Pay-outs, Electronic Commerce, Outsourcing, Cash Balances to maintain, and Factoring. ACCOUNTS RECEIVABLE MANAGEMENT: Credit and Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period

Total: 45 Hours

Reference(s)

1. Prasanna Chandra, "Financial Management- Theory and Practice", New Delhi: Tata McGraw-Hill Publishing Company Ltd, 2017.
2. I. M. Pandey, "Financial Management", New Delhi: Vikas Publishing House Pvt. Ltd., 2016.
3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.
4. M. Y. Khan and P. K. Jain, "Financial Management- Text, Problems and Cases", New Delhi: Tata McGraw Hill Publishing Company Ltd, 2018.
5. Brigham and Houston, "Fundamentals of Financial Management", New Delhi: Thomson Learning, 2015.

19CB401 OPERATING SYSTEMS 3 0 2 4

Course Objectives

- To make the students 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 multiprogramming environment using threads and scheduling algorithms
- To provide knowledge on the structure and operations of memory management and storage management

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Infer the knowledge on evolution of operating systems from primitive batch systems to sophisticated multi-user systems and implement the usage of different system calls to manage the resources.
2. Analyze the mechanism of threads with the process of scheduling algorithms used in a multiprogramming environment.
3. Outline the mechanism of inter process communication using shared memory, message passing and analyze the activities of process synchronization, deadlock to increase the system performance.
4. Design the hardware component to implement the virtual memory environment with the base knowledge of memory management methodologies.
5. Prefer a most suitable file system and the ordered perspective module of disk management methods for computing and storage scenario.

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

UNIT I **6 Hours**

INTRODUCTION

Concept of Operating Systems (OS),Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

UNIT II **11 Hours**

PROCESS MANAGEMENT SYSTEM

Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching, Threads: Definition, Various states, Benefits of threads, Types of threads, Concept of multi-threads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time, Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT III **9 Hours**

IPC AND DEADLOCKS

Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson"s Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader"s & Writer Problem, Dining Philosopher Problem, Barber"s shop problem, Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker"s algorithm, Deadlock detection and Recovery, Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

UNIT IV **10 Hours**

MEMORY MANAGEMENT SYSTEM

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation - Fixed and variable partition - Internal and External fragmentation and Compaction, Virtual Memory: Basics of Virtual Memory - Hardware and control structures - Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU), I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

UNIT V **9 Hours**

FILE AND DISK MANAGEMENT SYSTEM

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed),Free - space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance, Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C - SCAN, Disk reliability, Disk formatting, Boot - block, Bad blocks.

1 **3 Hours**

EXPERIMENT 1

Study of Linux commands - System Information, Files and Directories, Process, Text Processing and Scripting, Programming.

2 **3 Hours**

EXPERIMENT 2

Shell scripting (I/O, decision making, looping)

3 **3 Hours**

EXPERIMENT 3

Creating child process (using fork), zombie Orphan. Displaying system information using C.

4 **3 Hours**

EXPERIMENT 4
CPU Scheduling algorithms (FCFS, SJF, RR, Priority).

5 **3 Hours**

EXPERIMENT 5
Process synchronization (Producer Consumer/ Reader Writer/ Dining Philosopher using semaphores)

6 **3 Hours**

EXPERIMENT 6
Deadlock Avoidance Algorithm(Bankers Algorithm).

7 **3 Hours**

EXPERIMENT 7
Inter Process Communication system using (Threads, Shared Memory)

8 **3 Hours**

EXPERIMENT 8
Dynamic Memory Allocation algorithms (First Fit, Best Fit, Worst Fit)

9 **3 Hours**

EXPERIMENT 9
Page Replacement Algorithms. (FIFO, LRU, Optimal)

10 **3 Hours**

EXPERIMENT 10
Disk Scheduling Algorithms

Total: 75 Hours

Reference(s)

1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.
2. Operating Systems: Internals and Design Principles. William Stallings.
3. Operating System: A Design-oriented Approach.Charles Patrick Crowley.
4. Operating Systems: A Modern Perspective. Gary J. Nutt.
5. Design of the Unix Operating Systems. Maurice J. Bach.

19CB402 DATABASE MANAGEMENT SYSTEMS 3 1 0 4

Course Objectives

- Understand the database architecture, data models, conceptualize and design database.
- Process the SQL queries and optimize it.
- Impart knowledge in transaction processing and database security.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and 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.
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.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the architecture of database and the models for designing database.
2. Develop solutions to a broad range of query and remove the anomalies using normalization.
3. Understand database query processing and storage strategies.
4. Analyze the basic issues of transaction processing, concurrency control and recovery.
5. Outline the concept of database security.

Articulation Matrix

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

UNIT I **9 Hours**

DATABASE ARCHITECTURE AND DATA MODEL

Introduction to Database - Hierarchical, Network and Relational Models. Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML) Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

UNIT II **12 Hours**

RELATIONAL QUERY AND DATABASE DESIGN

Relational query languages: Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL,SQL server. Relational database design: Domain and data dependency, Armstrong"s axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.

UNIT III **8 Hours**

QUERY PROCESSING AND STORAGE

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. Storage strategies: Indices, B-trees, Hashing.

UNIT IV **8 Hours**

TRANSACTION PROCESSING

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT V **8 Hours**

DATABASE SECURITY

Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

FURTHER READING

Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining

Total: 60 Hours

Reference(s)

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.
2. Principles of Database and Knowledge - Base Systems, Vol 1 by J. D. Ullman.
3. Fundamentals of Database Systems. R. Elmasri and S. Navathe.
4. Foundations of Databases. Serge Abiteboul, Richard Hull, VictorVianu.

19CB403 SOFTWARE DESIGN WITH UML 3 0 2 4

Course Objectives

- Understand the basics of UML diagrams.
- Impart knowledge about the principles of object oriented methodologies.
- Build a conceptual model during analysis and design.

Programme Outcomes (POs)

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.
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.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Analyse the object oriented technologies in software development process using real world scenarios.
2. Apply the concept of object oriented software development for requirement analysis using case modelling.
3. Implement sequence diagram and collaboration diagram to identify objects from flow of events.
4. Design the Object Oriented Methodologies with interaction diagrams.
5. Design dynamic, component diagram and deployment models for object oriented system development.

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO ON OBJECT ORIENTED TECHNOLOGIES AND THE UML METHOD

Software development process: The Waterfall Model vs. The Spiral Model - The Software Crisis, description of the real world using the Objects Model- Classes, inheritance and multiple configurations- Quality software characteristics- Description of the Object Oriented Analysis process vs. the Structure Analysis Model.

UNIT II **9 Hours**

INTRODUCTION TO THE UML LANGUAGE AND CASE MODELLING

UML Language: Standards- Elements of the language- General description of various models- The process of Object Oriented software development - Description of Design Patterns - Technological Description of Distributed Systems. Case Modeling: Analysis of system requirements - Actor definitions- Writing a case goal - Use Case Diagrams - Use Case Relationships.

UNIT III **9 Hours**

TRANSFER FROM ANALYSIS TO DESIGN IN THE CHARACTERIZATION STAGE INTERACTION DIAGRAMS

Description of goal - Defining UML Method, Operation, Object Interface, Class - Sequence Diagram - Finding objects from Flow of Events - Describing the process of finding objects using a Sequence Diagram - Describing the process of finding objects using a Collaboration Diagram.

UNIT IV **9 Hours**

TRANSFER FROM ANALYSIS TO DESIGN IN THE CHARACTERIZATION STAGE INTERACTION DIAGRAMS

The Class Diagram Model: Attributes descriptions-Operations descriptions - Connections descriptions in the Static Model-Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity. Package Diagram Model: Description of the model-White box, black box - Connections between packagers - Interfaces-Create Package Diagram - Drill Down.

UNIT V **9 Hours**

DYNAMIC, COMPONENT DIAGRAM AND DEPLOYMENT MODELS

Dynamic Model: Description of the State Diagram - Events Handling - Description of the Activity Diagram - Exercise in State Machines. Component Diagram Model: Physical Aspect - Logical Aspect - Connections and Dependencies - User face - Initial DB design in a UML environment. Deployment Model: Processors - Connections - Components - Tasks - Threads - Signals and Events.

1 **3 Hours**

EXPERIMENT 1

Identify Use Cases and develop the Use Case model.

2 **3 Hours**

EXPERIMENT 2

Identify the conceptual classes and develop a domain model with UML Class diagram.

3 **3 Hours**

EXPERIMENT 3

Use the identified scenarios find the interaction between objects and represent them using UML

4 **3 Hours**

EXPERIMENT 4

To implement Sequence diagrams

5 **3 Hours**

EXPERIMENT 5

Draw relevant state charts and activity diagrams.

6 **3 Hours**

EXPERIMENT 6

Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical

7 **3 Hours**

EXPERIMENT 7

Draw architecture diagram with UML package diagram notation.

8 **3 Hours**

EXPERIMENT 8

Develop and test the Technical services layer.

9 **3 Hours**

EXPERIMENT 9

Develop and test the Domain objects layer

10 **3 Hours**

EXPERIMENT 10

Develop and test the User interface layer.

Total: 75 Hours

Reference(s)

1. Object-Oriented Software Engineering: using UML, Patterns, and Java. Bernd Bruegge and Allen H. Dutoit.
2. Design Patterns: Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides

19CB404 INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP

3 0 0 3

Course Objectives

- The successful completion of the course will help students gain knowledge on: How to identify and discover market needs
- How to manage an innovation program
- How to create, protect, assetize and commercialize intellectual property
- Opportunities and challenges for entrepreneurs

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.
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.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

Course Outcomes (COs)

1. Summarize the life cycle and types of innovation
2. Understand the challenges in the innovation
3. Interpret the needs, benefits and procedure of filing an IPR
4. Examine a business plan to ensure success of a start-up
5. Analyze the requirements of the technology-driven social innovation

Articulation Matrix

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

UNIT I **7 Hours**

INNOVATION

A primer on Innovation, IP Rights and Entrepreneurship, Types of Innovation (incremental, disruptive, etc.), Lifecycle of Innovation (idea, literature survey, PoT, PoC, etc.)

UNIT II **10 Hours**

CHALLENGES IN INNOVATION

Challenges in Innovation (time, cost, data, infrastructure, etc.), co-innovation and open innovation (academia, start-ups and corporates), Technology innovation - case study - jile - A scalable agile devops products, curefit - A platform to stay healthy.

UNIT III **9 Hours**

INTELLECTUAL PROPERTY RIGHT

Types of IPR (patents, copyrights, trademarks, GI, etc.), Lifecycle of IP (creation, protection, assetization, monetization), Balancing IP risks & rewards (Right Access and Right Use of Open Source and 3rd party products, technology transfer & licensing), IP valuation (methods, examples, limitations).

UNIT IV **10 Hours**

ENTREPRENEURSHIP

Opportunity identification in technology entrepreneurship (customer pain points, competitive context), Market research, segmentation & sizing, Product positioning & pricing, go-to-market strategy, Innovation assessment (examples, patentability analysis)

UNIT V **9 Hours**

ENTREPRENEURSHIP - SOCIAL INNOVATION

Startup business models (fund raising, market segments, channels, etc.), Innovation, Incubation & Entrepreneurship in Corporate Context Technology-driven Social Innovation & Entrepreneurship, Manage innovation, IP and Entrepreneurship Programs- Processes, Governance and Tools.

Total: 45 Hours

Reference(s)

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Richard Razgaitis, Valuation and Dealmaking of Technology-Based Intellectual Property Principles, Methods and Tools, Wiley, 2009
3. Clayton M.Christensen, Innovator"s Dilemma: When New Technologies Cause Great Firms to Fail (Management of Innovation and Change), Harvard Business Review Press, 2013
4. Case Study Materials: To be distributed for class discussion

19HS405 BUSINESS COMMUNICATION AND VALUE SCIENCE III 2 0 4 4

Course Objectives

- Develop technical writing skills
- Practice self-analysis techniques like SWOT & TOWS
- Understand key concepts of pluralism & cultural spaces
- Sensitise the cross-cultural communication
- Develop the science of nation building

Programme Outcomes (POs)

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

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

Course Outcomes (COs)

1. Identify the best practices of technical writing & apply technical writing in real life scenarios
2. Apply & analyze the basic principles of SWOT & life positions
3. Identify & respect pluralism in cultural spaces
4. Identify the common mistakes made in cross-cultural communication
5. Understand, analyze & leverage the power of motivation in real life

Articulation Matrix

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

6 Hours

UNIT I

Basic principles of SWOT and Life Positions - Apply SWOT in real life scenarios- Recognize how motivation helps real life- Leverage motivation in real life scenarios

6 Hours

UNIT II

Pluralism in cultural spaces- Differentiate between the different cultures of India- Define the terms global, glocal and translocational- Differentiate between global, glocal and translocational culture Recognize the implications of cross-cultural communication- Common mistakes made in cross-cultural communication - The roles and relations of different genders

UNIT III **6 Hours**

Role of science in nation building- Introduction to technical writing- Practice activity on technical writing - Assessment on technical writing

6 Hours

UNIT IV

AI (artificial intelligence)- Importance of AI- AI in Everyday Life- Communicating with machines - Identify the best practices of technical writing- technical writing in real life scenarios

6 Hours

UNIT V

Project- Visit rural area/ underprivileged parts of city to address some of the local issues; if relevant, suggest a practical technology solution to the issues.

1 **12 Hours**

EXPERIMENT 1

SWOT vs TOWS
The balancing act TED talks on Biomimicry and Stories
YouTube videos on Maslows Theory

2 **12 Hours**

EXPERIMENT 2

Rhythms of India (Cultures in India)
Cross-cultural Communication

3 **12 Hours**

EXPERIMENT 3

Role of science in Nation Building

4 **12 Hours**

EXPERIMENT 4

Role of science (Post- independence)
Practice activity on Technical Writing

5 **12 Hours**

EXPERIMENT 5

AI in Everyday Life
Design your college in the year 2090

Total: 90 Hours

Reference(s)

1. Raman, Meenakshi and Sangeeta Sharma. Fundamentals of Technical Communication. (2014)
2. Fine, Lawrence G. The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats. (2009)

19CB406 OPERATIONS RESEARCH 2 0 2 3

Course Objectives

- Learn the fundamental concepts of operations research, solving technique, analyze the results and propose recommendations in understandable to the decision - making processes in Management and Engineering.
- Understand and apply the methodologies of the Queueing theory and simulation.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Understand the basic concepts of operational research techniques from the verbal description of the real system.
2. Understand the mathematical tools that are needed to solve optimization problems for transshipment problems.
3. Understand the concepts of network use PERT and CPM techniques to plan, schedule and control project activities.
4. Identify and apply the queuing methodologies to optimize the result of the waiting line.
5. Understand the fundamental concepts related to random number generation in simulation techniques.

