Programme Ordinance, POs, PSOs & Course Outcomes (COs)

DEPARTMENT OF INFORMATION TECHNOLOGY
FACULTY OF ENGINEERING & TECHNOLOGY
UNIVERSITY OF LUCKNOW

PROGRAMME ORDINANCE

1. ADMISSION

1.1 Admission to B.Tech. First year in 1st semester and lateral admission in B.Tech. second year in 3rd semester (for diploma holder/B.Sc. candidates only) will be made as per the rules prescribed by the Academic Council of CCSU Meerut.

1.2 Admission on migration of a candidate from any other University to the University is not permitted.

2. ELIGIBILITY FOR ADMISSIONS

2.1 Admission to B. Tech. First Year through Entrance Examination:

(a) Eligibility for admission to under graduate courses in First year shall be as per guidelines of All India Council for Technical Education (AICTE) / Related Council and according to the latest U.P. Government notifications/rules.

2.2 Admission to B.Tech. Second Year through Lateral Entry Scheme:

(a) Candidates who have passed 3/4-year Diploma (with minimum 60% marks) from institutions recognized by the U.P. Board of Technical Education in any branch of Engineering/Technology except Agriculture Engineering are eligible for admission to Second year in any branch of Engineering. /Technology except Agriculture Engineering

(b) Candidates who have passed 3/4-year Diploma (with minimum 60% marks) from institutions recognized by the U.P. Board of Technical Education in Agriculture Engineering are only eligible for admission to Second year of Agriculture Engineering.

2.3 Direct admission on vacant seats at institution/college level: The eligibility criteria for direct admission on seats remaining vacant in first year after entrance examination counseling shall be such as may be notified from time to time.

2.4 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 2.1. & 2.2, as per the guidelines of AICTE.

3. ATTENDANCE

3.1 Every student is required to attend all the lectures, tutorials, practical's and other prescribed curricular and co-curricular activities. The attendance can be condoned up to 25% on medical grounds or for other genuine reasons beyond the control of students.

3.2 A further relaxation of attendance up to 15% for a student can be given by Head of Institution/college provided that he/she has been absent with prior permission of the Head of the institution/college for the reasons acceptable to him.

3.3 No student will be allowed to appear in the end semester examination if he / she do not satisfy the overall average attendance requirements of Clause Nos. 3.1, and 3.2. and such candidate(s) shall be treated as having failed due to detained and will be further governed by clause no. 4.2 & 4.3 and annexure I.

3.4 In each semester, the attendance shall be counted from the date of admission in the college or start of academic session whichever is later.

4. DURATION OF COURSES

4.1 Total duration of the B.Tech. Course shall be 4 years, each year comprising of two semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by A.I.C.T.E. from time to time.

4.2 The student admitted to 1st year B.Tech shall complete the course within a period of seven academic years from the date of first admission, failing which he/she has to discontinue the course. The students admitted under lateral entry scheme (2nd Year B.Tech) shall complete the course within a period of six academic years from the date of first admission, failing which he/she has to discontinue the course.

4.3 A candidate, who has failed twice in first year due to any reason (either due to his/her non-appearance or he/she being not permitted to appear in semester examinations) shall not be allowed to continue his/her studies further. Provided further that if a student wishes to continue third time in first year he/she may be allowed on the terms and conditions laid down by the University for such permission but the maximum time allowed for completing the course will remain the same as in clause 4.2.

4.4 The minimum credit requirement for B.Tech degree is 160 credits.

5. CURRICULUM

5.1 The 4 year curriculum has been divided into 8 semesters and shall include lectures, tutorials, practicals, seminars and projects etc. in addition to industrial training and educational tour etc. as defined in the scheme and executive instructions issued by the University from time to time.

5.2 The curriculum will also include such other curricular, co-curricular and extracurricular activities as may be prescribed by the University from time to time.

6. CHANGE OF BRANCH

6.1 Change of branch may be allowed against the vacant seats in the following two stages, provided criteria at following sub clauses is satisfied:

(a) In first year, after the last date of admission to the B.Tech. Ist semester, on the basis of merit of entrance examination on vacant seat subject to clause 6.2.

(b) In the second year, on the basis of merit at the B.Tech. first year examination for those who are pass without any carry over paper subject to clause 6.2.

6.2 After change of branch, number of students in branch(s) shall neither increase over the intake approved by A.I.C.T.E. nor it will decrease below 75% of intake approved by A.I.C.T.E.

6.3 Change of branch facility is not applicable to following: -

(a) Candidates admitted in B.Tech. Agricultural Engineering/Biotechnology courses.
(b) Candidates admitted in second year of B.Tech. courses as per clauses 2.2

6.4 The change of branch if allowed will become effective from B.Tech. IIIrd semester.

6.5 The Branch change process must be completed by 30th August of each academic session. Further change of branch shall not be permitted.

7. CHANGE OF COLLEGE

7.1 Change of College shall not be permitted.
7.2 Change of study center shall not be permitted.

8. EXAMINATION

8.1 The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous assessment (Sessional marks) shall be awarded at the end of the semester. The end semester examination shall be comprised of written papers, practicals and viva-voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

8.2 The distribution of marks for sessional, end semester theory papers, practicals and other examinations, seminar, project and industrial training shall be as prescribed. The practicals, viva-voce, projects and reports shall be examined/evaluated through internal and external examiners as and when required.

8.3 The marks obtained in a subject shall consist of marks allotted in end semester theory paper and sessional work.

9. ELIGIBILITY OF PASSING

9.1 A student who obtained Grades A^{+} to E shall be considered as passed. If a student secured "F" grade, he /she has to reappear for the examination. It is mandatory for a student to earn the required credits as mentioned in each semester.

A. For a pass in a Theory Subject, a student shall secure minimum of 30% of the maximum marks prescribed by the University in the end semester examination and 40% of aggregate marks in the subject including sessional marks. i.e. Minimum Passing Grade is "E".

(a) For a pass in a Practical/Internship/Project/Viva-voce examination, a student shall secure a minimum of 50% of the maximum marks prescribed by the University in the relevant Practical/Internship/Project/Viva-voce examination and 40% of marks in the aggregate in

the Practical/Internship/Project/Viva-voce including sessional marks. i.e. Minimum Passing Grade in a course is "E".

(c) For a pass in the subject which has only sessional component and No End semester exam component, such as Seminar, a student shall secure a minimum of 40% of the maximum marks prescribed. i.e. Minimum Passing Grade is "E".

(d) For a pass in a subject having Theory and Practical component, a student shall secure minimum of 30% of the maximum marks prescribed by the University in theory examination and 50% of marks in practical examination; in addition the student must secure 40% of marks in the aggregate in the subject including theory, practical, theory sessional and practical sessional marks. i.e. Minimum Passing Grade in a course is "E"..

9.2 The students who do not satisfy the condition 9.1 or the student who remains absent shall be deemed to have failed in that subject and may reappear for the University examination in the subsequent examinations. However, the Sessional marks awarded to the student/s at previous attempt in the concerned subject will be carried forward.

9.3 A student may, at his/her desire, opt to abandon his/her performance of a semester in following manner.

(a) A student may opt to abandon his/her performance only in end semester examination of university for a given semester.
(b) A student may opt to abandon his/her Total Performance of a Semester which includes performance in university end semester examination and sessional marks of all theory and practical subjects.
(c) A student may opt to abandon his/her performance in University Examination of any or both semesters of the same academic year only.
(d) A student shall be allowed to abandon the performance maximum twice during the entire course of study.
(e) Performance of a semester, once abandoned, cannot be claimed again.

9.4 The student, who opts to abandon the performance of a semester as per clause 9.3, shall abandon performance in all the courses of that semester, irrespective of the fact whether the student has passed or failed in any subject of that semester.

9.5 A student, who opts to abandon the total performance of the semester including sessional marks as per 9.3(b) and 9.3(c), has to take readmission for the relevant semester(s). Readmission to the First semester in such cases shall not be considered as fresh admission i.e., the student will continue to have the same University Roll Number, which was allotted earlier.

9.6 The student, who opted to abandon his / her performance only in the university end semester examination of a semester and does not desire readmission, shall be permitted to re-appear for examinations of all the subjects of the semester in the subsequent examinations as an Ex-

Student. However, the sessional marks obtained by the student in the abandoned semester shall be retained.

9.7 Such students who opted to abandon the performance at any stage of his/her study and has cleared any paper in more than one attempt are eligible for the award of *DIVISION* at the B.Tech. degree level but are not eligible for the award of RANKS and HONOURS degree.

9.8 The student who passes a course of a semester as per 9.1 shall not be allowed to appear for the same again, unless he/she opts for *abandoning of results* as per 9.3-9.7.

9.9 A student shall be declared to have completed the program of B.Tech. degree, provided the student has undergone the stipulated course work as per the regulations and has earned at least 160 Credits.

10. ELIGIBILITY FOR PROMOTION

10.1 There shall not be any restriction for promotion from an odd semester to the next even semester.

10.2 For promotion from even semester to the next odd semester (i.e. of the next academic year) the student has secured either of the semester of an academic year is fully cleared or earned the credit greater than or equal to minimum credit of either of the semester for example.

Example 1

1. **A Student of 1st year earned 10 credits in I semester and 8 credit in II semester. The total credit of I semester is 17.5 and II semesters are 20.5.**

Minimum Credit Threshold for Promotion Check Point	Credit* Threshold
First Year to Second Year	**17.5 credits in** First Year (I&II sem.)

Total credit earned by student is 18(10+8) therefore he / she is eligible for promotion from 1st to 2nd year.

Example 2

A Student of 1st year earned 17.5 credit in I semester and 18 credit in II semester. The total credit of I semester is 17.5 and II semester is 20.5.

Minimum Credit Threshold for Promotion Check Point	Credit* Threshold
First Year to Second Year	**17.5 credits in First** Year (I&II sem.)

His / Her I semester is fully cleared therefore he / she is eligible for promotion to 2nd year.

10.3 In yearly result, a student shall be declared PASS only if he/ she secures "E" or above grades in all the subjects and minimum Semester Grade Point Average (SGPA) of 5.0, in each semester of an academic year.

10.4 Student himself can decide to abandon the performance of any or both the semesters of same academic year as per clause 9.3 and reappear in abandoned semester examination as per clauses 9.4, 9.5 & 9.6.

11. Carry over System

11.1 Following rules shall be followed for carry over papers:

(a) A candidate who satisfies the requirements of clause 9.1 appear in those theory papers / practical during respective end failed.

(a) and 9.1 (b) will be required to semester exams in which he/she

(b) A candidate satisfying clause 9.3 (a) shall be required to appear in theory papers / practical examination to fulfil the requirements of clause 9.1(a) and 9.1 (b).

(c) A candidate shall be required he/she desires to appear in requirements of clause 10.3.

to exercise his/her choice of minimum theory papers in which the examination for improvement of SGPA to fulfil the

(d) Candidate appearing for carry over paper in any semester shall be examined with the examination paper of that subject running in that semester.

11.2 All carryover examinations shall be held only with end semester examination.

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12. **RE-ADMISSION IN THE INSTITUTION/ COLLEGE**

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

(a) A candidate is declared fail.
(b) A candidate did not appear in a semester examination / or he/she was not granted permission to appear in the examination.
(c) A candidate has been detained by the institute and subsequently has been permitted to take re-admission.
(d) A candidate has own desire to abandon the performance of semester(s) as stated in clause 9.3 (b) and 9.3 (c).

13. **COURSES**

13.1There will be four types of courses.

(i) Foundation Courses: The Foundation Courses are of two kinds: *Compulsory Foundation* and *Elective foundation*.

"Compulsory Foundation": These courses are the courses based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines.

"Foundation Electives": These are value-based courses aimed at man making education.

(ii) Core Courses: This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study

(iii) Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills.

(iv) Mandatory Courses: These courses are mandatory for students joining B.Tech. Program and students have to successfully complete these courses before the completion of degree.

13.2 The minimum number of students to be registered for an Elective to be offered shall be not less than twenty.

13.3 A student shall exercise his option in respect of the electives and register for the same at the beginning of the concerned semester. The student may be permitted to opt for change of elective subject within 15 days from the date of commencement of the semester as per the calendar of the University.

14. **COMPUTATION OF SGPA, YGPA AND CGPA**

14.1 The Dr. A.P.J.Abdul Kalam Technical University (APJAKTU) Lucknow adopts absolute grading system wherein the marks are converted to grades and every semester results will be declared with semester grade point average (SGPA). Yearly Grade Point Average (YGPA) shall be calculated at each year by calculating from the formula given in section 14.4 (b) of an academic year. The Cumulative Grade Point Average (CGPA) shall be calculated at the end of last semester of the program. The grading system is with the following letter grades and grade points scale as given below:

Level	Outstanding	Excellent	Very Good	Good	Above Average	Average	Poor	Fail
Letter Grade	A+	A	B+	B	C	D	E	F
Grade Points	10	9	8	7	6	5	4	00
Score (Marks) Range (%)	≥ 90 (90-100)	<90 (80-89)	<80, ≥70 (70-79)	<70, ≥60 (60-69)	<60 ,≥50 (50-59)	<50, ≥45 (45-49)	<45, ≥40 (40-44)	< 40 (0-39)

14. 2

(a) A student obtaining Grade ‘F’ in a subject shall be considered failed in that subject and will be required to reappear in the examination. Such students after passing the failed subject in subsequent examination(s) will be awarded with grade according to marks he/she scores in the subsequent examination(s).

(b) If a student's SGPA in a semester is less than 5 to be declared pass in that semester as laid down by clause 10.3 of the ordinance, he/she shall be allowed to appear in the improvement examination of the theory subjects of that semester. Such student after passing the said subjects in subsequent examination(s) will be awarded with grade according to marks he/she scores in the subsequent examination(s).

14.3

(a) The University has right to scale/moderate the theory exam/practical exam/sessional marks of any subject whenever required for converting of marks in to letter grades on the basis of the result statistics of university as in usual practice.

(b) The modality for moderation of marks before the declaration of result shall be decided by a committee of Pro-Vice Chancellor, Dean UG, Assoc. Dean UG and Controller of Examination.

(c) The modality for moderation of marks if needed after the declaration of result shall be decided by a committee of Pro-Vice Chancellor, Dean UG, Assoc. Dean UG, Controller of Examination and an external member not below the rank of Professor nominated by the Vice Chancellor.

(d) If the candidate(s) appeared in the examination but theory marks are not available due to missing of copy by any reason, the average marks may be awarded as decided by the committee mentioned in 14.3(a). In case of missing/unavailable of sessional marks, Controller of Examination can take decision as per the provision laid down by the Examination Committee.

(d) The Committee defined in14.3 (a) shall also fix up the responsibility and recommend the punishment for occurrence of such case(s) in14.3(c).

(e) All the matters defined under 14.3(a) to 14.3 (d) shall be executed subject to the approval of Academic Council of the APJAKTU.

14.4 **Computation of SGPA, YGPA and CGPA**

The following procedure to compute the Semester Grade Point Average (SGPA), Yearly Grade Point Average (YGPA) and Cumulative Grade Point Average (CGPA):

(a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e SGPA (Si) = Σ (Ci x Gi) / ΣCi where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

(b) The YGPA(Yearly Grade Point Average) is calculated at end of each year as:

$$YGPA= (SGPA_{(odd)} * \sum C_{i(odd)} + SGPA_{(even)} * \sum C_{i(even)} / (\sum C_{i(odd)} + \sum C_{i(even)})$$

(c) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e., CGPA = Σ (Ci x Si) / Σ Ci where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

(d) The SGPA shall be calculated at end of each semester and YGPA shall be calculated at the end of each academic year. CGPA shall be calculated at the end of last semester of the Program and shall be rounded off to 2 decimal places and reported in the transcripts / grade Sheet.