Articulation Matrix

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

UNIT I **6 Hours**

LINEAR PROGRAMMING

Linear programming - Examples from industrial cases, formulation & definitions, Matrix form. Basic concepts, Special cases - infeasibility, unboundedness, redundancy and degeneracy, Sensitivity analysis. Simplex Algorithm - slack, surplus & artificial variables, computational details, big - M method, identification and resolution of special cases through simplex iterations. Duality - formulation, results, fundamental theorem of duality, dual - simplex and primal - dual algorithms.

UNIT II **6 Hours**

TRANSPORTATION AND ASSIGNMENT PROBLEMS

TP - Examples, Definitions - decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods - NWCR, minimum cost and VAM, test for optimality

(MODI method), degeneracy and its resolution. AP - Examples, Definitions - decision variables, constraints, formulation, Balanced &unbalanced situations, Solution method - Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT III **6 Hours**

PERT - CPM AND INVENTORY CONTROL

Project definition, Project scheduling techniques - Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time - cost trade - off. Inventory Control: Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models - EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness.

UNIT IV **6 Hours**

QUEUING THEORY

Definitions - queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall"s notation, Little"s law, steady state behavior, Poisson"s Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures.

UNIT V **6 Hours**

SIMULATION METHODOLOGY

Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation - clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

1 **3 Hours**

EXPERIMENT 1

Mathematical model and Formulation of Linear programming

2 **3 Hours**

EXPERIMENT 2

Graphical method of Linear programming

3 **3 Hours**

EXPERIMENT 3

Simplex method of linear programming

4 **3 Hours**

EXPERIMENT 4

Penalty method to assess the Linear programming

5 **3 Hours**

EXPERIMENT 5

Duality method of Linear programming

6 **3 Hours**

EXPERIMENT 6

North West corner method of Transportation

7 **3 Hours**

EXPERIMENT 7
Least cost method of Transportation

8 **3 Hours**

EXPERIMENT 8
Vogels Approximation method of Transportation

9 **3 Hours**

EXPERIMENT 9
Minimization of Assignment

10 **3 Hours**

EXPERIMENT 10
Balanced and unbalanced model of Transportation

Total: 60 Hours

Reference(s)

1. Murthy K G, Linear Programming, Tata Mc Graw Hill Education,4th Edition, 2017
2. Hadley G, Introduction to Linear Programming Models,11th Edition, Academic Press, New York,2012
3. Wagner H M , Principles of OR with Application to Managerial Decisions ,World Press Private Ltd.,1968
4. F.S. Hiller and G.J. Lieberman, Introduction to Operations Research, 43rd Edition, Khanna Publication,Delhi,2014
5. A. Ravi Ravindran, Operations Research and Management Science, Hand Book,3rd Edition, TataMc Graw Hill Education,1999
6. Thomas L. Saaty, Elements of Queuing Theory, McGraw-Hill, 1961

19CB407 MARKETING RESEARCH AND MARKETING MANAGEMENT 3 0 0 3

Course Objectives

- To gain insight on fundamental concepts of marketing
- Comprehend the dynamics of marketing and analyse how its various components interact with each other in the real world
- Impart knowledge about the principles of marketing research

Programme Outcomes (POs)

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.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. To explain the functioning of elasticity of demand in micro economics.
2. Comprehend the dynamics of marketing and analyse how its various components interact with each other in the real world
3. Leverage marketing concepts for effective decision making
4. Understand the basic concepts , principles, statistical tools of marketing research
5. Execute various strategies of Internet Marketing

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				3			2							2
5			2				2							2

UNIT I **9 Hours**

MARKETING CONCEPTS AND APPLICATIONS

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services,
Importance of marketing in service sector-Marketing Planning & Environment: Elements of Marketing
Mix, Analysing needs & trends in Environment - Macro, Economic, Political, Technical & Social-

Understanding the consumer: Determinants of consumer behaviour, Factors influencing consumer behavior- Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT II **9 Hours**

MARKETING MIX

MARKETING MIX

Concept, elements, 7 Ps of marketing-Product Management: Product decision and strategies, Packaging,

Product Life cycle concept, New Product development & strategy, Stages in New Product development,

Branding.

UNIT III **9 Hours**

MARKETING RESEARCH

Introduction, type of Market Research, Scope,Objectives and Limitations Marketing Research Techniques, Survey Questionnaire design and drafting, Pricing Research, Media Research, qualitative Research. Data analysis- Use of various statistical tools,descriptive and inference statistics, statistical hypothesis testing,multivariate analysis,discriminant analysis,cluster analysis,segmenting and positioning,factor analysis

UNIT IV **9 Hours**

INTERNET MARKETING

Introduction to Internet Marketing, Mapping fundamental concepts of Marketing (7Ps,STP),Strategy and Planning for Internet Marketing. Business to Business Marketing-Fundamental of business markets,Organizational buying process. Business buyer needs. Market and sales potential.Product in business markets.Relationship, networks and customer relationship management. Business to Business marketing strategy

UNIT V **9 Hours**

INTERNET MARKETING

Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing

FOR FURTHER READING

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Business to Business marketing strategy Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management.

Total: 45 Hours

Reference(s)

1. Rajan Saxena , Marketing Management, McGraw Hill Education,6th edition, 2019
2. S.A. Sherlekar, Marketing Management, Himalaya Publishing House, 2014
3. Research for Marketing Decisions by Paul Green, Donald, Tull
4. Business Statistics, A First Course, David M Levine at al, Pearson Publication
5. Marketing Management , Philip Kotler
6. Service Marketing , S.M. Zha

19CB408 DATABASE MANAGEMENT SYSTEMS LABORATORY 0 0 2 1

Course Objectives

- To design database using ER diagram
- To illustrate the relational database implementation using SQL
- To demonstrate procedural extensions such as procedure, function, cursors and triggers
- To develop application using front end and back end
- To explain cloud storage for real time systems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and 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.
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.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Select suitable SQL commands to manage the database
2. Create and maintain tables using PL/SQL.

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		3									3

1 **4 Hours**

EXPERIMENT 1

Working with SQL commands like DDL, DML, TCL, and DCL.

2 **4 Hours**

EXPERIMENT 2

Execute simple queries using joins and Integrity constraints.

3 **6 Hours**

EXPERIMENT 3

Create database relation and check for normal forms

4 **6 Hours**

EXPERIMENT 4

Implement Cursor and trigger in PL/SQL block.

5 **4 Hours**

EXPERIMENT 5

Write PL/SQL block Programs using exception handling

6 **6 Hours**

EXPERIMENT 6

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

Total: 30 Hours

Reference(s)

1. Gupta G K, Database Management Systems, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

19CB501 DESIGN AND ANALYSIS OF ALGORITHMS 2 0 2 3

Course Objectives

- Understand the basic concepts of various algorithm design techniques
- Impart knowledge on runtime analysis of algorithms
- Empathize the limits of computation

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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

Course Outcomes (COs)

1. Analyse the algorithm efficiency by means of mathematical notations specialization to the solution of complex engineering problems.
2. Classify the fundamentals of Algorithmic problem solving methods
3. Analyse the different techniques in the design of Graph Algorithms
4. Differentiate algorithms design techniques of NP complete with NP hard problems
5. Understand the different approaches of advanced problem solving methods

Articulation Matrix

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

UNIT I **6 Hours**

INTRODUCTION

Characteristics of Algorithm, Analysis of Algorithm, Asymptotic analysis of Complexity Bounds-Best, Average and Worst-Case behavior, Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations, Substitution Method, Recursion Tree Method, and Masters Theorem

UNIT II **6 Hours**

FUNDAMENTAL ALGORITHMIC STRATEGIES - I

Brute-Force, Divide and conquer, Heuristics, Greedy Methodologies, Illustrations of these techniques for Problem Solving.

UNIT III **6 Hours**

FUNDAMENTAL ALGORITHMIC STRATEGIES - II

Dynamic Programming, Branch and Bound and Backtracking Methodologies, Illustrations of these techniques for Problem Solving, Bin Packing, Knapsack, Travelling Salesman Problem.

UNIT IV **6 Hours**

GRAPH AND TREE ALGORITHMS

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS)- Shortest path algorithms, Transitive closure, Heap Sort, Topological sorting, Network Flow Algorithm.

UNIT V **6 Hours**

TRACTABLE AND INTRACTABLE PROBLEMS AND ADVANCED TOPICS

Computability of Algorithms, Computability classes,P,NP, NP Complete and NP Hard- Standard NP complete Problems and Reduction Techniques- Approximation algorithms, Randomized algorithms

1 **6 Hours**

EXPERIMENT 1

Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

2 **6 Hours**

EXPERIMENT 2

Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

3 **6 Hours**

EXPERIMENT 3

Implement the 0/1 Knapsack problem using Greedy method.

4 **6 Hours**

EXPERIMENT 4

For any given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

5 **6 Hours**

EXPERIMENT 5

Design and implement an algorithm to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.

Total: 60 Hours

Reference(s)

1. E. Horowitz, S. Sahni, Fundamental of Computer Algorithms, 2nd edition, Jan 2008
2. A. Aho, J. Hopcroft and J. Ullman, The Design and Analysis of Computer Algorithms, June 1974
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, 2nd edition, 1990
4. S. Baase, Computer Algorithms-Introduction to Design and Analysis, Dec 1999
5. D. E. Knuth, The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3, Dec 2005
6. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information, Dec 2010

19CB502 COMPILER DESIGN 3 0 0 3

Course Objectives

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

Programme Outcomes (POs)

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.

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. Analyze the output generated in each phase of the compiler and construct finite automata for regular expression.
2. Construct Top down and Bottom up parser for Context free grammars.
3. Generate intermediate code for programming constructs
4. Apply memory allocation in symbol table and improve the code using optimization techniques.
5. 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		1									
2		3	3		1									
3		2	2											
4		2	1											
5		2	1											

UNIT I **9 Hours**

INTRODUCTION

Phases of compilation and overview-Lexical Analysis (scanner), Regular languages-Finite Automata-Regular expressions-Relating regular expressions and finite automata-Scanner generator(Lex, flex).

UNIT II **10 Hours**

SYNTAX ANALYSIS (PARSER)

Context-free languages and grammars, Push-down Automata-LL(1) grammars and top-down parsing, Operator grammars-LR(0)-SLR(1)-LR(1)-LALR(1) grammars and bottom-up parsing, Ambiguity and LR parsing, LALR(1) parser generator(yacc, bison)

UNIT III **9 Hours**

SEMANTIC ANALYSIS AND INTERMEDIATE CODE GENERATION

Attribute grammars-Syntax directed definition - Evaluation and flow of attribute in a syntax tree. Intermediate Code Generation: Translation of different language features, different types of intermediate forms

UNIT IV **9 Hours**

CODE IMPROVEMENT (OPTIMIZATION)

Symbol Table-Basic structure, Symbol attributes and management, Run-time environment, Procedure activation, Parameter passing, Value return, Memory allocation, Scope, Code Improvement (optimization)-Control-flow, Data-flow dependence, Local optimization, Global optimization, Loop optimization, Peep-hole optimization, etc

UNIT V **8 Hours**

ARCHITECTURE DEPENDENT CODE IMPROVEMENT

Instruction scheduling for pipeline-Loop optimization for cache memory etc, Register allocation and target code generation.

FOR FURTHER READING

Type systems-Data abstraction-Compilation of Object Oriented features and non-imperative programming languages.

Total: 45 Hours

Reference(s)

1. V. Aho, R. Sethi and J. Ullman, Compilers: Principles, Techniques and Tools, Dec 2005
2. Levine R. John, Tony Mason and Doug Brown, Lex & Yacc, Jan 1992
3. Bjarne Stroustrup, The Design and Evolution of C++, April 1994

19CB503 BUSINESS STRATEGY 3 0 0 3

Course Objectives

- To help the students to learn the process of strategic management
- To scan internal and external environment with the help of appropriate tools for strategic decision making
- To expose students to the strategic ideas of diversification and growth in management
- To help students develop skills for applying management concepts as a solution to the business problems
- To enable the students to have an insight into strategic implementation and control

Programme Outcomes (POs)

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.

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

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the fundamental concepts of strategic management
2. Apply holistic approach by integrating various perspectives to develop appropriate organisational policies and strategies
3. Understand and make decisions in through various tools and techniques
4. Identify the growth avenues against the back drop of the opportunities
5. Develop the skills on implementation of strategy through organisational structure and control systems

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO STRATEGIC MANAGEMENT

Importance of Strategic Management-Vision and Objectives-Schools of thought in Strategic Management-Strategy Content, Process, and Practice-Fit Concept and Configuration Perspective in Strategic Management

UNIT II **9 Hours**

INTERNAL ENVIRONMENT OF FIRM

Recognizing a Firms Intellectual Assets-Core Competence as the Root of Competitive Advantage-Sources of Sustained Competitive Advantage-Business Processes and Capabilities-based Approach to Strategy

UNIT III **9 Hours**

EXTERNAL ENVIRONMENTS OF FIRM

Competitive Strategy -Five Forces of Industry Attractiveness that Shape Strategy -The concept of Strategic Groups, and Industry Life Cycle-Generic Strategies-Generic Strategies and the Value Chain

UNIT IV **9 Hours**

CORPORATE STRATEGY, AND GROWTH STRATEGIES

The Motive for Diversification-Related and Unrelated Diversification-Business Portfolio Analysis-Expansion, Integration and Diversification-Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

UNIT V **9 Hours**

STRATEGY IMPLEMENTATION

Structure and Systems -The 7S Framework -Strategic Control and Corporate Governance

Total: 45 Hours

Reference(s)

1. Robert M. Grant, Contemporary Strategic Management, 7th Edition Blackwell, 2012
2. M.E. Porter, Competitive Strategy, first Edition, THE FREE PRESS,1980.
3. Richard Rumelt, Competitive Advantage, 2011
4. Richard Rumelt, Good Strategy Bad Strategy: The Difference and Why It Matters, Profile Books,2011

19CB504 DESIGN THINKING **2 0 2 3**

Course Objectives

- Understand and compare the important of design thinking
- Identify the steps in the design thinking (DT) process

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Interpret the importance of design thinking and steps in the DT process
2. Analyse empathize phase of design thinking
3. Compare the different perspectives on personas in the define phase
4. Analyse the ideate phase of design thinking
5. Recognize the importance of the prototype and testing phase in DT

Articulation Matrix

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

UNIT I **6 Hours**

INTRODUCTION

Introduction-Importance of Design Thinking (DT) -Design Thinking for business-Design Thinking for an Individual-Steps in the DT process- Empathize-Define-Ideate-Prototype-Test.

UNIT II **6 Hours**

EMPATHY PHASE

Empathy Phase:-Steps in the empathize phase of DT- Empathy- What, How, Why-Different types to developing Empathy towards People-Steps required to conduct an immersion activity-How to empathize- Introduction to Immersion Activity-Conducting an immersion activity-DT question template for Immersion activity

UNIT III **6 Hours**

DEFINE PHASE

Creating personas- Steps to create personas in the define phase of DT- Creating your own Persona- Four Different Perspectives on Personas-Goal-directed Personas, Role-Based Personas, Engaging Personas, Fictional Personas-Steps to create your Engaging Personas and Scenarios -Steps to create problem statements in the define phase of DT -Problem statements-Defining problem statements- Problem statements in define phase of DT

UNIT IV **6 Hours**

IDEATE PHASE

How to Ideate-Steps in the ideate phase of DT-Applying the steps in the ideate phase of DT-Ideation games- Six Thinking Hats and Million-dollar idea -Ideate to find solution-Characteristics Required for Successful Ideation-Doodling for expressing ideas-Importance of storytelling in presenting ideas and prototypes-Storytelling in DT

UNIT V **6 Hours**

PROTOTYPE AND TESTING PHASE

Importance of the prototype phase in DT-Prototype your idea-Create a prototype-Types of Prototyping-Low-Fidelity Prototyping and High-Fidelity Prototyping-Guidelines for Prototyping-Service value proposition-Creating a value proposition statement-Testing in Design Thinking-Test the Prototype -Role of DT in your work -DT for better coding -Agile and DT complement each other to deliver customer Satisfaction-Satori

1 **5 Hours**

EXPERIMENT 1

Design a mind map of design thinking

2 **5 Hours**

EXPERIMENT 2

Thirty circle Exercise-ideation

3 **5 Hours**

EXPERIMENT 3

Construct an empathy map for a given case study

4 **5 Hours**

EXPERIMENT 4

Develop customer journey map for a given case study

5 **5 Hours**

EXPERIMENT 5

Develop a web app for online doctor consultation (model)

6 **5 Hours**

EXPERIMENT 6

Develop a mobile app for home food Delivery Company (model)

Total: 60 Hours

Reference(s)

1. Mauricio Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena and Beatriz Russo, Design Thinking: Business innovation, First Edition,MJV Press, 2014.
2. Mads Soegaard, The Basics of User Experience Design by Interaction Design Foundation, Kindle Edition,2018
3. Nir Eyal, Hooked: How to Build Habit-Forming Products, Kindle Edition, Penguin Publishers, 2011
4. Judkins, The Art of Creative Thinking, Kindle Edition, Hachette Book Publishing,2015
5. Dan Senor and Saul Singer, Start Up Nation, , Kindle Edition, Twelve Publishers,2011.
6. Simon Sinek, Start with Why, Kindle Edition, Portfolio Publishers, 2011.

19CB507 COMPILER DESIGN LABORATORY 0 0 2 1

Course Objectives

- Understand the functions of each phase of the compiler
- Implement the phases of a compiler
- Familiar with Lex and YACC tool

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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. Identify and implement the phases of compiler
2. Implement scanner and parser using Lex and YACC.

Articulation Matrix

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

1 **3 Hours**

EXPERIMENT 1

Develop a lexical analysers to recognize a few patterns for a given language. Ex. identifiers, constants, comments, operators etc. The lexical analyser should ignore redundant spaces, tabs and new lines. It should also ignore comments.

2 **3 Hours**

EXPERIMENT 2

Implement Lex programs for the following:
a. Count the number of characters, words , spaces and lines
b. Check valid Mobile Number
c. Accept valid email

3 **3 Hours**

EXPERIMENT 3

Write a program for syntax checking for looping statements using LEX and YACC.

4 **3 Hours**

EXPERIMENT 4

Write a program for syntax checking for control statements using LEX and YACC

5 **3 Hours**

EXPERIMENT 5

Write a program for syntax checking for declaration statements using LEX and YACC

6 **3 Hours**

EXPERIMENT 6

Write a program for syntax checking for functions using LEX and YACC

7 **3 Hours**

EXPERIMENT 7

Implement a desk calculator using LEX and YACC

8 **3 Hours**

EXPERIMENT 8

Generate three address code for a simple program using LEX and YACC

9 **3 Hours**

EXPERIMENT 9

Implementation of Code Optimization techniques

10 **3 Hours**

EXPERIMENT 10

Implementation of Code generation technique for an optimized intermediate code

Total: 30 Hours

19CB601 COMPUTER NETWORKS 2 1 0 3

Course Objectives

- Understand the network protocols, architecture and applications
- Gain knowledge about the functions of different network layers
- Familiar with the various aspects of computer networks

Programme Outcomes (POs)

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.

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

m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Illustrate the basic concept in modern data communication and computer networking
2. Apply the functions of different layers and in depth knowledge of data link layer
3. Analyze the different protocols and network layer components
4. Outline the basic functions of transport layer and congestion in networks
5. Analyze the working of application layer along with the protocols used

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
3					2		2							
4					2		2							
5					2		3							

UNIT I **7 Hours**

INTRODUCTION

Computer networks and distributed systems-Classifications of computer networks-Preliminaries of layered network structures-Data communication Components -Representation of data and its flow-Various Connection Topology-Protocols and Standards-OSI model, Transmission Media-LAN-Wired LAN-Wireless LAN-Virtual LAN-Techniques for Bandwidth utilization-Multiplexing-Frequency division-Time division and Wave division-Concepts on spread spectrum.

UNIT II **6 Hours**

DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER

Fundamentals of Error Detection and Error Correction-Block coding-Hamming Distance-CRC-Flow Control and Error control protocols-Stop and Wait-Go-back-N ARQ-Selective Repeat ARQ-Sliding

Window-Piggybacking-Random Access-Multiple access protocols -Pure ALOHA-Slotted ALOHA-CSMA-CD-CDMA-CA

UNIT III **5 Hours**

NETWORK LAYER

Switching-Logical addressing-IPV4-IPV6-Address mapping-ARP-RARP-BOOTP and DHCP-Delivery-Forwarding and Unicast Routing protocols.

UNIT IV **5 Hours**

TRANSPORT LAYER

Process to Process Communication-User Datagram Protocol (UDP)-Transmission Control Protocol (TCP)-Stream Control Transmission Protocol (SCTP)-Congestion Control-Quality of Service (QoS)-QoS improving techniques-Leaky Bucket and Token Bucket algorithms.

UNIT V **7 Hours**

APPLICATIONLAYER

DNS-DDNS-TELNET-EMAIL-FTP-WWW-HTTP-SNMP-Bluetooth-Firewalls-Network Security-Electronic mail-directory services and network management-Basic concepts of Cryptography

Total: 45 Hours

Reference(s)

1. A. Tannenbaum,Computer Networks, Pearson,Fifth edition, 2013
2. William Stallings,Data and Computer Communication, Prentice Hall,2007
3. Kaufman, R. Perlman and M. Speciner, Network Security, Pearson ,2016
4. W. Richard Stevens,UNIX Network Programming, Vol. 1, 2 & 3, First Edition,Prentice-Hall,2004

19CB602 INFORMATION SECURITY 2 1 2 4

Course Objectives

- Understand information security" s importance in our data-driven digital world.
- Acquire the knowledge of key concepts of information security and how they work.
- Develop a Security mindset learn how to critically analyze situations of computer and network usage from a security perspective, identifying the salient issues, technologies, policies, laws, standards, and practices.

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.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. To understand the overview of computer security.
2. To understand the information security policy and access control models in information security
3. To design the security system based on the design principles, assurance technique and system evaluation
4. To analyze logic based systems that challenges security and digital forensic
5. To analyze security features in operating systems and in Database 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	3				2							2

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

UNIT I **4 Hours**

OVERVIEW OF SECURITY PARAMETERS

Overview: Confidentiality, integrity and availability - Security violation and threats- Security policy and procedure- Assumptions and Trust- Security Assurance, Implementation and Operational Issues- Security Life Cycle.

UNIT II **6 Hours**

ACCESS CONTROL MODELS AND SECURITY POLICIES

Access Control Models: Discretionary, mandatory, role-based and task-based models, unified models, access control algebra, temporal and spatio-temporal models. Security Policies: Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards.

UNIT III **7 Hours**

SYSTEM DESIGN

Systems design: Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems.

UNIT IV **8 Hours**

LOGIC BASED SYSTEM

Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security. Special Topics: Data privacy, introduction to digital forensics, enterprise security specification.

UNIT V **5 Hours**

OPERATING SYSTEMS SECURITY AND DATABASE SECURITY

Operating Systems Security: Security Architecture, Analysis of Security in Linux/Windows. Database Security: Security Architecture, Enterprise security, Database auditing.

1 **15 Hours**

EXPERIMENT 1

Analysis of security in Unix/Linux

2 **15 Hours**

EXPERIMENT 2

Administration of users, password policies, privileges and roles

Total: 75 Hours

Reference(s)

1. Security Engineering, Ross Anderson
2. Computer Security: Art and Science, M. Bishop, Pearson Education.
3. Information Security: Principles and Practice, M. Stamp.
4. Security in Computing, C.P. Pfleeger, S.L. Pfleeger, J. Margulies
5. Secure Programming HOWTO, David Wheeler.
6. Browser Security Handbook, Michael Zalewski.

19CB603 ARTIFICIAL INTELLIGENCE 2 0 4 4

Course Objectives

- Provide comprehensive and in-depth knowledge of AI principles and techniques by introducing AI fundamental problems
- Understand the basic concepts of analytic functions and method of construction in complex analysis

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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

Course Outcomes (COs)

1. Compare AI with human intelligence and traditional information processing, and discuss its strengths and limitations and its application to complex and human-centered problems
2. Analyze the structures and algorithms selection in Artificial Intelligence techniques related to searching techniques
3. Analyze the Importance of constraint satisfaction problem
4. Apply predicate logic to solve knowledge representation issues.
5. Understand probabilistic reasoning and planning techniques

Articulation Matrix

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

UNIT I **4 Hours**

INTRODUCTION AND OVERVIEW OF ARTIFICIAL INTELLIGENCE

Problems of AI- AI technique, -Tic - Tac - Toe Problem-Intelligent Agents- Agents & environment- nature of environment- structure of agents- goal based agents- utility based agents- learning agents.

UNIT II **8 Hours**

PROBLEM SOLVING AND SEARCH TECHNIQUES

Defining the problem as state space search- production system- problem characteristics- issues in the design of search programs. Problem solving agents- searching for solutions- uniform search strategies: breadth first search, -depth first search- depth limited search- bidirectional search-comparing uniform search strategies. Heuristic search strategies Greedy best-first search- A* search-AO* search- memory

bounded heuristic search: local search algorithms & optimization problems: Hill climbing search- simulated annealing search- local beam search

UNIT III **6 Hours**

CONSTRAINT SATISFACTION PROBLEMS

Local search for constraint satisfaction problems- Adversarial search- Games, optimal decisions & strategies in games- the minimax search procedure- alpha-beta pruning- additional refinements- iterative deepening. Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

UNIT IV **6 Hours**

KNOWLEDGE REPRESENTATION

Knowledge representation issues- representation & mapping- approaches to knowledge representation. Using predicate logic- representing simple fact in logic- representing instant & ISA relationship- computable functions & predicates- resolution, natural deduction. Representing knowledge using rules- Procedural verses declarative knowledge- logic programming- forward verses backward reasoning- matching- control knowledge.