Illustration for Computation of SGPA, YGPA and CGPA

Computation of SGPA of odd semester Illustration No.1

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	5.5	B^+	8	5.5x8 = 44
Course 2	4	C	6	4x6 = 24
Course 3	5	B	7	5x7 = 35
Course 4	3	A^+	10	3x10= 30
Total	17.5			**133**

Thus, SGPA= 133/17.5 =7.6

Computation of SGPA of even semester Illustration No.2

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	5.5	B^+	8	5.5x8 = 44
Course 2	4	C	6	4x6 = 24
Course 3	5	B	7	5x7 = 35
Course 4	3	A^+	10	3x10= 30
Course 5	3	F	0	3x0= 00
Total	20.5			**133**

Thus, SGPA= 133/20.5 =6.48

$$YGPA= (SGPA_{(odd)} * \sum C_{i(odd)} + SGPA_{(even)} * \sum C_{i(even)} / (\sum C_{i(odd)} + \sum C_{i(even)})$$

Thus, YGPA = 7.6 * 17.5+6.48 *20.5 / (17.5 +20.5) = 6.99

Illustration No.2a

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 5	3.0	E	4	3.0 x 4 = 12

C_i (First Attempt) + C_i (Subsiquent Attempt) = 133 + 12 = 145

Thus SGPA= 145/20.5 = 7.07

CGPA after Final Semester

Semester	I	II	III	IV	V	VI	VII	VIII
Credit	17.5	20.5	21.0	21.0	21.0	21.0	20	18.0
SGPA	7	8.5	9.2	6.86	8.18	7.73	8.68	9.4

Thus, CGPA= (17.5*x*7 + 20.5*x*8.5 + 21*x*9.2 + 21*x*6.86 + 21*x*8.18 + 21*x*7.73 + 20*x*8.68 + 18*x*9.4)/160 =8.66

14.5 Grade sheet: Based on the above recommendations on Letter grades, grade points, SGPA of each semester and YGPA of an academic year, a consolidated grade sheet indicating performance in a particular academic year.

14.6 CGPA (calculated at the end of the last semester of the program) shall be issued.

15. **CONVERSION OF CGPA INTO PERCENTAGE**

Conversion formula for the conversion of CGPA into Percentage is (CGPA-0.75) x 10 = Percentage of marks scored.

Illustration: (8.66-0.75) x 10 =79.1%

16. **AWARD OF DIVISION, RANK AND MEDALS**

16.1 Division and CGPA shall be awarded only after the eighth and final semester examination based on integrated performance of the candidate for all the eight semesters (six semesters for lateral entry) as per following details.

(a) After successful completion of 160 credits, a student shall be eligible to get under graduate degree in engineering/technology. A student will be eligible to get undergraduate degree with honours only, if he/ she voluntary completes additional University recommended courses only (equivalent to 20 credits offered by NPTEL of 4 weeks, 8 weeks and 12 weeks shall be of 2, 3 and 4 credits respectively) through MOOCs. For registration to MOOCs courses, the students shall follow NPTEL site http://nptel.ac.in/ as per the NPTEL policy and norms. These students can register for their courses through NPTEL directly as per the course offering in odd/even semesters at NPTEL. The registration fees will be borned by the student. These NPTEL courses (recommended by the university) may be cleared during the B.Tech degree program (not necessary one course in each semester). After successful completion of these MOOCs courses the students, shall, provide their successful completion NPTEL status/ certificates to the university (COE) through their college of study only. The student shall

be awarded **First division with Honours** Degree only if he/she secures 7.50 or above CGPA and passed each subject of that degree program in single attempt without any grace marks, without any gap along with successful completion of MOOCS based course of 20 credits.

(b) The student shall be awarded **First division with Distinction** Degree only if he/she secures 7.50 or above CGPA and passed each subject of that degree program in single attempt without any grace marks and without any gap.

(c) A candidate who qualifies for the award of the degree by securing E or above grades in all subjects of all the semesters (eight semesters/six semesters) as applicable, and secures CGPA less than 7.5 and greater than or equal to 6.5 shall be declared to have passed the examination in FIRST DIVISION.

(d) All other candidates who qualify for the award of degree by securing E or above grades in all subjects of all semesters (eight semesters/six semesters as applicable) and secures CGPA below 6.5 and greater than or equal to 5.0 shall be declared to have passed the examination in

SECOND DIVISION.

16.2 For award of ranks in a branch, a minimum of 10 students should have appeared in the 8th semester examination. The total number of ranks awarded shall be 10% of total number of students appeared in 8th semester or 10 students, whichever is less in that branch.

Illustration:

1. If 1028 students appeared for the 8th semester in Electronics and Communication Engineering Branch, the number of ranks to be awarded for Electronics and Communication Engineering will

10.

2. If 90 students appeared for the 8th semester in Biomedical Engineering Branch, the number of ranks to be awarded for Biomedical Engineering will be 09.

For award of rank in a branch of Engineering / Technology, the CGPA secured by the student from

(a) 1st to 8th semester for the students admitted to B.E./B.Tech. Program from 1st year, and

(b) 3rd to 8th semester for the students admitted to B.E./B.Tech. Program from 2nd year (Lateral Entry) shall be considered.

A student shall be eligible for a rank at the time of award of degree in each branch of Engineering / Technology, provided the student

(a) Has passed 1st to 8th (students joining from 1st semester) or 3rd to 8th (in case of lateral entry) semester in all the subjects in first attempt only

(b) Has not repeated/rejected any of the lower semesters.

If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* but, if it is not resolved even at this stage, the number of times a student has obtained higher grades like A^+, A, B^+, B etc shall be taken into account in rank ordering of the students in a program.

16.3 The Gold, Silver and any other Medals as decided by the university shall be awarded to students falls in the top ranks of various courses as per university rules.

17. SCRUTINY AND RE-EVALUATION

17.1 Scrutiny and re-evaluation shall be allowed in only theory papers.

17.2 Revaluation of theory/practical papers is permitted only with certain conditions as laid down by university.

18. UNFAIR MEANS

Cases of unfair means shall be dealt as per the rules and regulations of the University (**ANNEXURE-II**).

19. AWARD OF SESSIONAL MARKS

Sessional marks for theory subjects, practicals and project shall be awarded as prescribed and at present the break-up of sessional marks shall be as follows:

(a) Theory Subjects:

(i) Class test which will comprise 30 % of total theory marks with two mid-term tests of equal weightage.

(ii) Teacher Assessment Tutorial/Assignment/ Quizzes/ Attendance comprises 20% of total theory marks.

(b) Practicals,

(i) Two mid-term viva-voce/tests of equal weightage 30% of total Practical marks.

(ii) Teacher Assessment: Lab, Record/ Attendance 20% of total Practical marks.

(c) Make-up test may be held only for those students who could not appear in any one of mid-term class tests due to genuine reasons for which the prior permission from the Head of Institution/College was taken. Make up test shall ordinarily be held about two weeks before the semester examination. The syllabus for the make-up test shall be the whole syllabus covered by the subject teacher upto that time.

20. AWARD OF SEMINAR INDUSTRIAL TRAINING, EDUCATIONAL TOUR MARKS AT INSTITUTION/COLLEGE LEVEL

20.1 The marks of Seminar, Industrial Training, Educational tour marks shall be awarded on the following basis:

(i) Write-up / Report 50%

(ii) Presentation 50%

20.2 The marks in Seminar, Industrial Training and Educational Tour shall be awarded by a committee consisting of following members:

(i) Head of the Department or his/her nominee.

(ii) Concerned Officer – Incharge.

(iii) Senior Faculty Member of the department nominated by the Head of Department.

21. CANCELLATION OF ADMISSION

The admission of a student at any stage of study shall be cancelled if :

(a) He / She is not found qualified as per AICTE / State Government norms and guidelines or the eligibility criteria prescribed by the University. or

(b) He / She is found unable to complete the course within the stipulated time as prescribed in clause 4.2 or

(c) He / She is found involved in creating indiscipline in the Institution / College or in the University.

(a) The Academic Council shall have the power to relax any provision provided in the ordinance in any specific matter/situation subject to the approval of Executive Council of the University.

PROGRAMME OUTCOMES (POs)

PO1: Fundamental Engineering perspective: Apply the possess knowledge to solve complex computer science and engineering problems, using mathematics, science, engineering fundamentals and an engineering specialization.

PO2: Problem Tackling Skills: Based on the principles of mathematics, basic sciences, and engineering. It identifies, formulate and solves complex engineering issues.

PO3: Blueprint designing skills: For public health, safety, cultural, environmental and other specific needs, it develops system component, processes and provide solution.

PO4: Investigative Skills: Creating, identifying and implementing appropriate techniques, resources, and modern engineering and IT tools including predicting and modeling complex engineering activities with an understanding of limitations.

PO5: Sensitive towards Society: Apply reasoning informed by contextual knowledge to assess social, health, safety, legal and cultural issues and the resulting responsibilities relevant to professional engineering.

PO6: Environment enthusiast: Understanding the effect of technical engineering solutions in social and environmental contexts and demonstrating the awareness of sustainable development and needs.

PO7: Sense of Professional etiquettes: It generates sense about professional ethics and responsibility.

PO8: Team work: Work as an individual, as a member or leader in all multidisciplinary environments.

PO9: Expressive: Communicate effectively with the engineering community and with society at large on complex engineering practices, such as being able to understand and write effective reports and documents on design, making effective presentations, and providing and obtaining clear guidance.

PO10: Quality of life: Engineering skills are used for solving personal as well as social problems and improve the quality of life.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to exhibit logical and critical thinking along with essential analytical skills that are crucial for understanding, analyzing and developing the software and hardware solutions in the field of computer science and engineering.

PSO2: Ability to develop software systems to enable the convenient use of the computing system and possess professional skills and knowledge about software design process.

PSO3: Ability to acquire knowledge in various fields of computer science, and to apply for successful career in industry, entrepreneurship and/or higher studies.

PSO4: Ability to use the knowledge of ethical and management principles required for teamwork as well as for team leadership.

PSO5: Ability to detect real life/social problems or any industrial automation problems and articulate and resolve them using advance computer technologies like data science and some specialized area of computer science intending to emulate human intelligence such as machine learning, computer vision, pattern recognition, Natural language processing.

Course Structure and Evaluation Scheme for B.Tech.

SEMESTER-I

S. No.	Subject Code	Subject Name	L – T - P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	AS 103	Engineering Mathematics-I	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	AS 101	Engineering Physics-I	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	EE 101/ ME 101	Basic Electrical Engineering/ Elements of Mechanical Engineering	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
04.	AS 104 CS 101	Professional Communication/ Computer System & Programming in	**3-0-0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	EC 101/ AS 102	Basic Electronics/Engineering Chemistry	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	AS 151/ AS 152	Engineering Physics Lab/ Engineering Chemistry Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
07.	EE151/ ME 151	Basic Electrical Engineering Lab Elements of Mechanical Engineering Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
08.	AS 154/ CS 151	Professional Communication Lab/ Computer Programming . Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
09.	ME 152/ CE 151	Workshop Practice/Computer Aided Engineering Graphics	**0-0-3**	**-**	**20**	**20**	**30**	**50**	**2**
10.	GP	General Proficiency	**-**	**-**	**-**	**50**	**-**	**50**	**-**
Total								**700**	**24**

Abbreviations: CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination

SEMESTER-II

S. No.	Subject Code	Subject Name	L - T - P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	AS 203	Engineering Mathematics-II	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
02.	AS 201	Engineering Physics-II	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
03.	ME 201/ EE 201	Elements of Mechanical Engineering/ Basic Electrical Engineering	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
04.	CS 201/ AS 204	Computer System & Programming in C/ Professional Communication	**3-0-0**	**20**	**10**	**30**	**70**	**100**	**3**
05.	AS 202/ EC 201	Engineering Chemistry/ Basic Electronics	**3-1-0**	**20**	**10**	**30**	**70**	**100**	**4**
	Practical								
06.	AS 252/ AS 251	Engineering Chemistry Lab/ Engineering Physics Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
07.	ME 251/ EE 251	Elements of Mechanical Engineering Lab/ Basic Electrical Engineering Lab	**0-0-2**	**—**	**20**	**20**	**30**	**50**	**1**
08.	CS 251/ AS254	Computer Programming. Lab/ Professional Communication Lab	**0-0-2**	**-**	**20**	**20**	**30**	**50**	**1**
09.	CE 251/ ME 252	Computer Aided Engineering Graphics/Workshop Practice	**0-0-3**	**-**	**20**	**20**	**30**	**50**	**2**
10.	GP	**General Proficiency**				**50**		**50**	
Total								**700**	**24**

SEMESTER III

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
1.	AS - 301	Mathematics – III	**3--1--0**	**20**	**10**	**30**	**70**	**100**	**4**
2.	EE - 301	Network Analysis & Synthesis	**3--1--0**	**20**	**10**	**30**	**70**	**100**	4
3.	CS - 301	Data Structure Primer using C	**3--0--0**	**20**	**10**	**30**	**70**	**100**	**3**
4.	CS - 302	Numerical & Statistical Techniques in Computer Science	**3--0--0**	**20**	**10**	**30**	**70**	**100**	**3**
5.	EC - 301	Digital Circuits & Logic Design	**3--0--0**	**20**	**10**	**30**	**70**	**100**	3
6.	AS – 302/ AS - 303	Human Values & Ethics / Environment & Ecology	**3—0--0**	**20**	**10**	**30**	**70**	**100**	**3**
	Practical								
7.	EE - 351	Network Analysis & Synthesis Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
8.	CS - 351	Data Structure Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
9.	CS - 352	Numerical Technique Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
10.	EC - 351	Digital Circuits & Logic Design Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
11.	**GP - 301**	**General Proficiency**				**50**		**50**	
Total			**18-2-8**					**800**	**24**

SEMESTER - IV

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
1.	AS - 404	Discrete Mathematical Structure	**3--1--0**	**20**	**10**	**30**	**70**	**100**	**4**
2.	CS - 401	Computer Organization	**3--1--0**	**20**	**10**	**30**	**70**	**100**	**4**
3.	CS - 402	Theory of Automata	**3--0--0**	**20**	**10**	**30**	**70**	**100**	**3**
4.	CS - 403	Object Oriented Programming	**3--0--0**	**20**	**10**	**30**	**70**	**100**	**3**
5.	EC - 404	Fundamentals of Microprocessor	**3--0--0**	**20**	**10**	**30**	**70**	**100**	**3**
6.	AS – 402/ AS - 403	Human Values & Ethics/ Environment & Ecology	**3—0--0**	**20**	**10**	**30**	**70**	**100**	**3**
	Practical								
7.	CS - 451	**Computer Organization Lab**	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
8.	CS - 452	**Automata Lab**	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
9.	CS - 453	Object Oriented Programming / Java Lab	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
10.	EC - 454	**Microprocessor Lab**	**0--0--2**	**-**	**20**	**20**	**30**	**50**	**1**
11.	**GP - 401**	**General Proficiency**				**50**		**50**	
Total			**18-2-8**					**800**	**24**

SEMESTER-V

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	CS-501	Concepts of Operating System	3--1--0	20	10	30	70	100	4
02.	CS-502	Database Management Concepts	3--1--0	20	10	30	70	100	4
03.	CS-503	Software Engineering	3--0--0	20	10	30	70	100	3
04.	CS-504	Web Technology	3--0--0	20	10	30	70	100	3
05.	CS-505	Compiler Design	3--1--0	20	10	30	70	100	4
	Practical								
06.	CS-551	Operating System Lab	0--0--3	-	40	40	60	100	2
07.	CS-552	Database Management System Lab	0--0--3	-	40	40	60	100	2
08.	CS-553	Software Engineering Lab	0--0--2	-	20	20	30	50	1
09.	CS-554	Web Technology Lab	0--0--2	-	20	20	30	50	1
10.	GP-501	General Proficiency				50		50	
Total			**15-3-10**					**800**	**24**

SEMESTER - VI

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	CS-601	Design and Analysis of Algorithm	3--1--0	20	10	30	70	100	4
02.	CS-602	Computer Network	3--1--0	20	10	30	70	100	4
03.	CS-603	Computer Architecture	3--1--0	20	10	30	70	100	4
04.	CS-604	Graph Theory	3--0--0	20	10	30	70	100	3
05.	CS - 605	Any one from the list (DE – 1)	3--0--0	20	10	30	70	100	3
	Practical								
06.	CS-651	Design and Analysis of Algorithm Lab	0--0--2	-	20	20	30	50	1
07.	CS-652	Computer Network Lab	0--0--2	-	20	20	30	50	1
08.	CS-653	Mini Project	0--0--3	-	40	40	60	100	2
09.	CS-654	Seminar	0--0--3	-	40	40	60	100	2
10.	GP-601	General Proficiency				50		50	
Total			**15-3-10**					**800**	**24**

Abbreviations : CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination DE- Department Elective

Note: Students have to undergo Industrial Training for a period of six weeks during summer vacation. The report of Industrial Training will be submitted to the Head of the Department in the beginning of seventh semester.