UNIT V **6 Hours**

REASONING

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

1 **6 Hours**

EXPERIMENT 1

Solving Missionaries and cannibals problems

2 **6 Hours**

EXPERIMENT 2

Solving Water Jug Problem

3 **6 Hours**

EXPERIMENT 3

Solving 8 queens problem

4 **6 Hours**

EXPERIMENT 4

Travelling Salesman Problem

5 **6 Hours**

EXPERIMENT 5

Solving Wampus Problem using Logic

6 **6 Hours**

EXPERIMENT 6

Monkeys and Bananas Problem using Logic

7 **6 Hours**

EXPERIMENT 7
Bayesian Classification Problem

8 **6 Hours**

EXPERIMENT 8
Decision Tree Problem

9 **6 Hours**

EXPERIMENT 9
Developing a sentiment analysis systems

10 **6 Hours**

EXPERIMENT 10
Development of Medical Expert system with Recommendation system

Total: 90 Hours

Reference(s)

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach 2016
2. Artificial Intelligence, Russel, Pearson 2016
3. Artificial Intelligence, Ritch & Knight, TMH.2008
4. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
5. Logic & Prolog Programming, Saroj Kaushik, New Age International,2007
6. Expert Systems, Giarranto, VIKAS 1998

19HS604 BUSINESS COMMUNICATION AND VALUE SCIENCE-IV 2 0 2 3

Course Objectives

- To understand the importance of Diversity in workplace
- To recognize the importance of Emotional Intelligence, Multiple Intelligences, and Learner Styles
- To develop communicative writing and apply public speaking in real-life scenarios
- To recognize the importance of Corporate Social Responsibility, Corporate Etiquette, Stress Management, Time Management and Conflict Management

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Use tools of structured written communication and hone public speaking skills
2. Apply emotional intelligence and knowledge of multiple intelligences, and learning styles in real-life scenarios
3. Understand the importance of diversity in workplace and corporate social responsibility
4. Identify and practice best time management, stress management practices
5. Recognize and cultivate the attributes needed to function and grow in a corporate environment

Articulation Matrix

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

UNIT I **10 Hours**

WORKPLACE ENVIRONMENT AND BUSINESS WRITING

Importance of diversity in workplace,Diversity in corporate environments,Principles of Communicative Writing,Formal and Business letters,best practices for writing business proposals ,using charts and graphs in communicative writing,emotional intelligence,public speaking at workplace and real life scenarios,role plays

UNIT II **5 Hours**

CORPORATE SOCIAL RESPONSIBILITY

Importance of Corporate Social Responsibility(CSR),attributes needed to function and grow in a corporate environment

UNIT III **5 Hours**

FEEDBACK AND EMOTIONAL INTELLIGENCE

Image Management,best practices to share and receive feedback ,Applying emotional intelligence in real life scenarios

UNIT IV **5 Hours**

MULTIPLE INTELLIGENCES AND CONFLICT MANAGEMENT

Multiple intelligence and learning styles in interpersonal interactions,impact of conflicts,guidelines to manage conflicts,key features of corporate etiquette,business idioms and corporate terms

UNIT V **5 Hours**

STRESS, TIME MANAGEMENT AND PROJECT WORK

Impact of stress in life and work,managing stress,best practices to manage stress, importance of time management, best time management practices

1 **30 Hours**

EXPERIMENT 1

Project work: proof of concept for a start-up

Total: 60 Hours

Reference(s)

1. Daniel Goleman, Emotional Intelligence: Why it can Matter More than IQ.1996
2. Ryback David, Putting Emotional Intelligence to Work.2012
3. Dale Carnegie, How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion.
4. TED Talks, The official TED guide to public speaking-Tips and tricks for giving unforgettable speeches and presentations.2016

19CB607 COMPUTER NETWORKS LAB 0 0 2 1

Course Objectives

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and 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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand fundamental underlying principles of computer networking
2. Understand details and functionality of layered network architecture
3. Analyze performance of various communication protocols.
4. Practice packet /file transmission between nodes.

Articulation Matrix

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

1 **3 Hours**

EXPERIMENT 1

Study of system administration and network administration

2 **3 Hours**

EXPERIMENT 2

Study of socket programming and client server model using UDP and TCP

3 **3 Hours**

EXPERIMENT 3

Implementation of sliding window protocol and stop and wait protocol

4 **3 Hours**

EXPERIMENT 4

Applications using TCP Sockets like
a. File transfer
b. Remote command execution
c. Chat
d. Concurrent server

5 **3 Hours**

EXPERIMENT 5

Create a socket for HTTP for webpage upload and download

6 **3 Hours**

EXPERIMENT 6

Implementation of Subnetting Applications
a. DNS
b. SNMP

7 **3 Hours**

EXPERIMENT 7

Study of Network Simulator-3(NS3)

8 **3 Hours**

EXPERIMENT 8

Study of PUTTY (NETWORK FILE TRANSFER APPLICATION)

9 **3 Hours**

EXPERIMENT 9

Perform a case study about ETTERCAP (NETWORK SECURITY TOOL).

10 **3 Hours**

EXPERIMENT 10

Write a code simulating PING and TRACEROUTE commands

Total: 30 Hours

Reference(s)

1. Tanenbaum, Computer Networks, Pearson Education, 5th Edition, 2013.
2. William Stallings. Data and computer communications. Pearson Education India, 2013.

19CB701 USABILITY DESIGN OF SOFTWARE APPLICATIONS

3 0 0 3

Course Objectives

- Acquire Knowledge of quantitative user design and evaluating product assignments
- Independently plan, perform and make a report about both an expert evaluation and an evaluation of assignment and research.
- Describe the relation between design review and evaluation of projects, especially the relation between usability and design

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and 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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the user-cantered design process to evaluate the different Assignments
2. Apply heuristic evaluation techniques to evaluate the website and application
3. Generate ideas for developing and testing innovation through an assignment presentation
4. Understand the UX research techniques for analysing the application
5. Analyse the personal technique for different projects

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO USER CENTRED DESIGN

Aspects of User Centred Design - Product Appreciation Assignment - Evaluating the product from user centred design aspects such as functionality - ease of use - ergonomics - aesthetics.

UNIT II **9 Hours**

HEURISTIC EVALUATION

Heuristic Evaluation-10 Heuristic Principles-Examples-Heuristic Evaluation-Group Assignment initiation -Website and App- Evaluation for key tasks of the app or website for heuristic principles-severity - recommendations.

UNIT III **9 Hours**

GROUP ASSIGNMENT PRESENTATIONS AND REVIEWS

Discovery -Define-Design-Implement-Design Prototype -Usability Testing.

UNIT IV **9 Hours**

UX RESEARCH

Understanding users -their goals -context of use-environment of use-Research Techniques-Contextual Enquiry-User Interviews -Competitive Analysis for UX.

UNIT V **9 Hours**

SCENARIOS AND PERSONA TECHNIQUE

Presentation of Personas for the group project-Design Thinking Technique -Discovery and brainstorming-Concept Development-Task flow detailing for the Project-Prototyping Techniques-Paper-Electronic -Prototyping Tools

Total: 45 Hours

Reference(s)

1. Jenny Preece, Helen Sharp and Yvonne Rogers,Interaction Design: Beyond Human-Computer Interaction, 4th Edition, , 2015
2. About Face,4th Edition, Alan Cooper and Robert Reimann,Wiley,2014
3. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed,Observing the User Experience, Second Edition,A Practitioner"s Guide to User Research,2012
4. Jesse James Garrett,The Elements of User Experience User-Centered Design for the Web and Beyond,2nd Edition,New Riders2021
5. Jonny Schneider,Understanding Design Thinking, Lean, and Agile, 2017

19CB702 IT WORKSHOP 3 0 0 3

Course Objectives

- Understand the basic working principles of MATLAB.
- Understand the workspace and miscellaneous commands of MATLAB.
- Analysing matrix, array and basic mathematical functions
- Applying the basic plotting done using MATLAB
- Apply the different programming logics which help to complete different plotting structures.

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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Formulate the basic principles of MATLAB operations
2. Represent the working session and multiple statements per line in MATLAB.
3. Represent the concepts of sub matrix and its operation
4. Apply the language of graphs and trees to the real world problems.
5. Apply formalized arguments based on conditional looping statements

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
3	1				2									
4	3												1	2
5	1				1									

UNIT I **9 Hours**

MATLAB

History - basic features - strengths and weaknesses - good programming practices and plan your code. Creating MATLAB variables - overwriting variable - error messages - making corrections - controlling the hierarchy of operations or precedence - controlling the appearance of floating point number

UNIT II **9 Hours**

WORKSPACE AND MISCELLANEOUS COMMANDS

Managing the workspace - keeping track of your work session - entering multiple statements per line - miscellaneous commands.

UNIT III **9 Hours**

MATRIX, ARRAY AND BASIC MATHEMATICAL FUNCTIONS

Matrix generation, entering a vector, entering a matrix - matrix indexing, colon operator - linear spacing - creating a sub-matrix - dimension, matrix operations and functions matrix generators - special matrices- array and array operations - solving linear equations- other mathematical functions.

UNIT IV **9 Hours**

BASIC PLOTTNG

Overview - creating simple plots - adding titles - axis labels - and annotations - multiple data sets in one plot - specifying line styles and colours.

UNIT V **9 Hours**

INTRODUCTION TO PROGRAMMING

Introduction - M-File Scripts - script side-effects - M-File functions - anatomy of a M-File function - input and output arguments - input to a script file - output commands - Control flow and operators- if-end, structure - relational and logical operators-for-end, loop-while, end, loop-other flow structures, operator precedence, saving the output to a file-Debugging M-files-Debugging process, preparing for debugging, setting breakpoints, running with breakpoints-examining values-correcting and ending debugging-correcting an M-file, Implementation of various Image Processing Algorithms

Total: 45 Hours

Reference(s)

1. Digital Image Processing using MATLAB. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education, Inc., 2004.
2. MATLAB: A Practical Introduction to Programming and Problem Solving. Stormy Attaway, Butterworth-Heinemann, 2017.

19CB703 SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT **3 0 0 3**

Course Objectives

- Understand how service performance can be improved by studying services operations management
- Analyse the Service facility design, facility location and Service Quality
- Analyse the role of inventory in services and managing the service supply relationship

Programme Outcomes (POs)

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the concept of service operation system
2. Analysis of service development and delivery system
3. Understand the service design and quality
4. Explore the forecasting demand of services
5. Analyse the strategies for managing service supply relationship

Articulation Matrix

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

UNIT I **8 Hours**

INTRODUCTION

Introduction-Introduction to the course-Introduction to service operations-Role of service in economy and society-Introduction to Indian service sector-Nature of Services and Service Encounters-

Differences between services and operations-Service package-characteristics-various frameworks to design service operation system-Kind of service encounter-importance of encounters.

UNIT II **10 Hours**

SERVICE-DOMINANT LOGIC

From Goods-Dominant logic to Service-Dominant logic-Value Co-creation-Service Strategy and Competitiveness-Development of Strategic Service Vision (SSV) -Data Envelopment Analysis-New Service Development-NSD cycle -Service Blueprinting-Elements of service delivery system.

UNIT III **9 Hours**

SERVICE DESIGN

Customer Journey and Service Design-Design Thinking methods to aid Service Design-Locating facilities and designing their layout-models of facility locations (Huff""s retail model) -Role of service-scape in layout design-Service Quality-SERVQUAL-Walk through Audit-Dimensions of Service quality & other quality tools-Service Guarantee & Service Recovery-How to provide Service guarantee-How to recover from Service failure

UNIT IV **9 Hours**

FORECASTING DEMAND FOR SERVICES

A review of different types of forecasting methods for demand forecasting-Managing Capacity and Demand-Strategies for matching capacity and demand-Psychology of waiting-Application of various tools used in managing waiting line in services -Managing Facilitating Goods-Review of inventory models-Role of Inventory in services.

UNIT V **9 Hours**

MANAGING SERVICE SUPPLY RELATIONSHIP

Understanding the supply chain/hub of service-Strategies for managing suppliers of service-Vehicle Routing Problem-Managing after sales service-Understanding services that involve transportation of people and vehicle-Techniques for optimizing vehicle routes-Service Innovation-Services Productivity-Need for Services Innovation.

Total: 45 Hours

Reference(s)

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, 7th edition, McGraw Hill publications, 2019.
2. Wilson, A., Zeithaml, V. A., Bitner, M. J., &Gremler, D. D. Services marketing: Integrating customer focus across the firm, Seventh Edition, McGraw Hill, 2017.
3. Lovelock, C. Services Marketing, 7/e. Pearson Education India, 2011.
4. Reason, Ben, and Lovlie, Lavrans, Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India, 2016.
5. Chesbrough, H. Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons, 2010

19CB704 IT PROJECT MANAGEMENT 3 0 2 4

Course Objectives

- Understand what is a project management and scheduling
- Analyse the project management features and feasibility studies.
- Understand the purpose of SURUM and DEVOPS in project management.

Programme Outcomes (POs)

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the concept of project management.
2. Understand the project management scheduling
3. Analyse the features of project management with respect to AGILE model.
4. Explore the services of SURUM.
5. Understand the concept of Devops in project 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
3			2										2	
4					2									2
5					1				1	1				2

UNIT I **8 Hours**

PROJECT OVERVIEW AND FEASIBILITY STUDIES

Identification - Market and Demand Analysis- Project Cost Estimate, Financial Appraisal

UNIT II **9 Hours**

PROJECT SCHEDULING PROJECT SCHEDULING

Project Scheduling, Introduction to PERT and CPM - Critical Path Calculation - Precedence Relationship - Difference between PERT and CPM - Float Calculation and its importance - Cost reduction by Crashing of activity - Cost Control and Scheduling: Project Cost Control (PERT/Cost - Resource Scheduling & Resource Levelling

UNIT III **9 Hours**

PROJECT MANAGEMENT FEATURES

Risk Analysis-Project Control-Project Audit and Project Termination-Introduction, Agile Principles-Agile methodologies-Relationship between Agile Scrum-Lean-DevOps and IT Service Management (ITIL)

UNIT IV **10 Hours**

AGILE PROJECT MANAGEMENT

Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum-Lean-DevOps and IT Service Management (ITIL)-Scrum-Various terminologies used in Scrum-Sprint, product backlog- sprint backlog-sprint review-retro perspective-various roles (Roles in Scrum)-Best practices of Scrum

UNIT V **9 Hours**

DEVOPS

Overview and its Components-Containerization Using Docker-Managing Source Code and Automating Build-Automated Testing and Test Driven Development-Continuous Integration-Configuration Management-Continuous Deployment-Automated Monitoring-Other Agile Methodologies-Introduction to XP FDD-DSDM-Crystal

1 **5 Hours**

EXPERIMENT 1

How to start the project

2 **5 Hours**

EXPERIMENT 2

Creating a basic work breakdown structure (WBS)

3 **5 Hours**

EXPERIMENT 3

Adding more details to the WBS

4 **5 Hours**

EXPERIMENT 4

Adding resources to the WBS

5 **5 Hours**

EXPERIMENT 5

Printing an formatting the project information

6 **5 Hours**

EXPERIMENT 6

Assigning cost information to a task

Total: 75 Hours

Reference(s)

1. Mike Cohn, Succeeding with Agile: Software Development Using Scrum, 2021.
2. Roman Pichler, Agile Product Management with Scrum, 2021.
3. Ken Schwaber, Agile Project Management with Scrum (Microsoft Professional), 2004.

19CB707 SERVICES SCIENCE AND SERVICE OPERATIONAL MANAGEMENT

0 0 4 2

Course Objectives

- To understand how to design the operations so as to improve simultaneously efficiency and effectiveness through the implementation of best practices.

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.
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. Develop an understanding of the terminology and responsibilities that relate to Service Operations Management.
2. Describe the function of the Service Operations Management discipline in various sectors of the economy through case study
3. Interpret basic tools and skills used in solving problems traditionally associated with operating the service operations system

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	1	2			2									

1 **7 Hours**

EXPERIMENT 1

Design a new super market in a cosmopolitan city (Identify important attributes, specify attribute levels, experimental design, presentation of alternatives to respondents and estimation of choice model)

2 **7 Hours**

EXPERIMENT 2

Choose any service organization and present it from the perspective of nature of service, classification of service, blueprint or service design analysis, and service quality

3 **7 Hours**

EXPERIMENT 3

Prepare a service blueprint for a fast food outlet.

4 **7 Hours**

EXPERIMENT 4

Using data, software, user and mashup as services prepare a next gen service oriented architecture.

5 **7 Hours**

EXPERIMENT 5

Prepare a review article after analysing 5 relevant papers in services and explain your understanding and feedback on the same.

6 **7 Hours**

EXPERIMENT 6

Analyse a fortune 500 company in digital media and point out how these technologies could be effectively used in a start up in digital space.

7 **9 Hours**

EXPERIMENT 7

Analyse the booking policy of an international flight operator, assuming that the average number of no shows is 10 percent, explain why the best overbooking necessary isn't be 10 percent always.

8 **9 Hours**

EXPERIMENT 8

Prepare a comparative chart analysing any four food delivery agencies and rank them based on reliability, responsiveness, assurance, and empathy.

Total: 60 Hours

Reference(s)

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology,7th edition, McGraw Hill publications , 2019
2. Wilson, A., Zeithaml, V. A., Bitner, M. J., &Gremler, D. D. Services marketing: Integrating customer focus across the firm, Seventh Edition, McGraw Hill, 2017.
3. Lovelock, C. Services Marketing, 7/e. Pearson Education India, 2011.
4. Reason, Ben, and Lovlie, Lavrans, Service Design for Business: A Practical Guide to Optimizing the Customer Experience, Pan Macmillan India, 2016.
5. Chesbrough, H. Open services innovation: Rethinking your business to grow and compete in a new era. John Wiley & Sons, 2010

19CB001 CONVERSATIONAL SYSTEMS 3 0 0 3

Course Objectives

- Enable attendees to acquire knowledge on chatbots and its terminologies.
- Work with ML Concepts and different algorithms to build custom ML Model
- Better understand on Conversational experiences and provide better customer experiences

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.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Classify the fundamentals of conversational systems
2. Outline the basic concepts in chatbots using the Natural Language Processing.
3. Design a chatbot using Conversational Artificial Intelligence Systems.
4. Analyze how conversational systems uses ML technologies.
5. Outline the XR technologies in Conversational Systems.

Articulation Matrix

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

UNIT I **9 Hours**

FUNDAMENTALS OF CONVERSATIONAL SYSTEMS

Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI, Underlying technologies-Natural Language Processing, Artificial Intelligence, and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision, etc, Introduction to Top players in Market-Google, MS, Amazon &Market trends Messaging Platforms (Facebook, WhatsApp) and Smart speakers-Alexa, Google Home and other new channels Ethical and Legal Considerations in AI Overview

UNIT II **9 Hours**

FOUNDATIONAL BLOCKS FOR PROGRAMMING AND NATURAL LANGUAGE PROCESSING

Basic Python programming concepts, Node Basics, Coding Best Practices, Evaluation Test(Hands-On)-1HR, Introduction-Brief history, Basic Concepts, Phases of NLP, Application of chatbots, General chatbot architecture, Basic concepts in chatbots-Intents, Entities, Utterances, Variables and Slots, Fulfillment Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc), Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation, Information Extraction, Sentiment Analysis, NLP using Python-Make use of any of the NLP libraries like NLTK, spaCy, StanfordNLP, etc, (Practice session to use an NLP Tool -Hands-on), Affective NLG

UNIT III **9 Hours**

BUILDING A CHATBOT/CONVERSATIONAL AI SYSTEMS

Fundamentals of Conversational Systems (NLU, DM, and NLG), Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation, UX design, APIs and SDKs, Usage of Conversational Design Tools, Introduction to popular chatbot frameworks-Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASAChannels-Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps, Overview of CE Testing techniques, A/B Testing, Security &Compliance-Data Management, Storage, GDPR, PCI, Building a Voice/ChatBot - Hands-on

UNIT IV **9 Hours**

ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES

Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, etc, to effectively converse.

UNIT V **9 Hours**

CONTACT CENTERS AND OVERVIEW ON CONVERSATIONAL ANALYTICS

Introduction to Contact centers-Impact & Terminologies, Case studies & Trends, how does a Virtual Agent/Assistant fit in here, Conversation Analytics-The need of it, Introduction to Conversational Metrics, Summary

Total: 45 Hours

Reference(s)

1. Mich ael McTear, Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots (Synthesis Lectures on Human Language Technologies), OCT 2020
2. Nitin Indurkhya, Fred J. Damerau, Handbook of Natural Language Processing,2010.
3. Gerardus Blokdyk , Conversational Chatbots for Analytics Third Edition 2018

19CB002 CLOUD,MICROSERVICES AND APPLICATIONS 3 0 0 3

Course Objectives

- Acquire knowledge of cloud operation and services, security techniques provided by cloud computing.
- Understand the concepts of cloud native applications with micro services.
- Familiar with the cloud monitoring and security operation tools.

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.
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.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understanding the concept of guiding principle, utilization of cloud and pricing options of cloud.
2. Analyze the techniques help to do operation with cloud applications
3. Deploy the functions of cloud with the help of cloud application and its services.
4. Analyze the devops fundamental techniques and tools used for devops operation.
5. Apply the cloud monitoring and network monitoring tools.

Articulation Matrix

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

UNIT I **10 Hours**

CLOUD FUNDAMENTALS

Cloud Fundamentals- Cloud Service Components, Cloud service and Deployment Models - Cloud components Guiding Principle with respect to utilization, Security, Pricing and the applications of Cloud

UNIT II **10 Hours**

APPLICATION ARCHITECTURE

Public Cloud Platforms overview and their usage -Application architectures-Monolithic and Distributed, Micro service fundamental and design approach, Cloud Native applications-12 Factors App. Application integration process, API Fundamental.

UNIT III **9 Hours**

CLOUD MICROSERVICES

Micro service, API management, spring boot Fundamental and design of micro service, API tools-. Developer Portal - Applications of Micro service and APIFICATION

UNIT IV **9 Hours**

DEVOPS FUNDAMENTALS

Devops fundamentals. , Tools and Applications Containerization Process and application - DevOps Tools and their usage in cloud application development, Docker and Containerization Process

UNIT V **7 Hours**

CLOUD SECURITY AND MONITORING TOOLS

Cloud Security and Monitoring Tools.

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. 4. Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, Cloud Computing for Dummies,Wiley India, 2009.
4. TimMather, SubraKumaraswamy, ShahedLatif, CloudSecutiy and Privacy,Oreilly, 2009.
5. IrakliNadareishvili, Ronnie Mitra,MattMcLarty, and Mike Amundsen, Microservice Architecture Aligning Principle, Practice and Culture,2016 Oreilly.
6. Magnus Larsson,Hand-on Microservices with spring Boot and Spring Cloud: Build and delopy Java Microservices using Spring Cloud, Istio, and Kubernetes,Pack 2019.

19CB003 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. 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.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

Course Outcomes (COs)

1. Interpret the machine learning models and relationship between ML and human learning.
2. Identify the problems for machine learning. And select the either supervised, unsupersvised or reinforcement learning.
3. Analyze the various applications of Markov Models and Hidden Markov Models.
4. Apply the various methods using regression techniques
5. Apply the minimum spanning tree clustering and K-nearest neighbors clustering, for problems appear in machine learning.

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

UNIT I **9 Hours**

INTRODUCTION TO MACHINE LEARNING (ML)

Relationship between ML and human learning-A quick survey of major models of how machines learn, Example applications of ML.

UNIT II **9 Hours**

CLASSIFICATION

Supervised Learning-The problem of classification, Feature engineering, Training and testing classifier models, Cross-validation, Model evaluation (precision, recall, F1-mesure, accuracy, area under curve), Statistical decision theory including discriminant functions and decision surfaces, Naive Bayes classification, Bayesian networks, Decision Tree and Random Forests; k-Nearest neighbor classification, Support Vector Machines, Artificial neural networks including backpropagation, Applications of classifications, Ensembles of classifiers including bagging and boosting.

UNIT III **9 Hours**

HIDDEN MARKOV MODELS

Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms, Sequence classification using HMM, Conditional random fields, Applications of sequence classification such as part-of-speech tagging.

UNIT IV **9 Hours**

REGRESSION

Multi-variable regression, Model evaluation, Least squares regression, Regularization, LASSO, Applications of regression, Association rule mining algorithms including apriori, Expectation-Maximization (EM) algorithm for unsupervised learning

UNIT V **9 Hours**

CLUSTERING

average linkage-Wards algorithm, Minimum spanning tree clustering, K-nearest neighbors clustering, BIRCH, CURE, DBSCAN, Anomaly and outlier detection methods.

Total: 45 Hours

Reference(s)

1. R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley, 2001.
2. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2007
3. E. Alpaydin, Introduction to Machine Learning, 3/e, Prentice-Hall, 2014.
4. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
5. A. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.

19CB004 BEHAVIORAL ECONOMICS 3 0 0 3

Course Objectives

- To impart the knowledge on the concepts of behavioural economics
- To introduce the knowledge of biases, beliefs of buyers, self-evaluation, and self-projection
- To provide the knowledge of loss aversion
- To Familiarize intertemporal choice, hyperbolic discounting, and procedural choice
- To introduce the knowledge of game theory and Nash equilibrium.

Programme Outcomes (POs)

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.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Interpret the neoclassical, standard model and behavioral economics
2. Analyze of the statistical decision theory approaches to understanding of the principles of decision making under risk
3. Compare the various theories in the choice under uncertainty
4. Analyze the knowledge of approaches to human decision in time, and the problems related to inconsistency in intertemporal preferences
5. Apply the behavioural concepts in strategic interaction

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

The neoclassical/standard model and behavioral economics in contrast-historical background-behavioral economics and other social sciences-theory and evidence in the social sciences and in behavioral economics-applications-gains and losses-money illusion-charitable donation.

UNIT II **9 Hours**

BASICS OF CHOICE THEORY

Supervised Learning; The problem of classification-Feature engineering-Training and testing classifier models-Cross-validation-Model evaluation (precision, recall, F1-mesure, accuracy, area under curve)-Statistical decision theory including discriminant functions and decision surfaces-Naive Bayes classification-Bayesian networks-Decision Tree and Random Forests-k-Nearest neighbor classification-Support Vector Machines-Artificial neural networks including backpropagation-Applications of classifications-Ensembles of classifiers including bagging and boosting Revisiting rationality-causal aspects of irrationality-different kinds of biases and beliefs-self-evaluation and self-projection-inconsistent and biased beliefs-probability estimation-trading applications-trade in counterfeit goods-financial trading behavior-trade in memorabilia

UNIT III **9 Hours**

CHOICE UNDER UNCERTAINTY

Background and expected utility theory-prospect theory and other theories-reference points- loss aversion-marginal utility-decision and probability weighting-applications-ownership and trade-income and consumption-performance in sports.

UNIT IV **9 Hours**

INTERTEMPORAL CHOICE

Geometric discounting-preferences over time-anomalies of inter-temporal decisions- hyperbolic discounting-instantaneous utility-alternative concepts-future projection-mental accounts-heterogeneous selves-procedural choice-policy analysis-mobile calls-credit cards-organization of government-applications-consumption and savings-clubs and membership-consumption planning.

UNIT V **9 Hours**

STRATEGIC CHOICE

Review of game theory and Nash equilibrium-strategies-information-equilibrium in pure and mixed strategies - iterated games - bargaining - signaling - learning - applications - competitive sports -bargaining and negotiation-monopoly and market entry Individual preferences-choice anomalies and inconsistencies-social preferences-altruism - fairness- reciprocity - trust - learning - communication-intention - demographic and cultural aspects-social norms- compliance and punishment-inequity aversion-policy analysis-norms and markets-labor markets- market clearing-public goods-applications-logic and knowledge- voluntary contribution-compensation design.

Total: 45 Hours

Reference(s)

1. N. Wilkinson and M. Klaes,An Introduction to Behavioral Economics,3rd Edition,Palgrave Macmillan,2012

19CB005 COMPUTATIONAL FINANCE AND MODELING 3 0 0 3

Course Objectives

- Understand existing financial models in a quantitative and mathematical way
- Acquire the knowledge of quantitative tools to solve complex problems in the areas of portfolio management, risk management and financial engineering
- Explain the approaches required to calculate the price of options and Identify the methods required to analyze information from financial data and trading systems
- Acquire the Option products appropriately and construct portfolios of options
- Analyze the financial financial data using for statistical techniques

Programme Outcomes (POs)

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.
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.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Able to construct financial models in a quantitative and mathematical way
2. Apply quantitative tools in Financial Engineering
3. Choose appropriate products from financial markets to hedge the risk
4. Use the Option products appropriately and construct portfolios of options
5. Do the statistical analysis of financial returns

Articulation Matrix

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

UNIT I **9 Hours**

NUMERICAL METHODS FOR FINANCE

Numerical methods relevant to integration-differentiation and solving the partial differential equations of mathematical finance-examples of exact solutions including Black Scholes and its relatives-finite difference methods including algorithms and question of stability and convergence-treatment of near and far boundary conditions-the connection with binomial models-interest rate models-early exercise-and the corresponding free boundary problems-and a brief introduction to numerical methods for solving multi-factor models.