Departmental Elective – 1:-

CS - 6051 Software Project Management
CS - 6052 Multimedia System
CS - 6053 Software Testing & Audit
CS - 6054 E-Commerce
CS- 6055 Web Mining
CS- 6056 Data Compression

SEMESTER - VII

SI. No.	Subject Code	Subject Name	L-T-P	Th/Lab Marks	Sessional		Total	Credit
				ESE	CT	TA		
1	BT – 706	Introduction to Smart Grid	3--0--0	70	20	10	100	3
2	BT – 711	Human Computer Interface	3--0--0	70	20	10	100	3
3	BT – 712	Cloud Computing	3--1--0	70	20	10	100	4
4	BT-715	Cryptography & Network Security	3--1--0	70	20	10	100	4
5	BT-714	Artificial Intelligence	3--0--0	70	20	10	100	3
6	BT-765	Cryptography & Network Security Lab	0--0--2	50		50	100	1
7	BT-764	Artificial Intelligence Lab	0--0--2	50		50	100	1
8	BT-766	Industrial Training	0--0--3			100	100	2
9	BT-767	Project	0--0--6			200	200	3
	TOTAL			450	100	450	1000	24

Abbreviations:

CT -ClassTest TA - Teacher'sAssessment
ESE - EndSemester Examination DE - DepartmentalElective

SEMESTER - VIII

SI. No.	Subject Code	Subject Name	L-T-P	Th/Lab Marks	Sessional		Total	Credit
				ESE	CT	TA		
1	BT - 811	Machine Learning	3--0--0	70	20	10	100	3
2	BT - 812	Image Processing	3--1--0	70	20	10	100	4
3	BT - 814	Deep Learning	3--0--0	70	20	10	100	3
4	BT - 866	Seminar	0--0--3			100	100	2
5	BT - 867	Project	0--0--12	350		250	600	12
	TOTAL			560	60	380	1000	24

DEPARTMENTAL ELECTIVES

IT-ELECTIVE -3

1. BT-711A Computer Graphics
2. BT-711B Application of Soft Computing
3. BT-711C High Performance Computing
4. BT-711 H u m a n Computer Interface

IT-ELECTIVE-4

1. BT-712 Cloud Computing
2. BT-712A Blockchain Architecture Design
3. BT-712B Agile Software Development
4. BT-712C Augmented & Virtual Reality

IT-ELECTIVE-5

1. BT-812 Machine Learning (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc17_cs17/preview https://onlinecourses.nptel.ac.in/noc17_cs26/preview)
2. BT-812A Game Programming
3. BT-812B Image Processing (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_ee40/preview https://nptel.ac.in/courses/106105032/
4. BT-812C Parallel and Distributed Computing (Mapping with MOOCS: https://nptel.ac.in/courses/106102114/, https://nptel.ac.in/courses/106104024/)

IT-ELECTIVE-6

1. BT-814A Speech Natural language processing (Mapping with MOOCS: https://nptel.ac.in/courses/106101007/ https://nptel.ac.in/courses/106105158/)
2. BT-814 Deep Learning (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cs41/preview)
3. BT-814B Data Compression
4. BT-814C Quantum Computing (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cy07)

SYLLABUS

OF IT

AS 103
Engineering Mathematics - I

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra, Understand the definitions of Vector Space and its linear Independence, Solve Eigen value problems and apply Cayley Hamilton Theorem.
- Study the functions of more than one independent variable and calculate partial derivatives along with their applications
- Explore the idea for finding the extreme values of functions and integrate a continuous function of two or three variables over a bounded region.
- Understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
- Calculate line integral, surface integral and volume integral and correlate them with the application of Stokes, Green and Divergence theorem.

Unit - 1: Matrix Algebra
Types of Matrices, Inverse of a matrix by elementary transformations, Rank of a matrix (Echelon & Normal form). Linear dependence. Consistency of linear system of equations and their solution, Characteristic equation. Eigen values and Eigen vectors, Cayley-Hamilton Theorem, Diagonalization, Complex andUnitary Matrices and its properties

Unit -2: Differential Calculus -I
Successive Differentiation, Leibnitz's theorem, Limit , Continuity and Differentiability of functions of several variables. Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.

Unit - 3: Differential Calculus – II
Taylor's and Maclaurin's Theorem, Expansion of function of several variables, Jacobian, Approximation of errors. Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).

Unit - 4: Vector Calculus
Point function. Gradient, Divergence and Curl of a vector and their physical interpretations. Vector identities. Tangent and Normal, Directional derivatives. Line, Surface and Volume integrals. Applicationsof Green's, Stake's and Gauss divergence theorems (without proof).

Unit - 5: Multiple Integrals
Double and triple integrals. Change of order of integration. Change of variables. Application of integration to lengths, Surface areas and Volumes - Cartesian and Polar coordinates. Beta and Gamma functions, Dirichiefs integral and its applications.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics,John-Wiley & Sons
2. B. V. Ramana, Higher Engineering Mathematics, Tata Me Graw- Hill Publishing Company Ltd.
3. R.K.Jain & S.R.K. lyenger. Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Thomas & Finley, Calculus, Narosa Publishing House
4. Rukmangadachari, Engineering Mathematics -1, Pearson Education.
5. A.C.Srivastava&P.K.Srivastava, Engineering Mathematics, Vol.l, PHI Learning Pvt. Limited, NewDelhi.

AS 101

Engineering Physics - I

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To develop the concept of relativistic mechanics and to explain it in different domains.
- To develop the understanding of Modern Physics and their application in various micro and macro systems.
- To develop the understanding of Interference and Diffraction with different experimental results.
- To illustrate the nature of EM waves and to apply the ideas of production of different types of polarized light and to know about the components and types of laser i.e pulsed and continuous wave.
- To develop the understanding of components and types of optical fiber with light propagation mechanism and to illustrate construction and reconstruction of holograms.

Unit -1: Relativistic Mechanics 08 Hrs.

Inertial & non-inertial frames of reference, Galilean transformations, Michelson-Morley experiment, Einstein's postulates, Lorentz transformation equations. Length contraction & Time dilation. Relativistic addition of velocities; Variation of mass with velocity. Mass energy equivalence. Mass less particle.

Unit-II: Modem Physics 10 Hrs.

Black body radiation, Weins law and Rayleigh-Jeans law. Quantum theory of radiation, Planck's law. Wave-particle duality, de-Broglie matter waves, Bohr's quantization rule. Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications. Wave function and its significance, Time dependent and time independent Schrodinger's wave equations - particle in one dimensional potential box. Eigen values and Eigen function.

Unit - III: Wave Optics 10 Hrs.

Interference: Coherent sources, condition for sustained Interference in thin films (parallel and wedge shaped film), Newton's rings and its applications.

Diffraction: Types of diffractions, Single, double and N- Slit Diffraction, Diffraction grating. Grating spectra, dispersive power, Rayleigh's criterion and resolving power of grating.

Unit - IV: Polarization and Laser 08 Hrs.

Polarization: Phenomena of double refraction, Construction and working of Nicol prism. Production and analysis of plane, circular and elliptical polarized light. Retardation Plate, Optical Activity, Fresnel's theory. Specific rotation.

Laser: Spontaneous and stimulated emission of radiation, population inversion, Einstein's Coefficients, Coherence, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers , Laser applications.

Unit - V: Fiber Optics and Holography 06 Hrs.

Fiber Optics: Fundamental ideas about optical fiber, Propagation mechanism, Acceptance angle and cone,

Normalized frequency, Numerical aperture. Single and Multi Mode Fibers, Dispersion and Attenuation. Holography: Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Reference Books:

1. Concepts of Modem Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wielly)
3. Optics -AjoyGhatak(Tata McGraw Hill Education Private Ltd. New Delhi)
4. Optics - Brijlal& Subramanian (S. Chand)
5. Engineering Physics- C. Mani Naidu(Pearson)
6. Lasers Principles, Types and Applications- K R Nambiar (New Age)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New.

AS 102/AS 202

Engineering Chemistry

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- The students will gain knowledge of basic theories of solid materials, nano-materials and liquid crystals.
- To demonstrate the knowledge of synthesis of polymeric material, which are required for engineering applications.
- Apply basic knowledge of Science and fundamental aspect of cell working, equations in solving electrochemistry problems, functioning of lubricants and the techniques controlling the corrosion.
- Analyze the water sample parameters & identify the impurities and its effects. Able to design process for purification of water that is concern with safety of public health & environment.
- Apply basic knowledge of fuels and experimental techniques used in identification of structure of organic/inorganic moieties.

Unit-1	Molecular orbital theory and its applications to homo-nuclear diatomic molecules. Band theory of solids. Liquid crystals and its applications. Point defects in Solids. Structure and applications of Graphite and Fullerenes. Concepts of nano-materials and its applications	**8**
Unit-2	Polymers: Basic concepts of polymer- blends and composites. Conducting and biodegradablepolymers. Preparations and applications of some industrially important polymers(Buna N, Buna S, Neoprene, Nylon 6, Nylon 6,6 , Terylene). General methods of synthesis of organometallic compound (Giignard Reagent) and their applications in polymerization.	**8**
Unit-3	Electrochemistry: Galvanic cell, electrode potential. Lead storage battery. Corrosion, causes and its prevention. Setting and hardening of cement, applications of cement. Plaster of paris. Lubricants- Classification, mechanism and applications..	**8**
Unit-4	Hardness of water. Disadvantage of hard water. Boiler troubles. Techniques for water softening; Lime-soda, Zeolite, Ion exchange resin. Reverse osmosis. Phase Rule and its application to water system.	**8**
Unit-5	Fuels; Classification of fuels. Analysis of Coal. Determination of Calorific values (bomb calorimeter & Dulong's method). Biogas. Elementary ideas and simple applications of UV, Visible, IR and H^NMR spectral Techniques.	**8**

Text Book :

1. Chemistry for Engineers, by S. Vairam and Suba Ramesh; Wiley India

Reference Books :

1. Textbook of Engineering Chemistry by Dr. Gopal Krishna Bhatt, Acme Publishers
2. Chemistry (9th ed), by Raymond Chang, Tata McGraw-Hill
3. Chemistry Concepts and Applications by Steven S. Zumdahl; Cengage Learning
4. Engineering Chemistry, Wiley India

5. Engineering Chemistry Author: Abhijit Mallick, Viva Books
6. Text Book of Engineering Chemistry by Harsh Malhotra; Sonali Publications
7. Concise Inorganic Chemistry by J.D. Lee; Wiley India
8. Organic Chemistry (6 ed) by Morrison & Boyd; Pearson Education
9. Physical Chemistry by Gordon M. Barrow; Mc-Graw Hill
10. Organic Chemistry, Volume 1(6 ed)& 2 (5ed) by I. L. Finar; Pearson Education
11. Atkins' Physical Chemistry by Peter Atkins & Julio De Paula; Oxford University Press.

EC101/EC 201

Basic Electronics Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Acquire basic knowledge on the working of various semi-conductor devices.
- Develop analysis capability in BJT and FET Amplifier Circuits.
- Identify functions of digital multimeter, voltmeter, Cathode ray oscilloscope and Digital storage oscilloscope in measurement of physical variables.
- Understand fundamentals of radio communication

Unit-I

PN junction diode: Introduction of Semiconductor Materials Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance. Diode Equivalent Circuits, Transition and Diffusion Capacitance, Diodes breakdown mechanism (Zener and avalanche) Diode Application: Series, Parallel and Series, Parallel Diode Configuration, Half and Full Wave rectification. Clippers, Clampers, Zener diode as shunt regulator. Voltage-Multiplier Circuits Special Purpose two terminal Devices: Light-Emitting Diodes, Liquid-Crystal Displays.

12 Lectures

Unit-II

Bipolar Junction Transistor and Field Effect Transistor: Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration DC Biasing BJTs: Operating Point, Fixed-Bias, Emitter Bias, Voltage-Divider Bias Configuration.Emitter-Follower Configuration. Bias Stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model). Field Effect Transistor: Construction and Characteristic of JFETs. AC analysis of CS amplifier, MOSFET (Depletion and Enhancement)Type, Transfer Characteristic.

10 Lectures

Unit-III

Operational Amplifiers: Introduction and Block diagram of Op Amp, Ideal & Practical characteristics of Op Amp, Differential amplifier circuits. Practical Op- Amp Circuits (Inverting Amplifier, Non inverting Amplifier, Unity Gain Amplifier, Summing Amplifier, Integrator, Differentiator). **OP AMP Parameters: Input offset voltage, Output** offset **voltage, Input biased current. Input offset current** Differential and Common-Mode Operation.

6 Lectures

Unit-IV

Electronic Instrumentation and Measurements: Digital Voltmeter : Introduction, RAMP Techniques, Analog and Digital Multimeters: Introduction Oscilloscope: Introduction, Basic Principle, Block Diagram of Oscilloscope, Simple CRO, Measurement of voltage, current phase and frequency using CRO, Introduction of Digital Storage Oscilloscope and Comparison of DSO with Analog Oscilloscope.

6 Lectures

Unit-V

Fundamentals of Communication Engineering: Elements of a Communication System, Need of Modulation, Electromagnetic spectrum and typical applications. Basics of Signal Representation and Analysis, Introduction of various analog modulation techniques. Fundamentals of amplitude and frequency modulation. Modulation and Demodulation Techniques of AM.

6 Lectures

Text Books:

1. Robert L. Boylestand / Louis Nashelsky*"Electronic Devices and Circuit Theory" Latest*Edition, Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication,.
3. George Kennedy, "Electronic Communication Systems", Latest Edition, TMH,

Reference Books:

1. David A. Bell, *""Electronic Devices and Circuits",* Latest Edition, Oxford University Press.
2. Jacob Millman, C.C. Halkias, StayabrataJit, *""Electronic Devices and Circuits'",* Latest Edition , TMH.
3. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India.

ME101/ME 201

Elements of Mechanical Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Problems by applying the fundamental principles of engineering mechanics and to proceed to design and development of the mechanical systems.
- Understand the representation of forces and moments.
- Understand the concept of static equilibrium of particles and rigid bodies.
- Able to understand the concept of stress and strain.
- Understand the basic concepts of Thermodynamics

UNIT-I

Force System: Law of Parallelogram of forces, Lami's theorem. Principle of Transmissibility of forces. Moment of a force. Couple, Varignon's theorem. Resolution of a force into a force and a couple. Resultant and equilibrium of coplanar force system. Determination of reactions.Free body diagrams.

Concept of Centre of Gravity, Centroidand Area Moment of Inertia, Perpendicular axis theorem and Parallel axis theorem

9 Lectures

UNIT-II

Plane Trnss: Perfect Deficient and Redundant Truss. Assumptions and Analysis of Plane Truss by Method of joints and Method of section.

Beams: Types of beams., Shear force and bending moment in Statically Determinate Beams. Shear force and bending moment diagrams. Relationships between load, shear and bending moment.

8 Lectures

UNIT-III

Simple stress and strain: Normal and shear stresses. One Dimensional Loading; members of varying cross section, bars in series. Tensile Test diagram for ductile and brittle materials. Elastic constants. Strain energy.

Bending (Flexural) Stresses: theory of pure bending, neutral surface and neutral axis, stresses in beams .

Engineering Materials: Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials.

8 Lectures

UNIT-IV

Basic Concepts and Definitions of Thermodynamics: Introduction and definition of thermodynamics. Microscopic and Macroscopic approaches. System, surrounding and universe. Concept of continuum. Thermodynamic equilibrium. Thermodynamic properties, path, process and cycle. Quasi static process. Energy and its forms. Work and heat.

Zeroth law of thermodynamics: Temperature and its' measurement.

First law of thermodynamics: First law of thermodynamics. Internal energy and enthalpy. First law analysis for non-flow processes. Steady flow energy equation; Boilers, Condensers, Turbine, Throttling process. Pumps etc.

8 Lectures

UNIT-V

Second law: Thermal reservoir, Kelvin Planck statement. Heat engines. Efficiency; Clausius' statement Heat pump, Refrigerator, Coefficient of Performance, Carnot cycle, Carnot theorem and it's

corollaries.Clausius inequality. Concept of Entropy.

Properties of Pure Substances: P-v, T-s and h-s diagram, dryness fraction and steam tables. Rankine Cycle.

Internal Combustion Engines: Classification of I.C. Engines, working principle and comparison between 2 Stroke and 4 stroke engine , difference between SI and Cl engines. P- V and T-s diagramsof Otto and Diesel cycles, comparison of efficiency.

9 Lectures

Reference Books:

1. Engineering Mechanics: Statics by J.L Meriam , Wiley
2. Engineering Mechanics : Statics and Dynamics by R. C. Hibbler, Pearson
3. Strength of Materials by Thimoshenko& Young
4. Mechanics of Solid by R. C. Hibbler, Pearson
5. Introduction to Mechanical Engineering : Thermodynamics, Mechanics & strength of Material,Onkar Singh, New Age International (P) Ltd.
6. Engineering Thermodynamics by P.K.Nag, McGraw Hill
7. Thermodynamics An Engineering Approach by Cengel& Boles, McGraw Hill
8. Internal Combustion Engine by V Ganesan, McGraw Hill Pub .
9. Engineering Mechanics By S. S. Bhavikatti, K. G. Rajashekarappa, New Age International
10. Engineering Mechanics by R K Bansal, Laxmi Publications
11. Elements of Workshop Technology by Hajra Choudhary Media Promoter

EE101/EE 201

Basic Electrical Engineering

L	T	P
3	1	0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- To understand fundamentals of DC circuits and apply knowledge for
- Analyzing network theorems in DC circuits.
- To learn the fundamentals and analyze single phase AC circuits.
- To learn the fundamentals and analyze three phase AC circuits.
- To learn the basic operation and analyze the performance of single phase transformer.
- To understand the construction and basic operation of DC motors and generators.