UNIT II **9 Hours**

BLACK SCHOLES FRAMEWORK

Black-Scholes framework: Black-Scholes PDE: simple European calls and puts - put call parity - The PDE for pricing commodity and currency options - Discontinuous payoffs - Binary and Digital options- The Greeks: theta - delta - gamma - vega& rho and their role in hedging - The mathematics of early exercise - American options: perpetual calls and puts - optimal exercise strategy and the smooth pasting condition - Volatility considerations - actual - historical - and implied volatility - local vol and volatility surfaces

UNIT III **9 Hours**

FINANACIAL PRODUCTS AND MARKETS

Financial Products and Markets: Introduction to the financial markets and the products: Equities - indices - foreign exchange and commodities - Options contracts and strategies for speculation and hedging

UNIT IV **9 Hours**

AMERICAN OPTIONS

Application areas include the pricing of American options - pricing interest rate dependent claims and credit risk - The use of importance sampling for Monte Carlo simulation of VaR for portfolios of options - Copulas - hedging in incomplete markets - American Options - Exotic options - Electronic trading, Jump Diffusion Processes - High-dimensional covariance matrices - Extreme value theory, Statistical Arbitrage.

UNIT V **9 Hours**

STATISTICAL ANALYSIS

Statistical Analysis of Financial Returns: Fat - tailed and skewed distributions - outliers - stylized facts of volatility - implied volatility surface and volatility estimation using high frequency data.

Total: 45 Hours

Reference(s)

1. R. Seydel,Tools for Computational Finance, 2nd edition, Springer-Verlag, New York, 2019
2. P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer-Verlag, New York,2003
3. Press, S. Teukolsky, W. Vetterling and B. Flannery, Numerical Recipes in C: The Art of Scientific Computing, Cambridge University Press, Cambridge, UK,1992,Available on-line at: http://www.nr.com/
4. A. Lewis,Option Valuation under Stochastic Volatility, Finance Press, Newport Beach,California, 2016
5. A. Pelsser,Efficient Methods for Valuing Interest Rate Derivatives, Springer-Verlag, New York,2000
6. D. Ruppert, Statistics and Data Analysis for Financial Engineering with R Examples, Second Edition, Springer, 2015

19CB006 INDUSTRIAL PSYCHOLOGY 3 0 0 3

Course Objectives

- Understand the content areas of industrial psychology and the application of psychological theory to organizational issues. Topics include employment law, job analysis, recruitment and selection, training, performance appraisal and discipline, employee motivation, and workplace safety
- Using an applied approach, this course will help prepare students for their roles as employees and managers

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.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understanding the psychological research and fundamental concepts about statistical application to psychology
2. Analyze the criteria of a good psychological test and understand the value of ethical issues in psychological testing
3. Compare the competency based application in Performance Coaching and Evaluation, Evaluating Employee Performance
4. To explore issues of Motivation, Satisfaction and Commitment, Fairness and diversity in organizations
5. To develop an understanding of Leadership, Organizational Culture and to become an Organizational Behavior Practitioner

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO PSYCHOLOGY

What is I/O Psychology-Research Methods-Statistics and Evidence-based Practice-Introduction & Legal Context of Industrial Psychology-Job Analysis & Competency Modelling-Job Evaluation & Compensation-Job Design & Employee Well-Being- Recruitment?

UNIT II **9 Hours**

IDENTIFY CRITERIA AND VALIDATING TESTS

Identifying Criteria & Validating Tests and Measures-Screening Methods-Intensive Methods.

UNIT III **9 Hours**

PERFORMANCE GOALS AND FEEDBACK

Performance Goals and Feedback-Performance Coaching and Evaluation-Evaluating Employee Performance.

UNIT IV **9 Hours**

EMPLOYEE MOTIVATION

Employee Motivation-Satisfaction and Commitment-Fairness and Diversity.

UNIT V **9 Hours**

LEADERSHIP AND STRESS MANAGEMENT

Leadership-Organizational Climate-Culture and Development-Teams in Organizations-The Organization of Work Behavior-Stress Management-Demands of Life and Work.

Total: 45 Hours

Reference(s)

1. Landy, F. J. and Conte, J. M., Work in the 21st Century,4th Edition,Oxford: Blackwell Publishing,2013

19CB007 ROBOTICS AND ITS INDUSTRIAL APPLICATIONS 3 0 0 3

Course Objectives

- Understand the role of robotics and computer vision for the development of automation system in industry 4.0
- Understand the need for artificial intelligence and cloud computing with respect to robotics and develop a framework for robotics.

Programme Outcomes (POs)

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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand Robotic Process Automation in Industry 4.0
2. Analyze the aspects of imaging techniques using Computer vision and Cognitive Robotics
3. Illustrate the application of Artificial Intelligence in industrial robotics
4. Design the software architecture and interface for cloud robotic systems
5. Develop Robot Application framework using Robotic Operating Systems, Python and R.

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

UNIT I **7 Hours**

INTRODUCTION

Industry 4.0 Concept: Background and Overview-Industry 4.0 technologies: implementation patterns in manufacturing companies-Evolution of Industrial Robots and their Applications-Advancements in Robotics and Its Future Uses-Types of robotics in various fields for applications. Technologies essential for Cognitive Robotics - Computer systems and Technologies relevant to modern day robotics-Robotic

Process Automation - Overview of RPA and its applications-RPA, AI, and Cognitive Technologies for Leaders-Introduction to Robotics: Analysis, Control, Applications

UNIT II **10 Hours**

COMPUTER VISION AND COGNITIVE ROBOTICS

Concepts of computer vision and the how vision systems are becoming essential part of Robotics-Computer Vision: Models, Learning, and Inference -Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques-Machine Vision Applications- Application areas for vision systems - Robot inspection case study-Autonomous driving using 3D imaging case study. Data science and big data in the context of cognitive robotics - Cognitive Technologies: The Next Step Up for Data and Analytics in robotics-Cognitive Deep Learning Technology for Big Data Cognitive Assistant Robots for Reducing Variability in Industrial Human-Robot Activities

UNIT III **9 Hours**

ARTIFICIAL INTELLIGENCE AND ROBOTICS

Foundation for Advanced Robotics and AI- A Concept for a Practical Robot Design Process- Demo to train A Robot Using AI - Deep learning core applications-Deep learning business applications. The Review of Reliability Factors Related to Industrial Robots -Failure analysis of mature robots in automated production- Data Analytics for Predictive Maintenance of Industrial Robots - Failure Is an Option: How the Severity of Robot Errors Affects Human-Robot Interaction

UNIT IV **10 Hours**

CLOUD ROBOTIC SYSTEM

Learning Cloud Computing: Core Concepts - Cloud Computing: Private Cloud Platforms -Robot as a Service in Cloud Computing -Cloud Computing Technology and Its Application in Robot Control - A Comprehensive Survey of Recent Trends in Cloud. Google"s cloud robotics and high computing needs of industrial automation and systems-The role of cloud and open source software in the future of robotics-The Power of Cloud Robotics by Robotics Industry Association. A case study of online co-localization for fair resource competence-A Case Study on Model-Based Development of Robotic Systems using Monti Arc with Embedded Automata

UNIT V **9 Hours**

ROBOTIC OPERATING SYSTEM AND PROGRAMMING LANGUAGES

ROS for beginners an overview- Introduction to the Robot Operating System (ROS) Middleware - Secure communication for the Robot Operating System - An Introduction to Robot Operating System: The Ultimate Robot Application Framework by Adnan Quality of Service and Cyber security Communication Protocols -Analysis for the Robot Operating System Robotics systems communication-Threat modelling using ROS. Introduction to Python - Python Functions for Data Science-Basic ROS Learning Python for robotics- An Introduction to R -The R in Robotics rosR: A New Language Extension for the Robot Operating System

Total: 45 Hours

Reference(s)

1. Saeed Benjamin Niku, Introduction to Robotics: Analysis, Control, Applications, Wiley Publishers, 3rd edition, 2019.
2. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
3. Francis X. Govers,Artificial Intelligence for Robotics: Build Intelligent Robots that Perform Human Tasks Using AI Techniques, Packt publishing,2018.
4. Krishnendu Kar, Mastering Computer Vision with TensorFlow 2.x: Build Advanced Computer Vision Applications Using Machine Learning and Deep Learning Techniques, Packt publishing,2020.
5. Armando Vieira, Bernardete Ribeiro,Introduction to Deep Learning Business Applications for Developers from Conversational Bots in Customer Service to Medical Image processing,Apress,201

19CB008 MODERN WEB APPLICATIONS 3 0 0 3

Course Objectives

- Study about the design of web pages using frames and scripting languages.
- Develop dynamic web pages using JavaScript, PHP and MySQL.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand internet and World Wide Web.
2. Demonstrate the technologies used to create web pages.
3. Implement FORM controls using PHP.
4. Develop web applications using PHP and MySQL.

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

UNIT I **9 Hours**

INTRODUCTION TO INTERNET AND WORLD WIDE WEB

History of the Internet and World Wide Web,Web browsers,Web Servers,Uniform Resource Locator,Tools and web programming languages,Web standards,Categories of web applications,Tiered Architecture.

UNIT II **9 Hours**

HTML AND CSS

Basic HTML page,Text Formatting,Table, Headers,Linking, Images,List, Meta Elements.CSS-Inline,Internal and External Style Sheet,Bootstrap-CSS Text,CSS forms,CSS components drop down.

UNIT III **9 Hours**

JAVA SCRIPT AND XML

Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, Bootstrap-JS Alert,JS Button,JS popover. XML-Introduction,Structuring Data,Document Type Definition,XML Vocabularies,Document Object Model(DOM) with JavaScript,Extensible Stylesheet Language Transforms(XSL)

UNIT IV **9 Hours**

PHP PROGRAMS

Creating PHP Programs, Numbers and Strings, Literals and Variables, Operators and Functions. FORM - Creating Form Controls, Using values returned from forms using PHP.

UNIT V **9 Hours**

PHP DATABASE CONNECTIVIY

Connecting to MySQL Server, Selecting Databases, Checking for Errors, Closing the MySQL Server Connection. Manipulating data in MySQL using PHP - Inserting, Viewing, Updating and Deleting Records, Manipulating joined tables. User authentication - Creating Session, Authorization Level.

Total: 45 Hours

Reference(s)

1. Deitel P. J., Deitel H. M. and Deitel A. (2012) Internet and World Wide Web: How to Program, Fifth Edition, Pearson Prentice Hall,4th ed, 2008.
2. HTML & CSS: Design and Build Websites, Jon Duckett, John Wiley & Sons, 2011.
3. Naramore E., Gerner J., Scouarnec Y.L., et al., (2005) Beginning PHP5, Apache, MySQL Web Development: Programmer to Programmer, John Wiley & Sons Inc., ISBN: 9780764579660.
4. Sebesta R. W., Programming the World Wide Web, 8th edition, Pearson, 2015.
5. Pressman R. and Lowe D. (2008) Web Engineering: a practitioner"s approach, First Edition, Mc GrawHill
6. Kappel G., et al. (2006) Web Engineering: The Discipline of systematic Development of Web Applications, First Edition, John Wiley & Sons.

19CB009 DATA MINING AND ANALYTICS 3 0 0 3

Course Objectives

- Understand the data mining functionalities, technologies and steps in pre-processing the data.
- Analyse the data using data mining algorithms, methods and tools.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand various data mining technologies and applications
2. Analyze data pre-processing techniques with knowledge representation.
3. Apply suitable classification algorithms to perform prediction.
4. Apply regression analysis for prediction and approximation
5. Apply prescriptive analysis on time series data.

Articulation Matrix

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

UNIT I **7 Hours**

INTRODUCTION TO DATA MINING

Data Mining - Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications

UNIT II **9 Hours**

DATA PREPROCESSING AND DATA MINING KNOWLEDGE REPRESENTATION

Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies. Data mining knowledge representation - Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques. Attribute-oriented analysis - Attribute generalization, Attribute relevance, Class comparison, Statistical measures

UNIT III **9 Hours**

DATA MINING ALGORITHMS

Association rules - Motivation and terminology, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis. Classification - Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm, Decision trees, covering rules. Prediction - The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models

UNIT IV **10 Hours**

REGRESSION ANALYSIS

Descriptive analysis,Data Modelling,Trend analysis,Simple Linear Regression Analysis.Forecasting model,heuristic methods,predictive modelling and pattern discovery,logistic regression,logit transform,ML estimation, Tests of hypotheses,Wald test,score test,test for overall regression,multiple logistic regression,forward backward method,interpretation of parameters,relation with categorical data analysis.Nonlinear regerssion(NLS),Linearization transforms,their uses and limitations.Introduction to nonparametric regression methods.

UNIT V **10 Hours**

TIME SERIES AND PERSPECTIVE ANALYSIS

Auto Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt Winter smoothing, forecasting based on smoothing. Linear time series models- autoregressive, Moving Average, Auto regressive Moving Average and Auto regressive Integrated Moving Average models. Prescriptive analytics, Mathematical optimization, Networks modelling, Multi objective optimization Stochastic modelling, Decision and Risk analysis, Decision trees.

Total: 45 Hours

Reference(s)

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 3rd ed, 2010.
2. Lior Rokach and Oded Maimon, Data Mining and Knowledge Discovery Handbook, Springer, 2nd edition, 2010
3. Box, G.E.P and Jenkins G.M. Time Series Analysis, Forecasting and Control, Holden-Day,4th ed, 2015.
4. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis (John Wiley) Third Edition
5. Hosmer, D. W. and Lemeshow, S. (2000). Applied Logistic Regression (Wiley).

19CB010 ENTERPRISE SYSTEMS 3 0 0 3

Course Objectives

- Understand different models and secure data exchange mechanisms in enterprise systems.
- Analyse network models and hardware requirements to implement enterprise systems.