Unit-I

Electrical Circuit Analysis:

Introduction, Circuit Concepts: Concepts of network. Active and passive elements. Voltage and current sources. Concept of linearity and linear network. Unilateral and bilateral elements. Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis. Star-delta transformation,

AC fundamentals: Sinusoidal, square and triangular waveforms - Average and effective values. Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current.

Unit-II

Steady- State Analysis of Single Phase AC Circuits:

Analysis of series and parallel RLCCircuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers. Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)

Network theorems (AC & DC with independent sources): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems)

Unit-III

Three Phase AC Circuits:

Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations. Three-phase power and its measurement (simple numerical problems).

Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers), Single phase energy meter.

Power system: basic concept, power line diagram, concept of grid.

Unit-IV

Magnetic Circuits:

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).

Single Phase Transformer: Principle of operation, Construction, EMF equation, Phaser diagram Equivalent circuit. Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

Unit-V

Electrical Machines:

DC machines:Principle& Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor:Principle& Construction, Types, Slip-torque characteristics. Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Text Books:

1 . Basic Electrical Engineering, S N Singh; Prentice Hall International
2. Basic Electrical Engineering, Kuldeep Sahay, New Age International Publishers
3. Fundamentals of Electrical Engineering, B Dwivedi, A Tripathi; Wiley India
4. Principles of Electrical Engineering, V. Del Toro,; Prentice Hall International
5. Electrical Engineering, J. B. Gupta, Kataria and Sons
6. Basic Electrical Engineering, T.K.Nagsarkar,M.S. Shukhija; Oxford University Press.

Reference Books:

1. Electrical and Electronics Technology, Edward Hughes; Pearson
2. Engineering Circuit Analysis, W.H. Hayt& J.E. Kimerly; Me GrawHill
3. Basic Electrical Engineering, C L Wadhwa; New Age International

CS 101/CS 201

Computer System and Programming in C

L	T	P
3	0	0

Course Outcomes (COs):

- This course will let students understand the basics of solving a problem using the computer system.
- Students will be able to solve simple and precise problems using the computer.
- Students can develop the attitude to solve the problems in hand in logical manner.
- To able to understand the basic concepts of digital computer, binary arithmetic.
- To be able to understand the importance of algorithm and flowcharts in programming.
- To be able to understand the basic concepts of writing a program in C language: write, compile, and run programs in C language.
- To understand role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language
- To be able to write programs that involve decisions and iterations.
- To be able to understand how to use functions, arrays, pointers, preprocessor directives along with fare confidence in file handling.

Unit 1: **(10 Lectures)**

Basics of Computer: Introduction to digital computer, basic operations of computer, functional components of computer. Classification of computers.

Introduction to operating system: [DOS, Windows, Linux and Android] purpose, function, services and types.

Number system: Binary, octal and hexadecimal number systems, their mutual conversions. Binary arithmetic.

Basics of programming: Approaches to Problem Solving, Concept of algorithm and flow charts. Types of computer languages:- Machine Language, Assembly Language and High Level Language, Concept of Assembler, Compiler, Loader and Linker.

Unit2: **(8 Lectures)**

Standard I/O in "C", **Fundamental data types-** Character type, integer, short, long, unsigned, single and double floating point. Storage classes- automatic, register, static and external. Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bitoperations, assignment operator, operator precedence and associatively.

Fundamentals of C programming: Structure of C program, writing and executing the first C program. Components of C language. Standard I/O in C.

Units3: **(10 Lectures)**

Conditional program execution: Applying if and switch statements, nesting if and else, use of break and default with switch, program loops and iterations: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing values to functions, recursive functions.

Unit 4: **(6 Lectures)**

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Structure, union, enumerated data types

Unit 5: **(8 Lectures)**

Pointers: Introduction, declaration, applications File handling, standard C preprocessors, defining and calling macros, conditional compilation, passing values to the compiler.

Reference Books:

1. The C programming by Kemighan Brain W. and Ritchie Dennis M., Pearson Education .
2. Computer Basics and C Programming by V.Rajaraman, PHI Learning Pvt. Limited - 2015.
3. Programming in C by Kochan Stephen G. Pearson Education - 2015.
4. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
5. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
6. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication
7. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
8. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Fundamental and C programming by K K Gupta, Acme Learning Publication

AS 104/AS 204

Professional Communication

L	T	P
3	0	0

Course Outcomes:
Students are able to demonstrate the following:

- Understand the communication system for specific purpose.
- Be able to communicate professionally.
- Be able to communicate across organizational levels and cultures effectively.
- Be able to negotiate with the odds and bring in best of the results with specific success.
- Be able to understand the human needs and adjust accordingly the set goals.

Unit-I: Fundamentals of Communications
Technical Communication: features: Distinction between General And Technical Communication; Language as a tool of communications; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of communication: Downward, Upward, Lateral/Horizontal (Peer group): Importance of technical communication; Barriers to Communication

Unit-II: Written Communication
Words and Phrases: Word formation, Synonyms and Antonyms; Homophones; Selectvocabulary of about 500-1000 New words; correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Transformation of sentences; Requisites f Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronologicaletc.

Unit-III: Business Communication
Principles, Sales & Credit letters; Claim and Adjustment Letters; Job Application and Resumes.
Reports: Types; Significance; Structure, Style & Writing of Reports.
Technical Proposal; Parts; Types; Writing of Proposal; Significance; Negotiation skills.

Unit-IV: Presentation Strategies and Soft Skills.
Nuances and Modes of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Interpersonal communication: Definition; Types; Team work; Attitude; Way to improve Attitude Listening Skills : Types; Methods for improving Listening Skills.

Unit –V: Value- Based Text Readings
Following essays from the prescribed text book with emphasis on Mechanics of writing.

1. Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
2. The Language of Literature and Science by A. Huxley
3. Man and Nature by J. Bronowski
4. Science and Survival by Barry Commoner
5. The Mother of the Sciences by A.J. Bahm.

Text Book:

1. Improve your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
2. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta

Sharma, Oxford Univ. Press, 2007, New Delhi.
3. Functional skills in Language and Literature, by R.P. Singh, Oxford Univ. Press, 2005, New Delhi.

Reference Books:

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
2. Business Correspondence and Report Writing by Prof R.C.,Sharma& Krishna Mohan, Tata McGraw Hill & Co. Ltd. ,2001, New Delhi.
3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
4. Developing Communication skills by Krishna Mohan, MecraBannerji- Macmillan India Ltd. 1990, Delhi.
5. Manual of Practical Communication by L.U.B. Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
7. Spoken English- A manual of Speech and Phonetics by R.K. Bansal & J.B. Harrison Orient Blackswan, 2013, New Delhi.

CE151/CE 251

Computer Aided Engineering Graphics

L	T	P
0	0	3

Course Outcomes (COs):

On successful completion of this course, a student would be able to:

- Produce geometric construction, Multiview, dimensioning and detail drawings of typical 3-D engineering objects.
- Apply the skill for preparing detail drawing of engineering objects.
- Understand and visualize the 3-D view of engineering objects.
- Understand and apply computer software to prepare engineering drawing.
- Able to visualize better and understand the various engineering problems

Introduction

Drawing Instruments and their uses, BIS conventions. Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines,Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.
2 - Sheets

Orthographic Projections Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths. True and apparent inclinations to reference planes.
2 - Sheets

Orthographic Projections of Plane Surfaces (First Angle Projection Only)Introduction, Definitions-projections of plane surfaces-triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change ofposition method only.
1 - Sheet

Projections of Solids (First Angle Projection Only) Introduction, Definitions - Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.
2-Sheets

Sections And Development of Lateral Surfaces of Solids Introduction, Section planes. Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.
1 - Sheet

Isometric Projection (Using Isometric Scale Only)
Introduction, Isometric scale, Isometric projection of simple plane figures. Isometric projection of tetrahedron, hexahedron(cube), right regular prisms , pyramids, cylinders, cones, spheres, cut spheres.
1-Sheet

Text Books:

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, 48thedition, 2005-Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K International Publishing House Pvt. Ltd., New Delhi, 3rdrevised edition- 2006.

Reference Books:

1. Engineering Graphics - K.R. Gopalakrishna, 32”** edition, 2005- Subash Publishers Bangalore.

2. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, 2005-Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Engineering Drawing - M.B. Shah, B.C.Rana, 2nd Edition,2

AS 203

Engineering Mathematics - II

L	T	P
3	1	0

Course Outcomes (COs):
After the completion of the course, students are expected to have the ability to:

- Understand and implement the concept of differential equations and learn various methods to solve ordinary differential equation
- Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions
- Implement the integral transformation using the concept of Laplace transformation and application to solve differential equations
- Learn Fourier series and Fourier transformations for initial and boundary values problems.
- Application of Partial differential equation as heatequation,wave equation and Laplace equation.

Unit - 1: Ordinary Differential Equations
Linear differential equations of order with constant coefficients. Complementary function and Particular integral. Simultaneous linear differential equations. Solution of second order differential equations by changing dependent & independent variables. Method of variation of parameters. Applications to engineering problems (without derivation).

Unit - 2: Series Solution and Special Functions
Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions. Properties of Bessel function and Legendre polynomials.

Unit - 3: Laplace Transform
Laplace transform. Existence theorem, Laplace transforms of derivatives and integrals. Initial and final value theorems. Unit step function, Dirac- delta function, Laplace transform of periodic function. Inverse Laplace transform. Convolution theorem. Application to solve simple linear and simultaneous differential equations.

Unit - 4: Fourier Series and Partial Differential Equations
Periodic functions, Dirichlet's Conditions, Fourier series of arbitrary periods, Euler's Formulae, Even and odd functions, Half range sine and cosine series, Gibbs Phenomena.
Solution of first order Lagrange's linear partial differential equations. Second order linear partial differential equations with constant coefficients.

Unit - 5: Applications of Partial Differential Equations
Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B. V. Ramana, Higher Engineering Mathematics, Tata Me Graw- Hill Publishing Company Ltd.
3. R.K.Jain& S.R.K. lyenger, Advance Engineering Mathematics, Narosa Publishing House.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Peter V. O' Neil, Advanced Engineering Mathematics, Thomas (Cengage) Learning.
3. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudranalaya
4. A. C. Srivastava & P. K. Srivastava, Engineering Mathematics, Vol. - II, PHI Learning Pvt. Ltd.
5. Rukmangadachari, Engineering Mathematics - II, Pearson Education.

AS 201

Engineering Physics - II

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- To know about the fundamentals of crystal physics and illustrations of Nacl and diamond structures.
- To understand the concepts of dielectrics and its polarization and different properties of magnetic materials with their hysteresis curve.
- To formulate and solve the engineering problems on electromagnetism with the help of Maxwell's equations.
- To understand the basics of band theory of solids and discuss the Fermi energy for semiconductors.
- To develop the understanding of superconductors and its types, superconductivity with BCS theory and to understand the various applications of nanotechnology with the help of nano materials.

Unit -1: Crystal Structures and X-ray Diffraction **10Hrs**.

Space lattice, basis. Unit cell. Lattice parameter. Seven crystal systems and Fourteen Bravais lattices. Co-ordination number. Atomic radius and Packing factor of different cubic structures. Crystal structure of NaCl and diamond. Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. Compton Effect.

Unit - II: Dielectric and Magnetic Properties of Materials **10 Hrs**.

Dielectric Properties: Dielectric constant and Polarization of dielectric materials. Relation between E, D and P, Types of Polarization (Polarizability). Equation of internal fields in liquid and solid (One-Dimensional), Claussius-Mossotti equation. Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Ferroelectricity, Piezoelectricity.

Magnetic Properties: Magnetization, Origin of magnetic moment, Dia, para and ferro magnetism, Langevin's theory for diamagnetic material. Phenomena of hysteresis and its applications.

Unit - III: Electromagnetic Theory **06 Hrs.**

Equation of continuity, Maxwell's Equations (Integral and Differential Forms) and its derivations, Displacement Current, Poynting vector and Poynting theorem, EM - Wave equation and its propagation characteristics in free space, non-conducting and conducting media, energy density of electromagnetic wave, Skin depth.

Unit - IV: Band Theory of Solids **06 Hrs**.

Free electron Theory, Formation of bands in Solids, Classification of solids on band theory. Density of states, Fermi-Dirac distribution, Concept of effective mass. Charge carrier density (electrons and holes), Conductivity of semiconductors, carrier concentrations Fermi energy. Position of Fermi level in intrinsic and in extrinsic semiconductors. Temperature dependence of conductivity in semiconductors.

Unit - V: Physics of some technologically important Materials **08Hrs**.

Superconductors: Temperature dependence of resistivity in superconducting materials. Effect of magnetic field (Meissner effect), Temperature dependence of critical field, London equations, Josephson theory, persistent currents. Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors. **Nano-Materials:** Basic principle of nanoscience and technology, structure, properties and uses of Fullerene, Carbon nanotubes Single and double walled nanotubes, synthesis of nanotubes. Properties and Applications of nanotubes.

Reference books:

1. Concept of Modem Physics - by Beiser (Tata Mc-Graw Hill)
2. Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3. Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4. Solid State Physics - by S.O. Pillai, 5th edition (New Age International).
5. Introduction to Electrodynamics - by David J. Griffith (PH I)
6. Engineering Physics- C. Mani Naidu(Pearson)
7. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New Delhi)

AS - 301
MATHEMATICS- III

L	T	P
3	1	0

Course outcomes (COs)

After the completion of the course, students are expected to have the ability to:

- Deal with sequences and various types of series and their convergence,
- Determine whether a given complex function is differentiable, and if so find its derivative.
- Express complex-differentiable functions as power series, find the Singularities, Zeroes and Poles, Residue.
- Identify of Integral Transforms Fourier integral, Applications of Fourier transform and Z-transform and its application to solve difference equations.
- Analyze of different Statistical Techniques – I Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Correlation, Linear, nonlinear and multiple regression analysis,.
- Analysis of Statistical Techniques – II Binomial, Poisson and Normal distributions, Sampling theory, Tests of significations: Chi- square test, t-test, and Analysis of variance (one way), Application of. Time series and forecasting.

Unit- I: Sequences and Series **08**

Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for convergence, Standard infinite series, Geometric series and Harmonic series. Tests for convergence and divergence, Comparison test (only for series with positive terms), Cauchy's integral test, D'alembert's ratio test, Cauchy's nth root test, Raabe's test (higher ratio test), Logarithmic test, Demorgan's and Bertrand's tests, Alternating series Leibnitz's theorem (without proof), Absolute convergence and Conditional convergence, Power series.

Unit-II: Function of Complex variable **08**

Analytic function, C-R equations, Harmonic functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(cos\theta,\ sin\theta)d\theta$ and $\int_{-\infty}^{+\infty} f(x)dx$.

Unit-III: Integral Transforms **08**

Fourier integral, Complex Fourier transform, Inverse transform, Convolution theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Unit-IV: Statistical Techniques – I **08**

Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non-linear and multiple regression analysis, Probability theory.

Unit-V: Statistical Techniques – II **08**

Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tets of significations: Chi- square test, t-test, Analysis of variance (one way), Application to engineering, medicine, agriculture etc. Time series and forecasting (moving and semi- averages),Statistical quality control methods, Control charts, $\bar{X}$, R, p, np and c charts.

Test Books :-

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. J.N. Kanpur, Mathematical Statistics, S. Chand & company Ttd., 2000

Reference Books :-

1. R.K. Jain & S.R.K. Iyenger, Advance Engineering Mathematics, Narosa Publication House, 2002.
2. Chandika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Gra Hill Education, 2016.
4. E. Kreysig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
6. S.P. Gupta, Statistical Methods, Sultan and Sons, New Delhi, 2004.
7. Devore, Probability and Statistics, Thomson (Cengage) Learning, 2007.
8. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists, Pearson Education, 2003.

EE - 301

NETWORK ANALYSIS AND SYNTHESIS

L	T	P
3	1	0

Course Outcomes (COs):
After the completion of the course, students are expected to have the ability to:

- Apply different network analysis and simplification theorems to dc and ac circuits and verify the solutions using modern tools for lifelong learning
- Solve network equations using classical methods and verify the solutions using modern tools for lifelong learning
- Apply Laplace Transformation technique for solution of network equations
- Calculate two port parameters and analyze network functions to decide stability of networks
- Define basic terms related with filters and design low pass/high pass passive filters
- Understand the method to find different type of network function and network function importance
- Understand different methods use foe network synthesis.

UNIT I **05**

Graph Theory:- Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality, Loop and Nodal methods of analysis.

UNITII **07**

Network Theorems (Applications to AC networks):-Concept of linearity, and homogeneityPrinciple,Super-position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, Reciprocity theorem. Millman's theorem, compensation theorem, Tellegen's theorem.

UNITIII **07**

Network Functions:-Concept of Complex frequency, Transform Impedances, Network functions of one port and two ports networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot.

UNITIV **09**

Two Port Networks:-Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T & Π Representation, Concepts of multi-port networks and their practical examples.

UNIT V **12**

Network Synthesis:-Positive real function; definition, properties and limitations; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms, similarities and dissimilarities between Foster's and Cauer's forms.

Filters: Image parameters and characteristics impedance, passive and active filter fundamentals, low-pass, high-pass, (constant K type) filters, and introduction to active filters.

TextBooks:-

1. A.Chakrabarti, “Circuit Theory” Dhanpat Rai & Co.
2. C.L Wadhwa, “Network Analysis and Synthesis” New Age International Publishers, 2007.
3. N.C. Jagan and C. Lakshminarayana, “Newwork Analysis” B.S. Publications, 2008.

Reference Books

1. D.Roy Choudhary, “Networks and Systems” Wiley Eastern Ltd.
2. M.E. Van Valkenburg, “Network Analysis”, Prentice Hall of India
3. Donald E. Scott: “An Introduction to Circuit analysis: A System Approach” McGraw Hill
4 M.E. Van Valkenburg, “An Introduction to Modern Network Synthesis”,Wiley Eastern Ltd.

CS-301
DATA STRUCTURE PRIMER USING 'C'

L	T	P
3	0	0

Course Outcomes (COs):

- Students will be able to learn how to represent arrays, linked lists, stacks, queues, trees, and graphs in memory using the algorithms and their common applications.
- Students will able to understanding the concept of recursion, application of recursion and its implementation and removal of recursion.
- Students will be able to learn the computational efficiency of the sorting and searching algorithms.
- Students will be able to learn implementation of Trees and Graphs, and various operations on these data structure.
- Students will capable to identify the alternative implementations of data structures with respect to its performance to solve a real world problem.

Unit –I **07**

Introduction: Basic Terminology, Elementary Data Organization, Built in Data Types, Abstract Data Types.

Arrays: Single and Multidimensional Arrays, Representation of Arrays, Derivation of Index Formulae for 1D, 2D, 3D & nD Array Application of arrays, Sparse Matrices and their representations.

Linked lists: Implementation of Singly Linked List using Array, and Pointer, Doubly Linked List, Circularly Linked List, Operations on a Linked List: Insertion, Deletion, Traversal, Polynomial Representation.

Unit – II **08**

Stacks: Basic operations: Push & Pop, Array and Linked List Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Trade-offs between iteration and recursion.

Queues: Basic operations: Create, Add, Delete, Circular queues, Array and linked list implementation of queues in C, Dequeue and Priority Queue.

Unit – III **09**

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array and Pointer(Linked List) Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree. Extended Binary Trees, Tree Traversal algorithms: In-order, Pre-order and Post-order, Constructing Binary Tree from given Tree Traversal, Insertion , Deletion, Searching & Modification of data in Binary Search. Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree, B Tree & Binary Heaps.

Unit – IV **08**

Searching: Sequential search,Index Sequential Search, Binary Search.

Hashing: Concept of Hashing & Collision resolution Techniques.

Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort.

Unit – V **08**

Graphs: Basic terminology, Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

Text Books:

1. Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI
2. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
3. Thareja, "Data Structure Using C" Oxford Higher Education

Reference Books

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication
2. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education
3. Lipschutz, "Data Structures" Schaum's Outline Series, TMH

CS - 302

NUMERICAL AND STATISTICAL TECHNIQUES IN COMPUTER SCIENCE

L	T	P
3	0	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Apply numerical methods to obtain the approximate solutions to the linear and non-linear transcendental and polynomial equations and find error.
- Identify numerical methods for various mathematical operations and tasks, such as interpolation formulae like forward, backward, and divided difference formulae.
- Apply the appropriate techniques for numerical differentiation and integration problems
- Design the numerical solution of initial value problems of the ordinary differential equations with implicit and explicit methods as appropriate
- Work numerically on the partial differential equations using different methods through of finite difference.

Unit-I: Introduction **08**

Numbers and their accuracy, Computer Arithmetic, Mathematicalpreliminaries, Errors and their Computation, General error formula, Error in a seriesapproximation

Solution of Algebraic and Transcendental Equation:

Bisection Method, Iteration method, Method of false position, Newton-Raphson method,Methods of finding complex roots, Muller's method, Rate of convergence of Iterativemethods, Polynomial Equations.

Unit-II: Interpolation **08**

Finite Differences, Difference tablesPolynomial Interpolation**:** Newton's forward and backward formulaCentral Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's,Everett's formula.

Interpolation with unequal intervals: Langrange's Interpolation, Newton Divideddifference formula, Hermite's Interpolation

Unit-III: Numerical Integration and Differentiation **08**

Introduction, Numerical differentiationNumerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Boole's rule,Waddle's rule.

Unit-IV: Solution of differential Equations **08**

Picard's Method, Euler's Method, Taylor's Method,Runge-Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring andStability of solution

Unit-V: Boundary Value problems **08**

Finte difference method, solving eigenvalue problems, polynomial method and power method. Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs.

Text Books:

1. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int
2. Grewal B S, "Numerical methods in Engineering and Science", KhannaPublishers, Delhi

Reference Books

1. Rajaraman V, "Computer Oriented Numerical Methods", Pearson Education
2. Gerald &Whealey, "Applied Numerical Analyses", AW
3. T Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods,TMH
4. Pradip Niyogi, "Numerical Analysis and Algorithms", TMH
5. Francis Scheld, " Numerical Analysis", TMH
6. Sastry S. S, "Introductory Methods of Numerical Analysis", Pearson Education.
7. Gupta C.B., Vijay Gupta, "Introduction to Statistical Methods", Vikas Publishing.
8. Goyal, M, "Computer Based Numerical and Statistical Techniques", FirewallMedia, New Delhi.
9. JaanKiusalaas, Numerical methods in engineering with MATLAB, Cambridge University Press
10. C. Woodford and C. Phillips, Numerical methods with worked examples: MATLAB Edition, Springer

EC-301

DIGITAL CIRCUITS & LOGIC DESIGN

L	T	P
3	0	0

Course outcomes (COs):
The student will be able to

- Gain knowledge between different types of number systems, and their conversions.
- Design various logic gates and simplify Boolean equations.
- Design various flip flops, shift registers and determining outputs.
- Analyze, design and implement combinational logic circuits, e.g. design different types of counters.
- Classify different semiconductor memories.

Unit-I **09**

Digital system and binary numbers: Number System: Binary, Octal, Hexadecimal, Character Codes (BCD, ASCII, EBCDIC) and its arithmetic, Signed binary numbers, Cyclic codes, error detecting and correcting codes, Hamming Code.
Gate-level minimization: Boolean algebra: definition, axioms, basic theorems, and properties, Boolean functions, Canonical and standard forms, NAND and NOR implementation,K- map method up to five variable, don't care conditions, Quine Mc-Clusky method (tabular method).

Unit-II **07**

Combinational logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, decimal adder, magnitude comparator, decoders, encoders, multiplexers, Demultiplexers.

Unit-III **08**

Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure.
Registers and Counters: Shift registers, ripple counter, synchronous counter, other counters: Johnson & Ring Counter.

Unit-IV **08**

Synchronous and Asynchronous Sequential Circuits: Analysis of clocked sequential circuits with state machine designing, State reduction & assignments, Design procedure. Analysis procedure ofAsynchronous sequential circuits, circuit with latches, design procedure, Reduction of state and flow table, Race-free state assignment.

Unit-V **08**

Memory and programmable logic: Introduction to Digital Logic families, RAM, ROM, PLA, PAL, Introduction to VHDL, Basics, Design of Combinational and Sequential circuits using VHDL.

Text Books:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", Pearson Education.
2. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press

3. RP Jain, “Modern Digital Electronics”, Tata McGraw Hill Publication.
4. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.

Reference Books:

1. DP Kothari and J.S. Dhillon, “Digital Circuits and Design”, Pearson Education
2. A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI Learning Pvt. Ltd.
3. Douglas L. Perry, “VHDL: Programming by Example”, McGraw-Hill
4. Jairam Bhaskar, “A VHDL Primer”, Prentice Hall PTR

AS – 302/402

HUMAN VALUES AND ETHICS

L	T	P
3	0	0

Course outcomes (COs):

- This course would help to assess ideas about ethics, self-exploration and happiness through reflective enquiry.
- It will aid in evaluating the prevailing problems in society due to differentiation and understanding the importance of human values in relationships.
- The course would lead to knowledge of the ideas of globalisation and the world as a nation, for a transformative world order.
- It will help in analysing ideas of leadership and creativity and using leadership qualities in day-to-day lives.
- It will augment an understanding of cross-cultural ethics and help students learn the art of resolving ethical dilemmas in business.

UNIT 1 **08**

Course Introduction

1. Understanding: Why humans are ethical, why they are not;
2. Understanding the need, basic guidelines, content and process for Value Education;
3. Self Exploration–what is it? – It's content and process;
4. 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration;
5. Right understanding of Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority;
6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario;
7. Method to fulfil the above human aspirations: understanding and living in **harmony** at various levels

UNIT 2 **08**

Understanding of Human Values and Ethics

1. Understanding the needs of Self ('I') and Body ('Me');
2. Understanding values in human-human relationship;
3. Meaning of Co-existence and Mutual Satisfaction;
4. Understanding Respect;
5. Understanding Comprehensive Human Goals;

UNIT 3 **08**

Effects of Holistic Harmony on Professional Ethics

1. World as a Nation;
2. Definitiveness of Ethical Human Conduct;
3. Basis for Humanistic Education and Humanistic Universal Order;
4. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order;

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,;
c) Ability to identify and develop appropriate technologies and management patterns for above production system;

5. Strategy for transition from the present state to Universal Human Order:
   a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers;
   b) At the level of society: as mutually enriching institutions and organizations;

UNIT 4 **08**

Effects of Holistic Personality for Success

1. Negotiation as a tool for success;
2. Leadership as an attribute of a successful Professional;
3. Managing Stress and Time;
4. Team Building--creating a harmonious environment with apathy to each other;
5. Understanding difference between evolution and revolution;

UNIT 5 **08**

Managing Relationship for Success

1. Understanding and valuing Cross-Cultural Ethics;
2. Managing Relationships (Networking), Personal Effectiveness and Self Leadership;
3. Theory of Constraints;
4. A Decision Making Model: Ethics as making decisions and choices;
5. Conflicts and Ethical Dilemmas;
6. Entrepreneurship and Ethics: A sense of business Ethics;
7. Pragmatic Behaviour of Business to its Colleagues/Competitors

Text Books:

1. Kazuo Ishiguro, 1989, *The Remains of the Day*, Faber and Faber
2. Sussan George, 1976, *How the Other Half Dies*. Penguin Press, Reprint 1991;
3. Amitabh Ghosh, 2008, *Sea of Poppies*. John Murray Publications.

Reference Books

1. B. L. Bajpai, 2004, *Indian Ethos and Modern Management*. New Royal Book Co., Lucknow. Reprinted 2008;
2. R. K. Narayan, 1958, *The Guide*, Viking Press.
3. P. L. Dhar, R. R. Gour, 1990, *Science and Humanism*, Commonwealth Publishers;
4. R. R. Gaur, R. Sangal and G. P. Bagaria, 2010, *A Foundation Course in Human Values and Professional Ethics*, Excel Books.

Relevant movies and documentaries:

1. Story of Stuff (Documentary);
2. The Remains of the Day (Movie);
3. Pursuit of Happyness (Movie);
4. Fences (Movie);
5. Gifted (Movie)

AS – 303/ AS - 403
ENVIRONMENT AND ECOLOGY

L T P
3 0 0

COURSE OUTCOMES (COs)

After the completion of the course, students are expected to have the ability to:

- Get the information about environment, ecosystem and also about its functions like Food chain, Ecological pyramids etc.
- Get the complete information about EIA- Environmental Impact Assessment in which the student will get the knowledge about the projects and the process involved in getting the projects.
- Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources. Also get the knowledge about the analysis of polluted water.
- Gain the knowledge about different types of pollution and their treatment techniques like waste water treatment, solid waste management etc.,
- Get the complete information about the all legal aspects of environment protection.

Unit I- Fundamentals of Environment & Ecology **08**

Definition, Scope & Importance and Need for public awareness.
Ecosystem- Definition, Energy flow in ecosystem, Ecological succession andBalanced ecosystem.
Effect of human activities on food, Shelter, Economic and social security.
Effect of human activities on environment- Agriculture, Housing, Industry, Mining and Transportation activities.
Basics of Environmental Impact, Assessment and Sustainable development.

Unit II- Natural Resources & Environmental Quality standard **09**

Water resources- Availability and quality aspects. Mineral resources, Material Cycle- Carbon, Nitrogen & Sulphur cycles, DO, BOD and COD.
Modern techniques used in analysis of Pollutants- Determination of disinfectants, Pesticides, Ambient Quality standards, Water quality parameters and standards, Turbidity, pH, Suspended solids and hardness,

UnitIII- Environmental Pollution & Current Environmental issues **09**

Environmental Pollution-Definition, Causes, Effects and control measure of:

1. Air Pollution
2. Water Pollution
3. Soil pollution
4. Marine Pollution

Current environmental issues of importance: Population growth, Climate change & Global warming- effects, Urbanization, Cause of global warming, Acid rain. Ozone layer depletion- causes and effects on health, Control measures. Photochemical smog, Solid waste management, Waste water treatment.

Unit IV- Energy-Types, Sources and Uses **08**

Different types of energy, Conventional and nonconventional sources- Hydro-electric, Fossil fuel based, Nuclear, Solar, Biomass, Geothermal energy and Biogas. Hydrogen as alternative future source of energy.

Unit V- Environmental protection **06**

Role of Government, Legal aspects, Environment protection Act, Introduction to ISO 14000, Green building concept.

Text Book-

1. Environmental Studies- Dr. D. L. Manjunath, Pearson Education
2. Text book of Environment Science and Engineering- M. Anji Reddy- B S Publication
3. Elements of Environmental Science and Engineering- Dr. P. Meenakshi- Prentice-Hall of India Pvt Ltd, New Delhi, 2008.
4. Environment and Ecology- P.D. Sharma- Rastogi publication 2009.

Reference Books-

1. Principle of Environmental Science and Engineering- P. Venugopalan Rao, Prentice Hall of India.
2. Environmental studies- R. Rajagopalan- Oxford Publication-2005.

AS - 404

DISCRETE MATHEMATICAL STRUCTURE

L	T	P
3	1	0

Course Outcomes (COs):

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

- Will be able to apply logical skills developed in this course, in various computer applications.
- Will be able to apply the computing skills to formulate, solve and analyse interdisciplinary real-world problems for higher study and research.
- Will be able to apply various algebraic structures in different branches of computer science
- Will be able to apply Graph theoretical concepts to modal, analyse and solve real-world problems.

UNIT I **08**

Set Theory: Introduction, Combination of sets, Multi sets, ordered pairs, Set identities.

Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.

Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions.

UNIT II **09**

Propositional Logic: Proposition, Logical connectives, Truth tables, Well formed formula, Tautology, Contradiction, Algebra of proposition, Normal forms, Modus ponens, Modus tollens,Validity.

Predicate Logic: First order predicate, Well formed formula of predicate, Quantifiers, Inference theory of predicate logic.

Notion of Proof: Proof by implication, converse, inverse, contra-positive, Negation and contradiction, Direct proof, Proof by using truth table, Proof by counter example.

UNIT- III **09**

Combinatories: Mathematical induction, Basics of counting, Pigeonhole principle, Permutations, Combinations, Inclusion-exclusion.

Recurrence Relations &Generating function: Recurrence relation of order n with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation, Generating function Closed form expression, Properties of G.F., Solution of recurrence relation using G.F., Solution of combinatorial problem using G.F.

UNIT IV ` **08**

Algebraic Structures: Binary composition and its properties,Definition of algebraic structure, Semi group, Monoid, Group, Abelain group, Properties of groups, Permutation group, Sub group, Cyclic group, Rings and Fields(definition and standard results), and Integers modulo n.