Programme Outcomes (POs)

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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the 3 tier environment and the tools used in web application development.
2. Understand the components of SOA architecture and the functionalities of Enterprise Resource Planning.
3. Recognize the use of security mechanisms to exchange business information between customers and suppliers.
4. Understand networking policies and of-the-shelf products in enterprise systems.
5. Outline the hardware architectures for enterprise 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	1		1								2	
3		2	2		1									1
4		2	2		1									1
5		2	1		1								2	

UNIT I **9 Hours**

OVERVIEW OF WEB APPLICATION DEVELOPMENT

Overview of database management systems,Overview of Model,View-Control (MVC), Control (MVC) method of software development in a 3-tier environment-Control (MVC) development in a 3-tier environment,Tools and Technologies.Microsoft.NET framework,PHP Ruby on Rails-JavaScript-Ajax

UNIT II **9 Hours**

SOA AND ERP MODELS

Service Oriented Architecture (SOA)-Principles of loose coupling-encapsulation-interoperability.Web Services as the implementation vehicle protocols-usage.Enterprise Resource Planning (ERP)-systems and their architecture-Overview of SAP and Oracle Applications-Generic ERP Modules.Finance-HR-Materials Management-Investment etc.Examples of Domain Specific Modules.

UNIT III **9 Hours**

DATA EXCHANGE ANS SECURITY ISSUES

Electronic Data Exchange - Customer Relationship Management (CRM) - Supplier Relationship Management (SRM).Security Issues-authentications-authorizations-access control-roles-single-sign-on-directory servers-audit trials-digital signatures-encryption-review of IPSec-SSL and other technologies-simple applications Demo

UNIT IV **9 Hours**

NETWORKS AND APPLICATIONS

Overview of MPLS-Virtual Private Networks(VPN)-Firewalls- Network monitoring and enforcement of policies-Software Acquisition Process-Tendering-conditions of contract-Commercial off the shelf software (COTS) versus Bespoke Implementations-Total cost of ownership-Issues on using Open-source software or free software-Licensed software.

UNIT V **9 Hours**

HARDWARE FOR ERP

Hardware Architectures for Enterprise Systems: Servers - Clustering - Storage area networks - Storage units - Back-up strategies - Local Area Network (LAN) technologies and products- Data Centres - Disaster recovery site design and implementation issues - Hardware Acquisition Issues.

Total: 45 Hours

Reference(s)

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill, 2008.
2. Enterprise Resource Planning-Diversified by Alexis Leon, TMH, 2008
3. Enterprise Resource Planning-RaviShankar and S.Jaiswal, Galgotia, 1st Ed, 1999.
4. E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft - A Practical Roadmap For Success By Dr. Ravi Kalakota , Addison-Wesley , 2000

19CB011 ADVANCE FINANCE 3 0 0 3

Course Objectives

- Understand the issue management process and dividend decisions
- Acquaint the students in the area of corporate and financial restructuring
- Understand the impact of corporate actions in external external environment
- Identify the working capital requirements for financing the current assets effectively
- Acquire the knowledge on derivatives and option pricing models

Programme Outcomes (POs)

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.

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

m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Imbibe knowledge about the decisions and decision variables involved with financial activities of the firm.
2. Acquire knowledge on corporate and financial restructuring to reap its benefits
3. Ability to evaluate the leasing by using appropriate methods
4. Develop skills for interpretation business information and application of financial theory in corporate investment decisions with special emphasis on working capital management.
5. Gain knowledge on working mechanism and pricing of forward contracts, futures contracts, swaps and options

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

UNIT I **9 Hours**

Sources of Funds including regulatory framework-Types of securities, issuing the capital in market, Pricing of issue, Valuation of Stocks and bonds

UNIT II **9 Hours**

Dividend Decisions-Traditional Approach, Dividend Relevance Model, Miller and Modigliani Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split

UNIT III **9 Hours**

Leasing-Evaluation of Lease Contracts Corporate and Financial Restructuring-Mergers and Acquisitions- Types of Mergers, Evaluation of Merger Proposal, Take-over, Amalgamation, Leverage buy-out, Management buy-out, Corporate Failure and Liquidation Financial Restructuring: Share Split, Consolidation, Cancellation of Paid-up Capital, Other Mechanisms

UNIT IV **9 Hours**

Working Capital Management: Working Capital Planning, Monitoring and Control of Working Capital, Working Capital Financing, Managing the Components of Working Capital, Cash Management, Receivable Management, and Inventory Management

UNIT V **9 Hours**

Introduction to derivatives: Basics of Futures, Forwards, Options, Swaps, Interest rate Payoff Diagrams, Pricing of Futures, Put Call Parity, Option Pricing using Binomial Model and Black Scholes Model, Use of Derivatives for Risk-Return Management- Credit Default Swaps

Total: 45 Hours

Reference(s)

1. Brealey, Myers and Allen,Principles of Corporate Finance, New Delhi: McGraw Hill Education, 2017
2. I.M.Pandey, Financial Management, New DelhiVikas Publishing House Pvt. Ltd., 2016.
3. M.Y. Khan and P. K.Jain, Financial Management- Text, Problems and Cases, New Delhi Tata McGraw Hill Publishing Company Ltd, 2018.
4. Dr S. Gurusamy, Merchant Banking and Financial Services, New Delhi: Tata McGraw Hill, 2017.
5. Bhalla V K, Working Capital Management, New Delhi: S. Chand Publishing, 2014.
6. S. L. Gupta, Financial Derivatives Theory Concepts and Problems, New Delhi: PHI Learning, 2017

19CB012 IMAGE PROCESSING AND PATTERN RECOGNITION

3 0 0 3

Course Objectives

- Understand image formation and transformation.
- Apply different processing techniques to identify patterns in grey and color images.

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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand the different ways of representing image.
2. Outline the preprocessing techniques by considering the intensity values of images.
3. Apply segmentation techniques to identify similar attributes in images.
4. Apply feature extraction in images to perform dimensionality reduction.
5. Apply Morphological Filtering for color images with various color models.

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION

Image processing systems and its applications - Basic image file formats. Image formation: Geometric and photometric models - Digitization - sampling, quantization - Image definition and its representation - neighborhood metrics.

UNIT II **9 Hours**

INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING

Enhancement - contrast stretching - histogram specification - local contrast enhancement - Smoothing - linear and order statistic filtering - sharpening - spatial convolution - Gaussian smoothing - DoG - LoG.

UNIT III **9 Hours**

SEGMENTATION

Pixel classification - Grey level thresholding - global/local thresholding- Optimum thresholding - Bayes analysis - Otsu method - Derivative based edge detection operators- edge detection/linking - Canny edge detector - Region growing - split/merge techniques - line detection - Hough transform.

UNIT IV **9 Hours**

IMAGE FEATURES EXTRACTION

Textural features - gray level co-occurrence matrix - Moments - Connected component analysis - Convex hull - Distance transform - medial axis transform - skeletonization /thinning - shape properties. Registration: Mono-modal/multimodal image registration - Global/local registration- Transform and similarity measures for registration - Intensity/pixel interpolation.

UNIT V **9 Hours**

COLOUR IMAGE PROCESSING AND MORPHOLOGICAL FILTERING

Fundamentals of different colour models - RGB, CMY, HSI, YCbCr, Lab- False colour- Pseudocolour -Enhancement - Segmentation. Morphological Filtering Basics-Dilation and Erosion Operators - Top Hat Filters

Total: 45 Hours

Reference(s)

1. Digital Image Processing. R. C. Gonzalez and R. E. Woods, Prentice Hall, 4th Edition, 2018.
2. Image Processing: The Fundamentals. Maria Petrou and Panagiota Bosdogianni, John Wiley & Sons, Ltd, 1999.
3. Digital Image Processing. K. R. Castleman:, Prentice Hall, Englewood Cliffs,1979.
4. Visual Reconstruction. A. Blake and A. Zisserman, MIT Press, Cambridge, 2009.
5. Digital Pictures. A. N. Netravali and B. G. Haskell, Plenum Press,2nd edition, 1995 . 6. Digital Images and Human Vision. A. B. Watson:, MIT Press, Cambridge,1993.

19CB013 COGNITIVE SCIENCE AND ANALYTICS 3 0 0 3

Course Objectives

- To understand the concepts of Machine learning and Cognitive Science
- To understand the fundamentals of brain imaging and neuroscience
- To analyse the cognitive and emergent standpoints.

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.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Outline the basic concepts in the Neural network model.
2. Interpret the machine learning models and analyze the relationship between ML and Cognitive Science
3. Interpret the information processing models using brain imaging.
4. Apply the weka tool for information processing
5. Analyze the usage of various mathematical models in neuroscience

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO THE STUDY OF COGNITIVE SCIENCES

Neural network models-What is language-Affordances-Categories and concepts-Concept Learning-Introduction to the study of cognitive sciences-Neural network models-Syntax-semantics- (and pragmatics)-Direct perception-Logic-Machine Learning-A brief history of cognitive-science - Processing of sensory information in the brain - Linguistic Knowledge: Syntax - semantics - (and pragmatics) - Direct perception - Logic: Machine learning.

UNIT II **9 Hours**

INFORMATION PROCESSING THEORY

Processing of sensory information in the brain - Linguistic knowledge: Syntax, semantics, (and pragmatics) - Ecological Psychology - Constructing memories - Methodological concerns in philosophy - Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System - Generative linguistic - Affordance learning in robotics - Explicit vs. implicit memory.

UNIT III **9 Hours**

ARTIFICIAL INTELLIGENCE AND PSYCHOLOGY

Brain Imaging-Brain and language-Affordance learning in robotics-Information processing(three-box) model of memory-Structure and constituents of the brain-fMRI,MEG-Language disorders-Development-Information processing(three boxes)model of memory

UNIT IV **9 Hours**

HISTORY OF NEUROSCIENCE

PET,EEG-Lateralization-child and robotic development-sensory memory-short term memory-mathematical models-multi sensory integration in the cortex-Lateralization attention and related concepts-Long term memory-rationality-Mathematical models-Information fusion-the great past tense debate-Human visual attention-bounded rationality-Prospect theory-Heuristics and biases-Looking at brain signals-From sensation to cognition-the great past tense debate-computational models of attention-Reasoning in computers-Looking at brain signals-cybernetics

UNIT V **9 Hours**

STANDPOINTS

Cognitivist and emergent standpoints - Computational models of attention - Key points in social cognition - Processing of sensory information in the brain - From physics to meaning - Analog vs. Digital: Code duality - A robotic perspective - Applications of computational models of attentional - Context and social judgment - Schemas - Social signals.

Total: 45 Hours

Reference(s)

1. Cryptography, Theory and Practice. D. R. Stinson, CRC Press, 2018.
2. Handbook of Applied Cryptography. A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, CRC Press, 2014.

19CB014 INTRODUCTION TO IOT 3 0 0 3

Course Objectives

- To understand the components and protocols used in IoT
- To understand the IoT reference Architecture
- Ability to understand the various applications of IoT in real-time

Programme Outcomes (POs)

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.
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.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Identify the fundamental building blocks and use cases of IoT
2. Understand the Reference Architecture in IoT
3. Design and develop IoT based sensor systems
4. Understand the networking and communication protocols used in IoT
5. Understand the data processing and storage in IoT

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO IOT AND USE CASES

Understanding basic concepts of IoT, Consumer IoT vs Industrial Internet, Fundamental building blocks, Use Cases of IoT in various industry domains.

UNIT II **9 Hours**

ARCHITECTURE

IoT reference architectures, Industrial Internet Reference Architecture, Edge Computing, IoT Gateways, Data Ingestion, and Data Processing Pipelines, Data Stream Processing.

UNIT III **9 Hours**

SENSORS AND INDUSTRIAL SYSTEMS

Introduction to sensors and transducers, integrating sensors to sensor processing boards, introduction to industrial data acquisition systems, industrial control systems, and their functions.

UNIT IV **9 Hours**

NETWORKING AND COMMUNICATION FOR IOT

Recap of OSI 7-layer architecture and mapping to IoT architecture, Introduction to proximity networking technologies (ZigBee, Bluetooth, Serial Communication), Industrial network protocols (Modbus, CAN bus), Communicating with cloud applications (web services, REST, TCP/IP, and UDP/IP sockets, MQTT, Web Sockets, protocols. Message encoding (JSON, Protocol Buffers).

UNIT V **9 Hours**

IOT DATA PROCESSING AND STORAGE

Time Series Data and their characteristics, time-series databases, basic time-series analytics, data summarization, and sketching, dealing with noisy and missing data, anomaly, and outlier detection.

Total: 45 Hours

Reference(s)

1. The Internet of Things, Samuel Greengard, MIT Press Essential Knowledge Series, 2015.

19CB015 CRYPTOLOGY 3 0 0 3

Course Objectives

- To understand the principles of elementary cryptosystems and basic security services.
- To learn the algorithms of key cryptosystems.
- To understand the applications of cryptology in a real-time environment.

Programme Outcomes (POs)

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. Identify the elementary cryptosystem mechanisms
2. Understand the working principles of basic security services
3. Identify the types of symmetric and public ciphers.
4. Analyze the privacy issues and use the appropriate security measures.

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	3									
3			2	3	2									
4			2	3	3									

UNIT I **9 Hours**

INTRODUCTION TO CRYPTOGRAPHY

Elementary number theory - Pseudo-random bit generation - Elementary cryptosystems.

UNIT II **9 Hours**

BASIC SECURITY SERVICES

Confidentiality, integrity-availability-non-repudiation-privacy-introductory topics in Post Quantum Cryptography(two cipher techniques)

UNIT III **10 Hours**

SYMMETRIC KEY CRYPTOSYSTEMS

Stream Cipher: Basics Ideas-Hardware and software implementations-examples with some prominent ciphers: A5/1-Grain family-RC4-Salsa and cha cha-HC128-SNOW family-ZUC-Block Ciphers: DES-AES-Modes of operation

UNIT IV **8 Hours**

PUBLIC KEY CRYPTOSYSTEMS

Hash functions-Authentication-RSA-ECC-Digital signatures.

UNIT V **9 Hours**

SECURITY APPLICATIONS

Electronic commerce (anonymous cash, micro-payments)-Key management-Zero-knowledge protocols-Cryptology in Contact Tracing Applications-Issues related to Quantum Cryptanalysis.

Total: 45 Hours

Reference(s)

1. A course in number theory and cryptography. N. Koblitz:, GTM, Springer, 1994.
2. Cryptography and Network Security. W. Stallings, Prentice Hall, 2015.
3. Cryptography, Theory and Practice. D. R. Stinson, CRC Press, 2018.
4. Handbook of Applied Cryptography. A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, CRC Press, 2014.