UNIT V **06**

Elements of coding theory: Introduction, Definitions, Error detecting & correcting code, Harmonic Code and distance, Theorems.

Group (Linear) Codes, Decoding methods. Parity check and Generator matrix, Definition parity check Matrix decoding, Coset decoding

Hamming's Codes: Concept, implementation as error correcting code, single error correcting (SEC) Code and single error correcting & double error detection code (SEC- DED).

Text Books:

1. Liu and Mohapatra, " Elements of Discrete Mathematics", McGraw Hill
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley India, New Delhi, 2010.
3. R.P. Grimaldi, Discrete and Combinatorial Mathematics, Addison Welsy,
4. S.K. Sarkar, "A Text Book of Discrete Mathematics", S.Chand& Company Ltd., 2012.

Reference Books

1. Kenneth H. Rosen, " Discerete Mathematics and its Applications", Mc Graw Hill, 2002.
2 J.P. Tremblay & R. Manohar, " Discrete Mathematical Structure with Applications to Computer Science" Mc Graw Hill, 1975.
3. V. Krishnamurthy, "Combinatories: Theory and Apllications", East-West Press.
4. Seymour Lipschutz, M.Lipson, "Discrete Mathematics" Tata Mc Graw Hill, 2005.
5. Kolman, Busby Ross, "Discrete Mathematical Structures", Prentice Hall Internatinal.

CS-401

COMPUTER ORGANIZATION

L	T	P
3	1	0

Course Outcomes (COs):

- The student will Conceptualize the basics of organizational and architectural issues of a digital computer.
- The student will learn and perform computer arithmetic operations on integer and real numbers.
- Student will analyze some of the design issues in terms of speed, technology, cost and performance.
- Student will get Exemplified in a better way the I/O and memory organization.

Unit-I **08**

Introduction: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general register organization, stack organization and addressing modes.

Unit-II **09**

Arithmetic and logic unit: Fixed and floating point representation, IEEE standard for floating point representation, Signed Adder, Subtracter circuits. Look ahead carry adders. Multiplication: Signed operand multiplication, Booth's algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation,Arithmetic & logic unit design

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Unit-III **08**

Control Unit: Instruction types, formats, instruction cycles and sub-cycles (fetch and execute etc) , micro-operations, execution of a complete instruction. Hardwire and microprogrammed control: microprogramme sequencing, concept of horizontal and vertical microprogramming.

Unit-IV **08**

Memory: Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement. Auxiliary memories: magnetic disk, magnetic tape and optical disks. Virtual memory: concept implementation.

Unit-V **07**

Input / Output: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.

Text Books:

1. William Stalling, " Computer Organization", PHI
2. Vravice,Hamacher&Zaky, "Computer Organization", TMH
3. Mano," Computer System Architecture", PHI

Reference Books:

1. Patterson, Computer Organisation and Design, Elsevier Pub. 2009
2. John P Hays, " Computer Organization", McGraw Hill
3. Tannenbaum," Structured Computer Organization', PHI
4. P Pal chaudhry, ' Computer Organization & Design', PHI

CS - 402

THEORY OF AUTOMATA

L	T	P
3	0	0

Course outcomes (COs):
After the completion of course, the student will be able to:

- Understanding the basic terminology of Grammar and construction of logical machine of NFA and DFA with minimization of number of states.
- Learning to generate regular expressions of various languages, its relationship with FA, related theorems and limitation of finite automata.
- Understanding the CFG and its simplification and various forms.
- Able to write description for PDA and understand its relation with CFG
- Basic ability to write simple Turing machines and fair understanding of undecidability.

Unit-I **09**

Automata Theory: Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)-Definition, Representation, Acceptability of a String and Language, Non-Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata.

Unit-II **07**

Regular Expressions: Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression- Arden's theorem.
Regular and Non-Regular Languages: Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties.

Unit-III **07**

Regular and Non-Regular Grammars: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF), Chomsky Hierarchy.

Unit-IV **08**

Push Down Automata: Description and definition, Language of PDA, Acceptance by Final state, Acceptance by empty stack, DeterministicPDA, Equivalence of PDA and CFG, Two stack PDA.
Context Free Languages: Definition, Examples, and properties of CFL: Closure properties of CFLs,Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

Unit-V **09**

Turing Machines: Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Universal Turing machine, Linear Bounded Automata, Church's Thesis.
Recursive Function Theory: Recursive and Recursively Enumerable language, Halting Problem, Post's Correspondence Problem, Introduction to Recursive Function Theory.

Text Books:

1. Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition, Pearson Education Asia
2. Introduction to languages and the theory of computation, J Martin, 3rd Edition, Tata McGraw Hill
3. Elements and Theory of Computation, C Papadimitrou and C. L. Lewis, PHI

Reference Books:

1. Mathematical Foundation of Computer Science, Y.N.Singh, New Age International
2. KLP Mishra and N. Chandrasekaran, “Theory of Computer Science: Automata,Languages and Computation”, PHI Learning Private Limited, Delhi India.
3. Peter Linz, "An Introduction to Formal Language and Automata", NarosaPublishinghouse.
4. K. Krithivasan and R. Rama; Introduction to Formal Languages, Automata Theoryand Computation; Pearson Education.

CS - 403

OBJECT ORIENTED PROGRAMMING

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the basics of object-oriented features.
- Write, compile, run, and test simple object-oriented Java programs.
- Able to understand the use of Packages, Java Swing, AWT and Interface in java.
- Able to design GUI based applications and develop applets for web applications.

Unit-I **09**

Basic concepts of Object-Oriented Programming: Objects and classes, identifying object relationships, attributes and methods, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, meta data, candidate keys, constraints, Interfaces, Types and Roles, Packages.Data flow diagram, specifying operations, constraints, a sample functional model,OMT (object modeling techniques) methodologies, examples and case studies to demonstrate methodologies.

Unit-II **08**

Java Programming Language: Introduction to Java Programming, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Package and Interface, Polymorphism, Inheritance, Exception Handling, Multithread programming, Input / Output:exploring Java.io, Java Applet, String handling, Networking, Event handling.

Introduction to AWT: AWT Controls, Graphics, Layout Manager and Menus, Images, Additional packages.

Unit-III **08**

Java Swing: Creating a Swing Applet and Application, Programming using Panes, Pluggable Look and feel,

Labels, Text fields, Buttons, Toggle buttons, Checkboxes, Radio Buttons, View ports, Scroll Panes, Scroll Bars,Lists, Combo box, Progress Bar, Menus and Toolbars, Layered Panes, Tabbed Panes, Split Panes, Layouts,Windows, Dialog Boxes.

JDBC: The connectivity Model, JDBC/ODBC Bridge,java.sql package, connectivity to remote database.

Unit-IV **08**

Java Beans: Application Builder tools, The bean developer kit(BDK), JAR files, Introspection, Developing asimple bean, using Bound properties, The Java Beans API, Session Beans, Entity Beans, Introduction toEnterprise Java beans (EJB).

Unit-V **07**

Java Servlets: Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlets, Thread-safe Servlets, HTTP Redirects, Cookies, Introduction to Java Server pages (JSP).

Text Books:

1. James Rumbaugh etal, “Object Oriented Modeling and Design”, PHI
2. Balagurusamy E, “Programming in JAVA”, Tata Mcgraw-hill Education Pvt. Ltd.
3. Herbert Schicldt, “The Complete Reference: Java” TMH

Reference Books

1. Dustin R. Callway, “Inside Servlets”, Addison Wesley.
2. Mark Wutica, “Java Enterprise Edition”, QUE.
3. Steven Holzner, “Java2 Black book”, Wiley Dreamtech Publication.
4. Liang, “Introduction to Java Programming, Comprehensive Version”, Pearson Education.
5. Deitel and Deitel, “Java: How to Program” PHI Learning Private Limited, Delhi India.
6. Thampi, “Object Oriented Programming in JAVA” Wiley Dreamtech Publication

EC - 404

FUNDAMENTALS OF MICROPROCESSOR

L	T	P
3	0	0

Course Outcomes (COs):
After the successful completion of the course student will be able to:

- Describe the general architecture of a microcomputer system and architecture & organization of 8085 & 8086 Microprocessor and understand the difference between 8085 and advanced microprocessor.
- Understand and realize the Interfacing of memory & various I/O devices with 8085 microprocessor.
- Understand and classify the instruction set of 8085 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
- Understand the architecture and operation of Programmable Interface devices and realize the programming & interfacing of it with 8085 microprocessor.

Unit-I **08**

Introduction to Microprocessor: Microprocessor evolution and types, microprocessor architecture and its operation, addressing modes, interrupts, data transfer schemes, instruction and data flow, timer and timing diagram, Basic interfacing concepts, Memory interfacing, Interfacing output displays, Interfacing input devices.

Unit-II **09**

Introduction to 8085 microprocessor: Pin diagram and internal architecture of 8085 microprocessor, registers, ALU, Control & status, interrupt and machine cycle. Instruction sets. Instruction formats. Instruction Classification: data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions.

Unit-III **08**

Introduction to 8086 microprocessor: Architecture of 8086 microprocessor, pin diagram, Functional block diagram, register organization, bus interface unit, execution unit, memory addressing, and memory segmentation. Operating modes, Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.

Unit-IV **08**

Introduction to Assembly Language: Assembly language programming based on intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions.

Unit-V **07**

Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254 programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.

Text Books:

1. Gaonkar, Ramesh S , “Microprocessor Architecture, Programming and Applications with8085”, Penram International Publishing.
2. Hall D V ,”Microprocessor Interfacing’, TMH
3. Liu Y.C. & Gibson G.A. , “ Microcomputer System: The 8086/8088 family’’, Pearson Education

Reference Books

1. Aditya P Mathur Sigh, “Microprocessor, Interfacing and Applications M Rafiqzzaman, “Microprocessors, Theory and Applications
2. Ray A K , Bhurchandi K M , “Advanced Microprocessors and Peripherals”, TMH
3. Brey, Barry B, “INTEL Microprocessors”, PHI

CS - 501
OPERATING SYSTEM

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to :

- Analyze various process scheduling Algorithms and their comparisons.
- Understand deadlock concept and its algorithm.
- Contrast various Memory management schemes and Page replacement policies.
- Demonstration of paging Technique of Memory Management.

Unit-I **08**

Introduction: Operating system and its functions, classification of operating systems- batch, interactive, time sharing, real time system, multiprocessor systems, multiuser systems, multithreaded systems, operating system structure- layered structure, system components, and operating system services.

Unit-II **06**

Process and CPU Scheduling: Process concept, process states, process state transition diagram, scheduling concepts, performance criteria, schedulers, process control block (PCB), threads and their management, scheduling algorithms, and multiprocessor scheduling.

Unit-III **10**

Concurrent Processes and Deadlock: Principle of concurrency, producer / consumer problem, mutual exclusion, critical section problem, semaphores, test and set operation; Classical problem in concurrency- dining philosopher problem, sleeping barber problem; Inter process communication models and schemes, and process generation.**Deadlock:** System model, deadlock characterization, prevention, avoidance, detection, and recovery from deadlock.

Unit -IV **08**

Memory Management: Basic bare machine, resident monitor, multiprogramming with fixed partitions, multiprogramming with variable partitions, paging, segmentation, paged segmentation, virtual memory concepts, demand paging, performance of demand paging, page replacement algorithms, thrashing, and cache memory organization.

Unit -V **08**

I/O Management and Disk Scheduling: I/O devices, and I/O subsystems, I/O buffering, disk storage and disk scheduling, RAID. **File System:** File concept, file organization and access mechanism, file directories, file system implementation issues, and file system protection &security.

Text Book:

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley

Reference Books:

1. SibsankarHalder and Alex A Aravind, “Operating Systems”, Pearson Education

2. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
3. D M Dhamdhere, "Operating Systems: A Concept based Approach", 2nd Edition, TMH.
4. William Stallings, "Operating Systems: Internals and Design Principles ", 6th Edition, Pearson Education

CS - 502
DATABASE MANAGEMENTCONCEPTS

L	T	P
3	1	0

Course Outcomes (COs):
After the successful completion of the course student will be able to:

- Understand database concepts, structures and query language.
- Understand the E R model and relational model.

- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
- Understand concept of transaction processing and concurrency control.

Unit-I **08**

Introduction: An overview of database management system, database system vs file system, database system concept and architecture, data model schema and instances, data independence, database language and interfaces, and overall database structure.
Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, concepts of super key, candidate key, primary key, generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, and relationship of higher degree.

Unit-II **08**

Relational data Model and Language: Relational data model concepts, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, relational algebra, relational calculus, tuple calculus, and domain calculus.
Introduction to SQL Statements: Data retrieval, DDL, DML, TCL, DCL, characteristics of SQL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables, views and indexes, queries and sub queries, aggregate functions,joins, unions, intersection, minus, cursors, and triggers.

Unit-III **08**

Data Base Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, lossless join decompositions, and normalization using FD, MVD and JDs.

Unit-IV **08**

Transaction Processing Concept: Transaction system, testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, log based recovery, checkpoints, and deadlock handling.

Unit-V **08**

Concurrency Control Techniques: Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, and validation based protocol.

Text Book:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.

Reference Books:

1. Date C J, " An Introduction to Database Systems", Addision Wesley.

2. Elmasri, Navathe, " Fudamentals of Database Systems", Addision Wesley.
3. O"Neil, Databases, Elsevier Pub.
4. Leon &Leon,"Database Management Systems", Vikas Publishing House.
5. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications.
6. Majumdar& Bhattacharya, "Database Management System", TMH.
7. Ramkrishnan, Gehrke, " Database Management System", McGraw Hill.

CS - 503
SOFTWARE ENGINEERING

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the basic concepts of software engineering.
- Understand the requirement analysis and importance of SRS documentation.
- Understand the design of software product.
- Understand various testing techniques and maintenance of software product.

Unit-I **08**

Introduction: Software components, software characteristics, software crisis, software engineering processes, similarity and differences from conventional engineering processes, and software quality attributes.

SDLC Models: Water fall model, prototype model, spiral model, evolutionary development models, iterative enhancement models, and agile software development model.

Unit-II **08**

Software Requirement Specifications: Requirement engineering process, elicitation, analysis, documentation, review and management of user needs, feasibility study, information modeling, data flow diagrams, entity relationship diagrams, decision tables, SRS document, and IEEE standards for SRS. **SQA:** Verification and validation, SQA plans, software quality frameworks, ISO 9000 models, and SEI-CMM model

Unit-III **08**

Software Design: Basic concept, architectural design, low level design: modularization, design structure charts, pseudo codes, flow charts, coupling and cohesion measures, design strategies: function oriented design, object oriented design, top-down and bottom-up design.

Software Measurement and Metrics: Halestead's software science, function point (FP) based measures, and cyclomatic complexity measures: Control flow graphs.

Unit-IV **08**

Software Testing: Testing objectives, unit testing, integration testing, acceptance and regression test, testing for functionality and performance, **Top-down and bottom-up testing strategies:** test drivers and test stubs, structural testing (white box testing), functional testing (black box testing), test data suit preparation, alpha and beta testing of products, **Static testing strategies**: Formal technical reviews, walk through, code inspection, and compliance with design & coding standards.

Unit-V **08**

Software Maintenance and Software Project Management: Software as an evolutionary entity, need for maintenance, categories of maintenance, cost of maintenance, software re-engineering, reverse engineering, software configuration management activities, change control process, software version control, an overview of CASE tools, estimation of various parameters such as cost, efforts, schedule/duration, and constructive cost models (COCOMO).

Text Book:

1. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

Reference Books:

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
3. PankajJalote, Software Engineering, Wiley
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.

CS - 504
WEB TECHNOLOGY

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the knowledge of the internet and related internet concepts that are vital in understanding web application development.
- Analyze and apply the role of mark up languages like HTML, DHTML, and XML in the workings of the web and web applications.
- Programming web pages with JavaScript.
- Design and implementation of build dynamic web pages using client sideprogramming JavaScript and also develop the web application using servlet and JSP.

Unit-I **08**

Introduction: Introduction to web, protocols governing the web, web development strategies, web applications, web project, and web team.

Unit-II **08**

HTML: List, table, images, frames, forms, and CSS.

Unit-III **08**

XML:TAGS, DTD, XML schemes, presenting and using XML.

Unit -IV **08**

Java script: Introduction, documents, forms, statements, functions, objects, event and event handling, introduction to AJAX, VB Script, and CGI

Unit-V **08**

Server Site Programming: Introduction to active server pages (ASP), ASP.NET, java server pages (JSP), JSP application design, tomcat server, JSP objects, declaring variables and methods, debugging, and sharing data between JSP pages.

Text Books:

1. Xavier, C, " Web Technology and Design" , New Age International.
2. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication.

Reference Books:

1. Deitel, "Java for programmers", Pearson Education.
2. Ramesh Bangia, "Internet and Web Design", New Age International.
3. Jackson, "Web Technologies" Pearson Education.
4. Patel and Barik, "Introduction to Web Technology & Internet", Acme Learning.

CS - 505
COMPILER DESIGN

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Ability to analyze & design grammars for different formal languages.
- Determine the decidability and intractability of computational problems.
- Identify different formal language and design the recognizer for regular languages to establish their applicability.
- Apply concepts learned in various domains of compiler construction.
- Students will be able to design compiler.

Unit-I **08**

Introduction: Introduction to compiler, phases and passes, bootstrapping, finite state machines and regular expressions and their applications to lexical analysis, optimization of DFA-based pattern matchers implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, formal grammars and their application to syntax analysis, ambiguity, and YACC.
The syntactic specification of programming languages: Context free grammars, derivation & parse trees, and capabilities of CFG.

Unit-II **08**

Basic Parsing Techniques: Parsers, shift reduce parsing, operator precedence parsing, and top down parsing.
Predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical collection of LR(0) items, constructing SLR parsing tables, constructing canonical LR parsing tables, constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, and implementation of LR parsing tables.

Unit-III **08**

Syntax-directed Translation: Syntax-directed translation schemes, implementation of syntax directed translators, intermediate code, postfix notation, parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, boolean expressions, statements that alter the flow of control, postfix translation, and translation with a top down parser.

Unit-IV **08**

Symbol Tables: Data structure for symbols tables, and representing scope information.
Run-TimeAdministration: Implementation of simple stack allocation scheme, and storage allocation in block structured language.
Error Detection & Recovery: Lexical Phase errors, and syntactic phase errors semantic errors.

Unit -V **08**

Code Generation: Design issues, the target language, addresses in the target code, basic blocks and flow graphs, optimization of basic blocks, and code generator.
Code Optimization: Machine-independent optimizations, loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, and global data-flow analysis

Text Book:

1. Aho, Sethi& Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education

Reference Books:

1. V Raghvan, " Principles of Compiler Design", TMH
2. Kenneth Louden," Compiler Construction", Cengage Learning.
3. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

CS - 601
DESIGN ANDANALYSIS OF ALGORITHMS

L	T	P
3	1	0

Course Outcomes (COs):
After the successful completion of the course student will be able to

- Implementation of various sorting algorithm and their comparisons.
- Analysis of various problem solved using Divide & Conquer and Greedy techniques
- Implementation of Dynamic Programming concept in solving various problems.

Unit-I **08**

Introduction: Algorithms, analyzing algorithms, complexity of algorithms, growth of functions,performance measurements, sorting and order statistics - shell sort, quick sort, merge sort, heap sort, comparison of sorting algorithms, and sorting in linear time.

Unit -II **08**

Advanced Data Structures: Red-Black trees, B – trees, binomial heaps, and fibonacciheaps.

Unit - III **08**

Design and Analysis Technique: Divide and conquer with examples such as sorting, matrix multiplication, convex hull and searching, greedy methods with examples such as optimal reliability allocation, Knapsack, minimum spanning trees – Prim's and Kruskal's algorithms, single source shortest paths – Dijkstra's and Bellman ford algorithms.

Unit - IV **08**

Dynamic Programming: Knapsack, all pair shortest paths – Floyd-Warshall algorithms, backtracking, branch and bound with examples such as travelling salesman problem, graph coloring, n-Queen problem, and Sum of subsets problems.

Unit -V **08**

Selected Topics: String Matching, theory of NP-completeness, approximation algorithms, and randomized algorithms.

Text Book:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Printice Hall of India.

Reference Books:

1. RCT Lee, SS Tseng, RC Chang and YT Tsai, "Introduction to the Design and Analysis of Algorithms", McGraw Hill, 2005.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Berman, Paul," Algorithms", Cengage Learning.
4. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008.

CS - 602
COMPUTER NETWORK

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand basic computer network technology.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP.
- Understand the concept of IP addressing, subnetting and routing mechanisms.

Unit –I **08**

Introduction Concepts: Goals and applications of networks, network structure and architecture, the OSI reference model, services, **Network Topology Design**: Delay analysis, back bone design, local access network design, physical layer transmission media, switching methods, ISDN, and terminal handling.

Unit-II **08**

Medium Access sub layer: Medium access sub layer - channel allocations, LAN protocols - ALOHA protocols - overview of IEEE standards - FDDI. Data Link Layer - Elementary data link protocols, sliding window protocols, and error handling.

Unit - III **08**

Network Layer: Point to point networks, routing, and congestion control.
Internet Working -TCP / IP, IP packet, IP address, IPv6.

Unit - IV **08**

Transport Layer: Transport layer design issues, connection management, session layer design issues, and remote procedure call. Presentation layer design issues, data compression techniques, cryptography - TCP - window management.

Unit-V **08**

Application Layer: File transfer, access and management, electronic mail, virtual terminals, other application. Example networks - Internet and public networks.

Text Book:

1. Forouzen, "Data Communication and Networking", TMH
2. A.S. Tanenbaum, Computer Networks, Pearson Education

Reference Books:

1. W. Stallings, Data and Computer Communication, Macmillan Press
2. AnuranjanMisra, “Computer Networks”, Acme Learning
3. G. Shanmugarathinam, ”Essential of TCP/ IP”, Firewall Media

CS - 603
COMPUTER ARCHITECTURE

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand about parallel computing and various performance metrics and measure.
- The student will visualize and learn to use appropriate tools to design, verify and test the CPU architecture.
- Understand about pipelining concept.
- Student will understand the architecture and functionality of central processing unit.
- Student will learn and analyze categorization of memory organization and get a detailed explanation of the function of each element of a memory hierarchy.

Unit-I **08**

Introduction: Parallel computing, parallel computer model, program and network properties, parallel architectural classification schemes, Flynn's & Feng's classification, performance metrics and measures, **Speedup Performance Laws:** Multiprocessor system and interconnection networks; **IEEE POSIX Threads:** Creating and exiting threads, simultaneous execution of threads, and thread synchronization using semaphore and mutex.

Unit-II **08**

Pipelining and Memory Hierarchy: Basic and intermediate concepts, Instruction set principle; **ILP:** Basics, exploiting ILP, limits on ILP; linear and nonlinear pipeline processors; super scalar and super pipeline design; **Memory Hierarchy Design:** Advanced optimization of cache performance, memory technology and optimization, cache coherence, and synchronization mechanisms.

Unit-III **08**

Thread and Process Level Parallel Architecture: Introduction to MIMD architecture, multithreaded architectures, distributed memory MIMD architectures, shared memory MIMD architecture, clustering, instruction level data parallel architecture, SIMD architecture, fine grained and coarse grained SIMD architecture, associative and neural architecture, data parallel pipelined and systolic architectures, vector architectures.

Unit-IV **08**

Parallel Algorithms: PRAM Algorithms: Parallel reduction, prefix sums, preorder tree traversal, merging two sorted lists; matrix multiplication: row column oriented algorithms, block oriented algorithms; parallel quicksort, hyper quicksort; solving linear systems: Gaussian elimination, Jacobi algorithm; parallel algorithm design strategies.

Unit-V **08**

Developing Parallel Computing Applications: Open MP implementation in 'C' and its execution model, memory model; **Directives:** Conditional compilation, internal control variables, parallel construct, work sharing constructs, combined parallel work-sharing constructs,master and synchronization constructs; **Run-Time Library Routines:**execution environment routines, lock routines, and timing routines.

Text Books:

1. Quinn, “Parallel Computing: Theory & Practice”, TMH
2. Kai Hwang,” Advance Computer Architecture”, TMH

Reference Books:

1. Matthew, ”Beginning Linux Programming”, SPD/WROX
2. Hennessy and Patterson,” Computer Architecture: A Quantitative Approach”, Elsevier
3. Dezso and Sima, ”Advanced Computer Architecture”, Pearson
4. Quinn, “Parallel Programming in C with MPI and Open MP”, TMH

CS - 604
GRAPH THEORY

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- Solve problems using graph theory and apply some basic algorithms for graphs.
- Determine whether a graph is a Hamiltonian and/or an Euler graph.
- Demonstrate different traversal methods for trees and graphs.
- Solve problems involving vertex and edge connectivity, planarity and crossing numbers.
- Represent graphs in Vector space and using Matrix.
- Model real world problems using graph theory like four color problem.

Unit-I **08**

Introduction: Graphs, sub graphs, some basic properties, various example of graphs & their sub graphs, walks, path & circuits, connected graphs, disconnected graphs and component, Euler graphs, various operation on graphs, Hamiltonian paths and circuits, and the traveling sales man problem.

Unit- II **08**

Trees and Fundamental Circuits: Distance diameters, radius and pendent vertices, rooted and binary trees, spanning trees, fundamental circuits, finding all spanning trees of a graph and a weighted graph, Prim's and Kruskal's algorithm.

Unit -III **08**

Cut Set and Planarity: Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity and separability, network flows planer graphs, **Combinatorial and Geometric dual:***K*uratowski's graphs, detection of planarity, geometric dual, discussion on criterion of planarity, thickness and crossings.

Unit -IV **08**

Vector Space and Matrix Representation: Vector space of a graph and vectors, basis vector,cut set vector, circuit vector, circuit and cut set subspaces, matrix representation of graph – basic concepts; incidence matrix, circuit matrix, path matrix, cut-set matrix, and adjacency matrix.

Unit -V **08**

Graph Coloring: Coloring, covering and partitioning of a graph, chromatic number, chromatic partitioning, chromatic polynomials, matching, covering, and four color problem.

Text Book:

1. Deo, N, Graph theory with applications to Engineering and Computer Science, PHI.

Reference Books:

1. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, TMH.
2. Robin J. Wilson, Introduction to Graph Theory, Pearson Education.
3. Harary, F, Graph Theory, Narosa.

CS - 6051

SOFTWARE PROJECT MANAGEMENT

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- Successful development of the project's procedures of initiation, planning, execution, regulation and closure.
- Guidance of the project team's operations towards achieving all the agreed upon goals within the set scope, time, quality and budget standards.
- Project plans that address real-world management challenges.
- Develop the skills for tracking and controlling software deliverables.

Unit-I **08**

Introduction and Software Project Planning: Fundamentals of software project management (SPM), need identification, vision and scope document, project management cycle, SPM objectives, management spectrum, SPM framework, software project planning, planning objectives, project plan, types of project plan, structure of a software project management plan, software project estimation, estimation methods, estimation models, and decision process.

Unit-II **08**

Project Organization and Scheduling: Project elements, work breakdown structure (WBS), Types of WBS, functions, activities and tasks, project life cycle and product life cycle, ways to organize personnel, project schedule, scheduling objectives, building the project schedule, scheduling terminology and techniques, **Network Diagrams:** PERT, CPM, Bar charts, Milestone charts, and Gantt charts.

Unit-III **08**

Project Monitoring and Control: Dimensions of project monitoring & control, earned value analysis, earned value indicators: budgeted cost for work scheduled (BCWS), cost variance (CV), schedule variance (SV), cost performance index (CPI), schedule performance index (SPI), interpretation of earned value indicators, error tracking, software reviews, types of review: inspections, desk checks, walkthroughs, code reviews, and pair programming.

Unit-IV **08**

Software Quality Assurance and Testing: Testing objectives, testing principles, test plans, test cases, types of testing, levels of testing, test strategies, program correctness, program verification & validation, testing automation & testing tools, concept of software quality, software quality attributes, software quality metrics and indicators, the SEI capability maturity model (CMM), SQA activities, formal SQA approaches: proof of correctness, statistical quality assurance, and cleanroom process.

Unit-V **08**

Project Management and Project Management Tools: Software configuration management: software configuration items and tasks, baselines, plan for change, change control, changerequests management, version control, risk management: risks and risk types, risk breakdown structure (RBS), risk management process: risk identification, risk analysis, risk planning, risk

monitoring, cost benefit analysis, software project management tools: CASE tools, planning and scheduling tools, and MS-project.

Text Books:

1. M. Cotterell, Software Project Management, Tata McGrawHill Publication.
2. S. A. Kelkar, Software Project Management, PHI Publication.

Reference Books:

1. Royce, Software Project Management, Pearson Education
2. Kieron Conway, Software Project Management, Dreamtech Press

CS - 6052
MULTIMEDIA SYSTEMS

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- Describe the types of media and define multimedia system.
- Describe the process of digitizing (quantization) of different analog signals (text, graphics, sound and video).
- Use and apply tools for image processing, video, sound and animation.
- Apply methodology to develop a multimedia system.
- Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge in this field.

Unit-I **09**

Introduction: Multimedia, multimedia information, multimedia objects, multimedia in business and work, convergence of computer, communication and entertainment products, stages of multimedia projects, multimedia hardware, memory & storage devices, communication devices, multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit-II **06**

Multimedia Building Blocks: Text, sound MIDI, digital audio, audio file formats, MIDI under windows environment, audio & video capture.

Unit-III **09**

Data Compression: Huffman coding, Shannon fano algorithm, Huffman algorithms, adaptive coding, arithmetic coding, higher order modelling, finite context modelling, dictionary based compression, sliding window compression, LZ77, LZW compression, compression ratio, lossless & lossy compression.

Unit-IV **06**

Speech Compression & Synthesis: Digital audio concepts, sampling variables, lossless compression of sound, lossy compression & silence compression.

Unit-V **10**

Images: Multiple monitors, bitmaps, vector drawing, lossy graphic compression, image file format animations, images standards, JPEG compression, Zig-Zag coding, multimedia database, content based retrieval for text and images. **Video:** Video representation, colors, video compression, MPEG standards, MHEG standard video streaming on net, video conferencing, multimedia broadcast services, indexing and retrieval of video database, and recent development in multimedia.

Text Books:

1. Tay Vaughan “Multimedia, Making IT Work” Osborne McGraw Hill.
2. Buford “Multimedia Systems” Addison Wesley.
3. Agrawal & Tiwari “Multimedia Systems” Excel.

Reference Books:

1. Mark Nelson “Data Compression Book” BPB.
2. David Hillman “Multimedia technology and Applications” Galgotia Publications.
3. Rosch “Multimedia Bible” Sams Publishing.
4. Sleinreitz “Multimedia System” Addison Wesley.

CS - 6053
SOFTWARE TESTING & AUDIT

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods to discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
- To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.

Unit-I **08**

Introduction: Software development life cycle, testing process, terminologies in testing: error, fault, failure, test cases, testing suite, test oracles, impracticality of testing all data, and impracticality of testing all paths.

Audit: Verification, **v**erification methods, validation, validation methods, evolutionary nature of verification and validation, difference between verification and validation. SRS verification, source code reviews, user documentation verification, software project audit, tailoring software quality assurance program by reviews, walkthrough, inspection, and configuration audits.

Unit-II **08**

Functional Testing: Boundary value analysis, equivalence class testing, decision table based testing, and cause effect graphing technique.

Structural Testing: Control flow testing, path testing, independent paths, generation of graph from program, identification of independent paths, cyclomatic complexity, data flow testing, and mutation testing.

Unit-III **08**

Regression Testing: Concept, regression test cases selection, reducing the number of test cases, and code coverage prioritization technique.

Reducing the number of test cases: Prioritization guidelines, priority category, scheme, and risk analysis.

Unit-IV **08**

Software Testing Activities: Levels of testing, debugging, testing techniques and their applicability, and exploratory testing

Automated Test Data Generation: Test data, approaches to test data generation, test data generation using genetic algorithm, test data generation tools, software testing tools, and software test plan.

Unit-V **08**

Object oriented Testing: Definition, issues, class testing, object oriented integration and system testing.

Testing Web Applications: What is Web testing?, user interface testing, usability testing, security testing, performance testing, database testing, and post deployment testing.

Text Books:

1. Yogesh Singh, "Software Testing", Cambridge University Press, New York, 2012
2. K.K. Aggarwal&Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.

Reference Books:

1. Roger S. Pressman, "Software Engineering -A Practitioner's Approach", Fifth Edition, McGraw Hill International Edition, New Delhi, 2001.
2. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.

CS - 6054
E-COMMERCE

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- Demonstrate an understanding of the foundations and importance of E-commerce
- Demonstrate an understanding of retailing in E-commerce by:
  - Analyzing branding and pricing strategies.
  - Using and determining the effectiveness of market research.
  - Assessing the effects of disintermediation.
- Analyze the impact of E-commerce on business models and strategy.

Unit-I **08**

Introduction: Definition of electronic commerce, **E-Commerce:** Technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, impact of E-commerce on business, and E-Commerce models.