19CB016 QUANTUM COMPUTATION AND QUANTUM INFORMATION

3 0 0 3

Course Objectives

- Understand the principles, quantum information, and limitation of quantum operations formalizing.
- Understand quantum algorithms
- Gain knowledge about the quantum error and its correction.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Course Outcomes (COs)

1. Explain the basic concepts of quantum computing.
2. Explore the quantum computing algorithms and operations.
3. Describe the various types of quantum key distribution

Articulation Matrix

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

UNIT I **9 Hours**

INTRODUCTION TO QUANTUM INFORMATION

States, Operators, Measurements, Quantum Entanglement: Quantum Teleportation, Super-dense coding, CHSH Game, Quantum gates, and circuits.

UNIT II **9 Hours**

QUANTUM ALGORITHMS

Deutsh-Jozsa, Simon, Grover, Shor, Implication of Grover"s and Simon"s algorithms towards classical symmetric key cryptosystems, Implication of Shor"s algorithm towards factorization and discrete logarithm based classical public-key cryptosystem.

UNIT III **9 Hours**

QUANTUM ALGORITHMS

The implication of Shor"s algorithm towards factorization and Discrete Logarithm based classical public-key cryptosystem.

UNIT IV **9 Hours**

QUANTUM TRUE RANDOM NUMBER GENERATORS (QTRNG)

Detailed design and issues of quantumness, Commercial products and applications.

UNIT V **9 Hours**

QUANTUM KEY DISTRIBUTION (QKD)

BB84, Ekert, Semi-Quantum QKD protocols and their variations, Issues of Device Independence, Commercial products.

Total: 45 Hours

Reference(s)

1. Quantum Computation and Quantum Information. M. A. Nielsen and I. L. Chuang, Cambridge University Press, 2012.
2. Presskil Lecture notes Available online: http://www.theory.caltech.edu/~preskill/ph229.

19CB017 ADVANCED SOCIAL TEXT AND MEDIA ANALYTICS 3 0 0 3

Course Objectives

- Understand the basic ideas of Text mining.
- Analyse 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									

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.

19CB018 MOBILE COMPUTING 3 0 0 3

Course Objectives

- Understand the basic concepts of mobile communication systems.
- Analyse various protocols of all layers for mobile and ad hoc wireless communication networks.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Course Outcomes (COs)

1. To understand concepts of Mobile Communication.
2. To analyze next-generation Mobile Communication systems.
3. To understand the network and transport layers of Mobile Communication.
4. Analyze various protocols of all layers for mobile and ad hoc wireless communication networks.
5. To Gain knowledge on 5G cellular networks.

Articulation Matrix

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

UNIT I **8 Hours**

INTRODUCTION

Overview of wireless and mobile infrastructure; Preliminary concepts on cellular architecture-Design objectives and performance issues-Radio resource management and interface-Propagation and path loss models-Channel interference and frequency reuse-Cell splitting-Channel assignment strategies-Overview of generations:-1G to 5G.

UNIT II **9 Hours**

LOCATION AND HANDOFF MANAGEMENT

Introduction to location management (HLR and VLR)-Mobility models characterizing individual node movement (Random walk, Fluid flow, Markovian, Activity-based)-Mobility models characterizing the movement of groups of nodes (Reference point-based group mobility model, Community based group mobility model); Static (Always vs. Never update, Reporting Cells, Location Areas) and Dynamic location management schemes (Time, Movement, Distance, Profile Based)-Terminal Paging (Simultaneous paging, Sequential paging)-Location management and Mobile IP-Overview of handoff

process-Factors affecting handoffs and performance evaluation metrics-Handoff strategies-Different types of handoffs (soft, hard, horizontal, vertical).

UNIT III **9 Hours**

WIRELESS TRANSMISSION FUNDAMENTALS

Introduction to narrow and wideband systems; Spread spectrum-Frequency hopping-Introduction to MIMO-MIMO Channel Capacity and diversity gain-Introduction to OFDM-MIMO-OFDM system-Multiple access control (FDMA, TDMA, CDMA, SDMA)-Wireless local area network-Wireless personal area network (Bluetooth and ZigBee).Mobile Ad-hoc networks-Characteristics and applications-Coverage and connectivity problems-Routing in MANETs.

UNIT IV **10 Hours**

WIRELESS SENSOR NETWORKS

Concepts-basic architecture-design objectives and applications-Sensing and communication range-Coverage and connectivity-Sensor placement-Data relaying and aggregation-Energy consumption-Clustering of sensors-Energy-efficient Routing (LEACH)-Cognitive radio networks-Fixed and dynamic spectrum access-Direct and indirect spectrum sensing-Spectrum sharing-Interoperability and co-existence issues-Applications of cognitive radio networks.

UNIT V **9 Hours**

D2D COMMUNICATIONS IN 5G CELLULAR NETWORKS

Introduction to D2D communications-High-level requirements for 5G architecture-Introduction to radio resource management-power control and model selection problems-Millimeter-wave communication in 5G.

Total: 45 Hours

Reference(s)

1. Mobile Communications. Jochen Schiller, Pearson Education, 2012.
2. Wireless Communications. Andrea Goldsmith, Cambridge University Press, 2012.

19CB019 FUNDAMENTALS OF MANAGEMENT 3 0 0 3

Course Objectives

- To understand the basics of management and its theories.
- To analyse the individual behaviour in organizational setting to motivate the multicultural workforce
- To acquaint with the concepts of ethics, governance and social responsibilities in the business

Programme Outcomes (POs)

h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.
n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Able to understand the evolutions of management and apply the concept of management principles in the decision-making process.
2. Effectively manage the business by understanding the functions of management and to identify the factors influencing employee's behaviour in the organizations
3. Able to design the effective organizational structure to achieve the objectives of the organization
4. Assess the impact of organizational decisions and activities on the society
5. Able to understand and develop the leadership qualities to influence and lead the organization across the globe

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

UNIT I **9 Hours**

MANAGEMENT THEORIES

Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-onward). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

UNIT II **9 Hours**

FUNCTIONS OF MANAGEMENT

Planning, Organizing, Staffing, Directing, Controlling, Leadership - Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid.

UNIT III **9 Hours**

ORGANIZATIONAL DESIGN

Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure).

UNIT IV **9 Hours**

ORGANIZATION BEHAVIOR

Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity

UNIT V **9 Hours**

MANAGERIAL ETHICS

Ethics and business, Ethics of Marketing and advertising, Ethics of Finance and accounting, Decision making frameworks, business and social responsibility, International standards, Corporate Governance, Corporate Citizenship , Corporate social responsibility

Total: 45 Hours

Reference(s)

1. Richard L. Daft, Understanding the Theory and Design of Organization, Eleventh Edition, Cengage Learning India Private Limited, 2020
2. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behaviour, Eighteenth Edition, Pearson India, 2019.

19CB020 FINANCIAL AND COST ACCOUNTING 3 0 0 3

Course Objectives

- To enable students to read and understand Financial Statements
- To provide insights about the concepts of Financial Management and its application for managerial decision making
- To provide an in depth study Accounting Principles and Techniques for Managerial Decision Making
- To acquaint the students with fundamental principles of accounting
- To enhance the knowledge of students in the areas of Costing, Budgeting and Marginal Costing Techniques

Programme Outcomes (POs)

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.

k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Understand and explain the conceptual framework of Financial & Cost Accounting
2. Apply the basic concepts in Preparation of Final Accounts using the principle of GAAP
3. Analyze and interpretation of Income Statement and Balance Sheet
4. Evaluate the overheads and other costs across various products
5. Gain insights about the need of Material cost & Methods to control Manufacturing cost

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							2			2
4				3							3			3
5				2							3			3

UNIT I **9 Hours**

ACCOUNTING CONCEPT

Introduction, Techniques and Conventions, Financial Statements- Understanding and Interpreting Financial Statements

UNIT II **9 Hours**

ACCOUNTING PROCESS

Book Keeping and Record Maintenance - Fundamental Principles and Double Entry - Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts - Cash Book and Subsidiary Books - Rectification of Errors

UNIT III **9 Hours**

FINANCIAL STATEMENTS

Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam Cash Flow and Fund Flow Techniques: Introduction, how to prepare, Difference between them

UNIT IV **9 Hours**

COSTING SYSTEMS

Elements of Cost, Cost behavior,Cost Allocation, OH Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, cost volume Profit Analysis, Budgets, ABC Analysis, Class Discussion-Application of costing concepts in the service sector

UNIT V **9 Hours**

COMPANY ACCOUNTS AND ANNUAL REPORTS

Audit Reports and Statutory Requirements-Directors Report-Notes to Accounts-Pitfalls

Total: 45 Hours

References

1. Robert N Anthony, David Hawkins, Kenneth Marchant, Accounting Texts and Cases, McGrawHill.2017

19CB021 HUMAN RESOURCE MANAGEMENT 3 0 0 3

Course Objectives

- To enable the students to understand the basics of HRM.
- To gain the knowledge about strategies required to select and manage manpower resources.
- To understand the role of training and development in the organisation.
- To understand job-based compensation scheme and career management.
- To give an insights about performance evaluation and grievance redressal methods.

Programme Outcomes (POs)

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

k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

m. PSO1 Ability to demonstrate the technical knowledge in Computer Science with equal appreciation of humanities, management sciences and human values.

n. PSO2 To create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions

Course Outcomes (COs)

1. Analysis the various aspects of HRM and its relevanace in the organisation.
2. Ability to plan,recruit, select and manage the job candidate.
3. Assess the training needs and able to train using various methods of Training.
4. Able to implement Employee benefits and Welfare measures,Employee safety and Health Measures.
5. Evaluate the Performance of the employees and able to devise the strategies to handle the employee issues.

Articulation Matrix

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

UNIT I **9 Hours**

PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT

Evolution of human resource management-The importance of the human capital-Role of human resource manager-Challenges for human resource managers-trends in Human resource-Computer applications in human resource management-Human resource accounting

UNIT II **9 Hours**

HUMAN RESOURCE PLANNING AND RECRUITMENT

Importance of Human Resource Planning-Forecasting human resource requirement-matching supply and demand -- Internal and External sources - Organizational Attraction -Recruitment, Selection, Induction and Socialization- Theories, Methods and Process

UNIT III **9 Hours**

TRAINING AND DEVELOPMENT

Types of training methods-purpose-benefits-resistance. Executive development programme-Common practices-Benefits-Self Development-Knowledge management

UNIT IV **9 Hours**

EMPLOYEE ENGAGEMENT

Compensation plan-Reward-Motivation-Application of theories of motivation -Career management-Mentoring-Development of mentor-Protege relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behaviour-Theories, Models

UNIT V **9 Hours**

PERFORMANCE EVALUATION AND CONTROL

Method of performance evaluation-Feedback-Industry practices. Promotion,Demotion,Transfer and Separation-Implication of job change.The control process-Importance-Methods-Requirement of effective control systems grievances-causes-implications-Redressel methods

Total: 45 Hours

Reference(s)

1. Human Resource Management, 8th Edition, K. Aswathappa, Tata McGraw Hill, 2017
2. Dessler Human Resource Management, Pearson Education Limited, 14th Edition, 2015.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012
4. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8th edition 2012.
5. Wayne Cascio, Managing Human Resource, McGraw Hill, 2007.
6. Ivancevich, Human Resource Management, McGraw Hill 2012.

19CB0XA DIGITAL MARKETING-BEGINNERS 1 0 0 1

Course Objectives

- To Understand the fundamentals of Digital Marketing
- To Learn different types of digital marketing

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.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to oneÃ¢??s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes (COs)

1. Explain the basic concepts of Digital Marketing
2. Compare the different types of digital marketing with suitable examples

Articulation Matrix

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

20 Hours

UNIT I

Fundamental of Digital Marketing-Market Research-Target Audience-Brand Marketing-Email Marketing-Search Engine Marketing-Social Media Marketing-Content Marketing-Search Engine Optimization-Affiliate Marketing-Marketing Analytics

Total: 20 Hours

Reference(s)

1. https://moz.com/blog
2. https://www.searchenginejournal.com/category/pay-per-click/
3. https://www.kaushik.net/avinash/
4. https://analytics.google.com/analytics/academy/

19CB0XB DIGITAL MARKETING-INTERMEDIATE 3 0 0 3

Course Objectives

- To Understand the concepts of Search engine optimization
- To Analyze various social media marketing
- To Understand the basics of Analytics tool

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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. Explain the Search Engine optimization with an example
2. Compare the different types of social media marketing with suitable examples
3. Apply the analytics tools in suitable places of SEO.

Articulation Matrix

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

20 Hours

UNIT I

Introduction to SEO-Google algorithm-SEO Ranking Factor-Keyword Research-Different type of keyword-Google my business page setup-social media marketing-Facebook page optimization-Facebook for business-The basics of Facebook Ads-Instagram Business Profile Creation and optimization-Twitter Basics and Optimizing Twitter-Twitter Hashtags and Trends-analytics Tool basic

Total: 20 Hours

Reference(s)

1. https://moz.com/blog
2. https://www.searchenginejournal.com/category/pay-per-click/
3. https://www.kaushik.net/avinash/
4. https://analytics.google.com/analytics/academy/

19CB0XC DIGITAL MARKETING-ADVANCED 3 0 0 3

Course Objectives

- To Analyze the different types of SEO.
- To Understand the usage of AdWords
- To Understand Google Analytics

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Acquire knowledge and training on SEO
2. Apply the AdWords in appropriate places of Website creation
3. Gain knowledge on Google analytics

Articulation Matrix

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

20 Hours

UNIT I

SEO-On Page SEO, Off Page SEO-Technical SEO-Google Speed test-Mobile SEO-Facebook Campaign Setup and Optimization-Facebook Target Audience-Facebook Audience Manager-Google Ad words Campaign Setup-Ad Words Campaign Budget Management-Optimizing Google Ads-Landing Page Design-Google Analytics Configuration-Google analytics Dashboard-analytics Data Overview

Total: 20 Hours

Reference(s)

1. https://moz.com/blog
2. https://www.searchenginejournal.com/category/pay-per-click/
3. https://www.kaushik.net/avinash/
4. https://analytics.google.com/analytics/academy/