Unit-II **08**

Network Infrastructure for E- Commerce: Internet and intranet based E-commerce- Issues, problems and prospects, network infrastructure, network access equipment's, and broadband telecommunication (ATM, ISDN, FRAME RELAY). **Mobile Commerce**: Introduction, wireless application protocol, WAP technology, and mobile information device.

Unit-III **08**

Web Security: Security issues on web, importance of firewall, components of firewall, transaction security, emerging client server, security threats, network security, factors to considerin firewall design, limitation of firewalls.

Unit-IV **08**

Encryption: Encryption techniques, symmetric encryption: keys and data encryption standard, triple encryption, secret key encryption; asymmetric encryption: public and private pair key encryption, digital signatures, and virtual private network.

Unit-V **08**

Electronic Payments: Overview, the SET protocol, payment gateway, certificate, digital tokens, Smart card, credit card, magnetic strip card, E-Checks, credit/debit card based EPS, online banking. EDI application in business, E- Commerce law, forms of agreement, govt. policies and agenda.

Text Book:

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison-Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH

Reference Books:

1. Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education.
2. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education

CS- 6055

WEB MINING

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- Identify and differentiate between application areas for web content mining, web structure mining and web usage mining.
- Describe key concepts such as deep web, surface web, semantic web, web log, hypertext, social network, information synthesis, corpora and evaluation measures such as precision and recall.
- Discuss the use of methods and techniques such as word frequency and co-occurrence statistics, normalization of data, machine learning, clustering, vector space models and lexical semantics.
- In detail explain the architecture and main algorithms commonly used by web mining applications.

Unit-I **08**

Overview: Purpose, Content, type of data on web, structured and unstructured data, structure and usage mining, web crawling, and indexing.

Unit-II **08**

Text and Image Mining: Text analysis and classification, text mining, image and multimedia mining, link analysis, and ranking algorithms.

Unit-III **08**

Information Retrieval: Web search and retrieval of information, web semantics, clustering/community algorithms, and topical locality.

Unit-IV **08**

Growth Models: Web growth models and web traffic models, traffic analysis, log, traffic graph, and web server log analyzer.

Unit-V **08**

Social tagging: Social networks, social media, and Information diffusion.

Text Book:

1. Russell Matthew A.,Mining the Social Web, Shroff Publishers & Distributors Pvt Ltd.

Reference Books:

1. Anthony Scime, Web Mining: Applications and Techniques, Idea Group Publishing.
2. Guandong Xu, Yanchun Zhang, Web Mining and Social Networking- Techniques and Applications, Springer.

CS - 6056

DATA COMPRESSION

L	T	P
3	0	0

Course Outcomes (COs):
Students will be able to:

- To Program, analyze Hoffman coding: Loss less image compression, Text compression, Audio Compression.
- To Program and analyze various Image compression and dictionary based techniques like static Dictionary, Diagram Coding, Adaptive Dictionary.
- Understand the statistical basis and performance metrics for lossless compression.
- Understand the conceptual basis for commonly used lossless compression techniques, and understand how to use and evaluate several readily available implementations of those techniques.

Unit - I **08**

Compression Techniques: Lossless compression, lossy compression, modeling and coding, **Mathematical Preliminaries for Lossless Compression:** A brief introduction to information theory, models: physical models, probability models, markov models, composite source model, Coding: uniquely decodable codes, and prefix codes.

Unit – II **08**

The Huffman coding algorithm: Minimum variance huffman codes, adaptive huffman coding: update procedure, encoding procedure, decoding procedure, applications of huffman coding: lossless image compression, text compression, and audio compression.

Unit-III **08**

Arithmetic Coding: Coding a sequence, generating a binary code, comparison of binary and huffman coding, **Applications:** Bi-level image compression-the JBIG standard, JBIG2, image compression. **Dictionary Techniques:** Introduction, static dictionary: diagram coding, Adaptive dictionary, LZ77 approach, LZ78 approach, and applications.

Unit – IV **08**

Mathematical Preliminaries for Lossy Coding: Distortion criteria, models,
Scalar Quantization: The quantization problem, uniform quantizer, adaptive quantization, and non-uniform quantization.

Unit-V **08**

Vector Quantization: Advantages of vector quantization over scalar quantization, the Linde-Buzo-Gray algorithm, tree structured vector quantizers, and structured vector Quantizers.

Text Books:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers.

Reference Books:

1. Drozdek,Elements of Data Compression,Cengage Learning
2. David Salomon, Data Compression: The Complete Reference, 4th Edition Springer
3. Timothy C. Bell, Text Compression, 1st Edition Prentice Hall.

B.TECH. (INFORMATION TECHNOLOGY) VII & VIII SEMESTER (DETAILED SYLLABUS)

CRYPTOGRAPHY & NETWORK SECURITY		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Introduction to security attacks, services and mechanism, Classical encryption techniques-substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard (DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES	**08**
II	Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryptionFermat's and Euler's theorem, Primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem,Principals of public key crypto systems, RSA algorithm, security of RSA	**08**
III	Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,	**08**
IV	Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.	**08**
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls	**08**

Text books:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Behrouz A. Frouzan: Cryptography and Network Security, Tata McGraw Hill
3. C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security ,Wiley
4. Bruce Schiener, "Applied Cryptography". John Wiley & Sons
5. Bernard Menezes," Network Security and Cryptography", Cengage Learning.
6. AtulKahate, "Cryptography and Network Security", Tata McGraw Hill

ARTIFICIAL INTELLIGENCE		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.	**08**
II	**Introduction to Search :** Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning	**08**
III	**Knowledge Representation & Reasoning:** Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utilitytheory, Hidden Markov Models (HMM), Bayesian Networks.	**08**
IV	**Machine Learning :** Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning,	**08**
V	**Pattern Recognition :** Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.	**08**

Text books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education

2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill

3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education

4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India,

CRYPTOGRAPHY & NETWORK SECURITY LAB

The following programs may be developed -

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
   a) Ceaser Cipher
   b) Substitution Cipher
   c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java keytool.
8. Write a Java program to implement RSA Algoithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

Artificial Intelligence Lab

The following programs may be developed -

1.Study of Prolog.

2 Write simple fact for the statements using PROLOG.

3 Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.

4 Write a program to solve the Monkey Banana problem.

5 WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.

6 WAP to implement factorial, fibonacci of a given number.

7 Write a program to solve 4-Queen problem.

8 Write a program to solve traveling salesman problem.

9 Write a program to solve water jug problem using LISP

COMPUTER GRAPHICS		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	**08**
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping	**08**
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.	**08**
IV	**Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	**08**
V	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	**08**

Text books:

Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education

2. Foley, Vandam, Feiner, Hughes – “Computer Graphics principle”, Pearson Education.

3. Rogers, “ Procedural Elements of Computer Graphics”, McGraw Hill

4. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – Tata MCGraw Hill.

5. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, Tata MCGraw Hill.

6. R.K. Maurya, “Computer Graphics ” Wiley Dreamtech Publication.

7. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited.

8. Donald Hearn and M Pauline Baker, “Computer Graphics with OpenGL”, Pearson education

APPLICATION OF SOFT COMPUTING		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Neural Networks-I (Introduction & Architecture) :** Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.	**08**
II	**Neural Networks-II (Back propogation networks):** Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.	**08**
III	**Fuzzy Logic-I (Introduction):** Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.	**08**
IV	**Fuzzy Logic –II (Fuzzy Membership, Rules)** : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications	**08**
V	**Genetic Algorithm(GA):** Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.	**08**

Text books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications” Prentice Hall of India.

2. N.P.Padhy,”Artificial Intelligence and Intelligent Systems” Oxford University Press. Reference Books:

3. Siman Haykin,”Neural Netowrks”Prentice Hall of India

4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.

5. Kumar Satish, “Neural Networks” Tata Mc Graw Hill

HIGH PERFORMANCE COMPUTING		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	Overview of Grid Computing Technology, History of Grid Computing, High Performance Computing, Cluster Computing. Peer-to-Peer Computing, Internet Computing, Grid Computing Model and Protocols, Types of Grids: Desktop Grids, Cluster Grids, Data Grids, High- Performance Grids, Applications and Architectures of High Performance Grids, High Performance Application Development Environment.	**08**
II	Open Grid Services Architecture, Introduction, Requirements, Capabilities, Security Considerations, GLOBUS Toolkit.	**08**
III	Overview of Cluster Computing, Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming, Environments and Tools, Cluster Applications, Cluster Systems,	**08**
IV	Beowulf Cluster: The Beowulf Model, Application Domains, Beowulf System Architecture, Software Practices, Parallel Programming with MPL, Parallel Virtual Machine (PVM).	**08**
V	Overview of Cloud Computing, Types of Cloud, Cyber infrastructure, Service Oriented Architecture Cloud Computing Components: Infrastructure, Storage, Platform, Application, Services, Clients, Cloud Computing Architecture.	**08**

Text books:

1. Laurence T.Yang, Minyi Guo – High Performance Computing Paradigm and Infrastructure John Wiley

2. Ahmar Abbas, "Grid Computing: Practical Guide to Technology & Applications", Firewall Media, 2004.

3. Joshy Joseph and Craig Fellenstein , "Grid Computing" Pearson Education, 2004.

4. lan Foster, et al.,"The Open Grid Services Architecture", Version 1.5 (GFD.80). Open Grid Forum, 2006.

6. RajkumarBuyya. High Performance Cluster Computing: Architectures and Systems. PrenticeHall India, 1999.

HUMAN COMPUTER INTERFACE		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction :** Importance of user Interface – definition, importance of 8 good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface	**08**
II	**Design process:** Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions. III Screen Designing : Design goals – Scre	**08**
III	**Screen Designing :** Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interfacedesign.	**08**
IV	**Windows :** New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors	**08**
V	**Software tools :** Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.	**08**

Text books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.

2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in HumanComputer Interaction, Wiley, 2010.

3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0- 321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

CLOUD COMPUTING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION** Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.	**08**
II	**CLOUD ENABLING TECHNOLOGIES** Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish- Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.	**08**
III	**CLOUD ARCHITECTURE, SERVICES AND STORAGE** Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.	**08**
IV	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD** Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.	**08**
V	**CLOUD TECHNOLOGIES AND ADVANCEMENTS** Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.	**08**

Text books:

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

BLOCKCHAIN ARCHITECTURE DESIGN		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Blockchain**: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains:Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric (A):** Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation **Hyperledger Fabric (B):** Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool	**08**
IV	**Use case 1 :** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc	**08**
V	**Use case 3**: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Text books:

1. Mstering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric
4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

AGILE SOFTWARE DEVELOPMENT		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**AGILE METHODOLOGY** Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values	08
II	**AGILE PROCESSES** Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.	08
III	**AGILITY AND KNOWLEDGE MANAGEMENT** Agile Information Systems – Agile Decision Making – Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).	08
IV	**AGILITY AND REQUIREMENTS ENGINEERING** Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.	08
V	**AGILITY AND QUALITY ASSURANCE** Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development.	08

Text books:

1.David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2.Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.
3.Craig Larman, "Agile and Iterative Development: A Managers Guide", Addison-Wesley, 2004.
4.Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2007.

AUGMENTED & VIRTUAL REALITY		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS:** The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces.	**08**
II	**3D USER INTERFACE INPUT HARDWARE:** Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.	**08**
III	**SOFTWARE TECHNOLOGIES:** Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market	**08**
IV	**3D INTERACTION TECHNIQUES:** 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry . **DESIGNING AND DEVELOPING 3D USER INTERFACES:** Strategies for Designing and Developing Guidelines and Evaluation. **VIRTUAL REALITY APPLICATIONS:** Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.	**08**
V	Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	**08**

Text books:

1. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice",

Addison Wesley, USA, 2005.

4. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.

5. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

6. John Vince, "Virtual Reality Systems", Addison Wesley, 1995.

7. Howard Rheingold, "Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society",Simon and Schuster, 1991.

8. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design (The MorganKaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

MACHINE LEARNING

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias	**08**
II	DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation AlgorithmConvergence, Generalization;	**08**
III	Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; **Bayesian Learning:** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;	**08**
IV	**Computational Learning Theory:** Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning	**08**
V	**Genetic Algorithms:** an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms-General to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q Learning.	**08**

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

GAME PROGRAMMING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**3D GRAPHICS FOR GAME PROGRAMMING :** 3D Transformations, Quaternions, 3D Modeling And Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera And Projections, Culling And Clipping, Character Animation, Physics-Based Simulation, Scene Graphs.	**08**
II	**GAME ENGINE DESIGN:** Game Engine Architecture, Engine Support Systems, Resources And File Systems, Game Loop And Real-Time Simulation, Human Interface Devices, Collision And Rigid Body Dynamics, Game Profiling.	**08**
III	**GAME PROGRAMMING** : Application Layer, Game Logic, Game Views, Managing Memory, Controlling The Main Loop, Loading And Caching Game Data, User Interface Management, Game Event Management.	**08**
IV	**GAMING PLATFORMS AND FRAMEWORKS:** 2D And 3D Game Development Using Flash, DirectX, Java, Python, Game Engines – DX Studio, Unity.	**08**
V	**GAME DEVELOPMENT:** Developing 2D And 3D Interactive Games Using DirectX Or Python – Isometric And Tile Based Games, Puzzle Games, Single Player Games, Multi Player Games.	**08**

Text books:

1. Mike Mc Shaffrfy And David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach To Real-Time Computer Graphics" 2nd Editions, Morgan Kaufmann, 2006.
4. Ernest Adams And Andrew Rollings, "Fundamentals Of Game Design", 2nd Edition Prentice Hall / New Riders, 2009.
5. Eric Lengyel, "Mathematics For 3D Game Programming And Computer Graphics", 3rd Edition, Course Technology PTR, 2011.
6. Jesse Schell, The Art Of Game Design: A Book Of Lenses, 1st Edition, CRC Press, 2008.

IMAGE PROCESSING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**DIGITAL IMAGE FUNDAMENTALS:** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	**08**
II	**IMAGE ENHANCEMENT :** Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	**08**
III	**IMAGE RESTORATION :** Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	**08**
IV	**IMAGE SEGMENTATION:** Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	**08**
V	**IMAGE COMPRESSION AND RECOGNITION:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.	**08**

Text books:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition, 2010
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.
3. Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D,E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt,Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

PARALLEL AND DISTRIBUTED COMPUTING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Scope , issues, applications and challenges of Parallel and Distributed Computing **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, co-processing. **Principles of Parallel Algorithm Design:** Decomposition Techniques,Characteristics of Tasks and Interactions,Mapping Techniques for Load Balancing.	**08**
II	**CUDA programming model:** Overview of CUDA, Isolating data to be used by parallelizedcode, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function.	**08**
III	**Analytical Modeling of Parallel Programs:** Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time	**08**
IV	**Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms **Graph Algorithms:** Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph	**08**
V	**Search Algorithms for Discrete Optimization Problems:** Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms	**08**

Text books:

1. A Grama, A Gupra, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003.
2. C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company, 2008.
3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming. Morgan Kaufmann Publishing and Elsevier, 2013.
4. T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.

SPEECH AND NATURAL LANGUAGE PROCESSING		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION :** Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance **WORD LEVEL ANALYSIS** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.	**08**
II	**SYNTACTIC ANALYSIS** Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.	**08**
III	**SEMANTICS AND PRAGMATICS** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	**08**
IV	**BASIC CONCEPTS of Speech Processing :** Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	**08**
V	**SPEECH ANALYSIS**: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. **UNIT III : SPEECH MODELING** : Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	**08**

Text books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language

Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, "Fundamentals Of Speech Recognition", Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, "Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition", Pearson Education, 2002.
5. Frederick Jelinek, "Statistical Methods Of Speech Recognition", MIT Press, 1997.
6. 1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
7. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
8. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
9. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

DEEP LEARNING

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	**08**
II	DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	**08**
III	DIMENTIONALITY REDUCTION 9 Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization	**08**
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	**08**
V	CASE STUDY AND APPLICATIONS : Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions	**08**

Text books:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.

2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.

4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

DATA COMPRESSION

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introductionto information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.	**08**
II	The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.	**08**
III	Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Moveto-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.	**08**
IV	Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.	**08**
V	Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured VectorQuantizers.	**08**

Text books:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers

2. Elements of Data Compression,Drozdek, Cengage Learning

3. Introduction to Data Compression, Second Edition, Khalid Sayood,The Morgan aufmann Series

4.Data Compression: The Complete Reference 4th Edition byDavid Salomon, Springer

5.Text Compression1st Edition by Timothy C. Bell Prentice Hall

QUANTUM COMPUTING		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**08**
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	**08**
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**08**
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**08**
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	**08**

Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.

2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import,

3 Oct 2014 3. Computing since Democritus by Scott Aaronson

4. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.